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The gravity waves from the binary galaxies - the new deal of the James Webb Space Telescope

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Abstract

The energy spectrum of gravitons emitted by the black hole binary as a gravity waves is calculated in the first part of the article. Then, the total quantum loss of energy, is calculated in the Schwinger theory of gravity. Using analogy with the binary stars, we calculate the graviton spectrum of the binary galaxies discovered by the JWST of NASA.
Keywords Binary stars, binary galaxies, JWST, Graviton, Schwinger source theory.

1 Introduction

A binary star is a system of two stars that are gravitationally bound to and in orbit around each other. Binary stars - a single object to the naked eye - are often resolved using a telescope as separate stars, in which case they are called visual binaries.

Many visual binaries have long orbital periods of several centuries and therefore have orbits which are uncertain, or, poorly known. They may also be detected by indirect techniques, such as spectroscopy - spectroscopic binaries, or, astrometry - astrometric binaries.

If a binary star happens to orbit in a plane along our line of sight, its components will eclipse and transit each other; these pairs are called eclipsing binaries , or, together with other binaries that change brightness as they orbit, photometric binaries. If components in binary star systems are close enough they can gravitationally distort their mutual outer stellar atmospheres.

Double stars, a pair of stars that appear close to each other, have been observed since the invention of the telescope . Mizar, in the Ursa Major , was observed to be double by Giovanni Battista Riccioli in 1650 and earlier by Benedetto Castelli and Galileo. The double star Acrux, in the Southern Cross, was discovered to be double by Father Fontenay in 1685. William Herschel began observing double stars in 1779.

Over the years, many more double stars have been cataloged and measured. As of June 2017, the Washington Double Star Catalog, a database of visual double stars compiled by the

United States Naval Observatory, contains over 100000 pairs of double stars, including optical doubles as well as binary stars. Our goal is not to consider the binary stars but binary galaxies discovered by JWST.

2 Binary galaxies

A galaxy is a system of stars, stellar remnants, interstellar gas, dust, and dark matter bound together by gravity. Galaxies, averaging an estimated 100 million stars, range in size from dwarfs with less than a hundred million stars, to the largest galaxies known super giants with one hundred trillion stars, each orbiting its galaxy's center of mass . Most of the mass in a typical galaxy is in the form of dark matter, with only a few percent of that mass visible in the form of stars and nebulae. Super massive black holes are a common feature at the centers of galaxies.

Galaxies are categorized according to their visual morphology as elliptical, spiral, or irregular. Many are thought to have super massive black holes at their centers.

It is estimated that there are roughly 200 billion galaxies in the observable universe. Most galaxies are 1000 to 100000 parsecs in diameter and are separated by distances on the order of millions of parsecs, or, mega parsecs.

For comparison, the Milky Way has a diameter of at least 26800 parsecs and is separated from the Andromeda Galaxy (with diameter of about 152000 ly), its nearest large neighbor, by 780000 parsecs.

3 James Webb Space Telescope -JWST

JWST is able the detailed observations of distant and ancient galaxies. The telescope's improved capabilities enable scientists to study the structures, properties, and dynamics of these galaxies with remarkable precision. This revolutionizes our ability to unravel the mysteries of the early universe and gain insights into the processes that shaped cosmic evolution.

The JWST observations have revealed a staggering number of galaxies, surpassing earlier estimates. The JWST allows to observe distant objects that emit light at longer wavelengths. This enables the detection of ancient galaxies that have undergone significant redshift due to the expansion of the universe. At the same time , the JWST allows to observe galaxies forming the binaries and radiating the gravity waves. This is the new deal of JWST.

The telescope's enhanced resolution and sensitivity provide clearer and more detailed images of these galaxies, unveiling their structures and properties with unprecedented clarity. The discovery of thousands of galaxies in the GOODS-South region provides a wealth of data for studying cosmic evolution. By examining the properties and distribution of these galaxies, researchers can gain insights into how galaxies formed, evolved, and interacted in the early universe. This information helps piece together the puzzle of cosmic evolution and contributes our broader understanding of the universe's history.

4 Black holes

In 1916, Schwarzschild published the solution of the Einstein field equations (Schwarzschild, 1916) that was later understood to describe a black hole (Finkelstein, 1958; Kruskal, 1960) and in 1963 Kerr generalized the solution to rotating black holes (Kerr, 1963). The year 1970 was the starting point of the theoretical work leading to the understanding of black hole quasi normal modes (Vishveshwara, 1970; Press, 1971; Chandrasekhar et al., 1975) and in the 1990 higher-order post-Newtonian calculations (Blanchet et al., 1995) was performed and later the extensive analytical studies of relativistic two-body dynamics realized (Blanchet, 2014; Buonanno, et al. 1999). These advances, together with numerical relativity break through in the past decade (Pretorius, 2005; Campanelli et al., 2006; Baker et al. 2006). Numerous black hole candidates have now been identified through electromagnetic observations (Webster, 1972 et al.; Bolton, 1972; Casares, 2014). The black hole binary and their rotation and et al. mergers is open problem of the astrophysics and it is the integral part of the binary black hole physics.

The binary pulsar system PSR B**1913+16** (also known as PSR J1915+1606) discovered by Hulse and Taylor (1975) and subsequent observations of its energy loss by Taylor and Weisberg (1982) demonstrated the existence of gravitational waves (Aasi et al., 2015)..

By the early 2000s, a set of initial detectors was completed, including TAMA 300 in Japan, GEO 600 in Germany, the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the United States, and Virgo in Italy. In 2015, Advanced LIGO became the first of a significantly more sensitive network of advanced detectors (a second-generation interferometric gravitational wave detector) to begin observations (Acernese et al., 2015).

Taylor and Hulse, working at the Arecibo radio telescope, discovered the radio pulsar PSR B**1913+16** in a binary, in 1974, and this is now considered as the best general relativistic laboratory (Taylor, Jr., 1993).

Pulsar PSR B**1913+16** is the massive body of the binary system where each of the rotating pairs is 1.4 times the mass of the Sun. These neutron stars rotate around each other in an orbit not much larger than the Sun's diameter, with a period 7.8 hours. Every 59 ms, the pulsar emits a short signal that is so clear that the arrival time of a 5-min string of a set of such signals can be resolved within 15 μs.

A pulsar model based on strongly magnetized, rapidly spinning neutron stars was soon established as consistent with most of the known facts (Gold, 1968) its electrodynamic properties were studied theoretically (Goldreich, et al.1969) and shown to be plausibly capable of generating broadband radio noise detectable over interstellar distances. The binary pulsar PSR B**1913+16** is now recognized as the harbinger of a new class of unusually short-period pulsars, with numerous important applications.

Because the velocities and gravitational energies in a high-mass binary pulsar system can be significantly relativistic, strong-field and radiative effects come into play. The binary pulsar PSR B**1913+16** provides significant tests of gravitation beyond the weak-field, slow-motion limit (Damour et al., 1992; Taylor et al., 1992).

We do not here repeat the derivation of the Einstein quadrupole formula in the Schwinger gravity theory (Manoukian, 1990). We show that just in the framework of the Schwinger gravity theory it is easy to determine the spectral formula for emitted gravitons and the quantum energy-loss formula of the binary system. The energy-loss formula is general, including black hole binary and it involves arbitrarily strong gravity.

Since the measurement of the motion of the black hole binaries goes on, we hope that sooner or later the confirmation of our formula will be established.

4.1 The spin 2 gravity in source theory

Source methods by Schwinger are in source theory adequate for the solution of the calculation of the spectral formula of gravitons and energy loss of binary. Source theory (Schwinger et al., 1976; Dittrich, 1978; Schwinger, 1976) was initially constructed to describe the particle physics situations occurring in high-energy physics experiments. However, it was found that the original formulation simplifies the calculations in the electrodynamics and gravity, where the interactions are mediated by photon and graviton respectively. The source theory of gravity forms the analogue of quantum electrodynamics because, while in QED the interaction is mediated by the photon, the gravitational interaction is mediated by the graviton (Schwinger, 1976). The basic formula in the source theory is the vacuum-to-vacuum amplitude (Schwinger, 1970):

$$\langle 0_+|0_-\rangle = e^{\frac{i}{\hbar}W(S)}, \tag{1}$$

where the minus and plus symbols refer to any time before and after region of space-time with action of sources. The exponential form is postulated to express the physically independent experimental arrangements, with result that the associated probability amplitudes multiply and the corresponding W expressions add (Schwinger et al., 1976; Dittrich, 1978; Schwinger, 1976).

In the flat space-time, the field of gravitons is described by the amplitude (1) with the action ($c = 1$ in the following text) (Schwinger, 1970):

$$W(T) = 4\pi G \int (dx)(dx') \left[T^{\mu\nu}(x)D_+(x-x')T_{\mu\nu}(x') - \frac{1}{2}T(x)D_+(x-x')T(x')\right], \tag{2}$$

where the dimensionality of $W(T)$ has dimension of the Planck constant $\hbar$; $T_{\mu\nu}$ is the momentum and energy tensor that, for a particle trajectory $\mathbf{x} = \mathbf{x}(t)$, is defined by the equation (Cho, et al., 1976):

$$T^{\mu\nu}(x) = \frac{p^\mu p^\nu}{E}\delta(\mathbf{x} - \mathbf{x}(t)), \tag{3}$$

where p^μ is the relativistic four-momentum of a particle with a rest mass m and

$$p^\mu = (E, \mathbf{p}) \tag{4}$$

$$p^\mu p_\mu = -m^2, \tag{5}$$

and the relativistic energy is defined by the known relation

$$E = \frac{m}{\sqrt{1 - \mathbf{v}^2}}, \tag{6}$$

where $\mathbf{v}$ is the three-velocity of the moving particle.

Symbol $T(x)$ in formula (2) is defined as $T = g_{\mu\nu}T^{\mu\nu}$, and $D_+(x - x')$ is the graviton propagator whose explicit form will be determined later.

4.2 The graviton spectrum of the black hole binary

It may be easy to show that the probability of the persistence of vacuum is given by the following formula (Schwinger et al., 1976):

$$|\langle 0_+|0_-\rangle|^2 = \exp\left\{-\frac{2}{\hbar}\mathrm{Im}W\right\} \stackrel{d}{=} \exp\left\{-\int dtd\omega \frac{1}{\hbar\omega}P(\omega,t)\right\}, \tag{7}$$

where the so-called power spectral function $P(\omega, t)$ has been introduced (Schwinger et al., 1976). For extraction of the spectral function from Im W, it is necessary to know the explicit form of the graviton propagator $D_+(x-x')$. This propagator involves the graviton property of spreading with velocity c. It means that its mathematical form is identical with the photon propagator form. With regard to Schwinger et al. (1976) the x-representation of $D(k)$ in eq. (2) is as follows:

$$D_+(x - x') = \int \frac{(dk)}{(2\pi)^4} e^{ik(x-x')} D(k), \tag{8}$$

where

$$D(k) = \frac{1}{|\mathbf{k}^2| - (k^0)^2 - i\epsilon}, \tag{9}$$

which gives

$$D_+(x - x') = \frac{i}{4\pi^2} \int_0^\infty d\omega \frac{\sin \omega|\mathbf{x} - \mathbf{x}'|}{|\mathbf{x} - \mathbf{x}'|} e^{-i\omega|t-t'|}. \tag{10}$$

Now, using formulas (2), (7) and (10), we get the power spectral formula in the following form:

$$P(\omega, t) = 4\pi G\omega \int (d\mathbf{x})(d\mathbf{x}')dt' \frac{\sin \omega|\mathbf{x} - \mathbf{x}'|}{|\mathbf{x} - \mathbf{x}'|} \cos \omega(t - t') \times$$

$$\left[T^{\mu\nu}(\mathbf{x}, t)T_{\mu\nu}(\mathbf{x}', t') - \frac{1}{2} g_{\mu\nu}T^{\mu\nu}(\mathbf{x}, t)g_{\alpha\beta}T^{\alpha\beta}(\mathbf{x}', t')\right]. \tag{11}$$

4.3 The power spectral formula for the binary system

In the case of the binary system with masses m_1 and m_2, we suppose that they move in a uniform circular motion around their center of gravity in the xy plane, with corresponding kinematic coordinates:

$$\mathbf{x}_1(t) = r_1(\mathbf{i}\cos(\omega_0 t) + \mathbf{j}\sin(\omega_0 t)) \tag{12}$$

$$\mathbf{x}_2(t) = r_2(\mathbf{i}\cos(\omega_0 t + \pi) + \mathbf{j}\sin(\omega_0 t + \pi)) \tag{13}$$

with

$$\mathbf{v}_i(t) = d\mathbf{x}_i/dt, \quad \omega_0 = v_i/r_i, \quad v_i = |\mathbf{v}_i| \quad (i = 1,\, 2). \tag{14}$$

For the tensor of energy and momentum of the binary we have:

$$T^{\mu\nu}(x) = \frac{p_1^\mu p_1^\nu}{E_1}\delta(\mathbf{x} - \mathbf{x}_1(t)) + \frac{p_2^\mu p_2^\nu}{E_2}\delta(\mathbf{x} - \mathbf{x}_2(t)), \tag{15}$$

where we have omitted the tensor $t^G_{\mu\nu}$, which is associated with the mass-less, gravitational field distributed all over space and proportional to the gravitational constant G (Cho, et al., 1976):

After insertion of eq. (15) into eq. (11), we get (Pardy, 1983):

$$P_{total}(\omega, t) = P_1(\omega, t) + P_{12}(\omega, t) + P_2(\omega, t), \tag{16}$$

where $(t' - t = \tau)$:

$$P_1(\omega, t) = \frac{G\omega}{r_1\pi}\int_{-\infty}^{\infty} d\tau \frac{\sin[2\omega r_1 \sin(\omega_0\tau/2)]}{\sin(\omega_0\tau/2)}\cos\omega\tau \times$$

$$\left(E_1^2(\omega_0^2 r_1^2\cos\omega_0\tau - 1)^2 - \frac{m_1^4}{2E_1^2}\right), \tag{17}$$

$$P_2(\omega, t) = \frac{G\omega}{r_2\pi}\int_{-\infty}^{\infty} d\tau \frac{\sin[2\omega r_2 \sin(\omega_0\tau/2)]}{\sin(\omega_0\tau/2)}\cos\omega\tau \times$$

$$\left(E_2^2(\omega_0^2 r_2^2\cos\omega_0\tau - 1)^2 - \frac{m_2^4}{2E_2^2}\right), \tag{18}$$

$$P_{12}(\omega, t) = \frac{4G\omega}{\pi}\int_{-\infty}^{\infty} d\tau \frac{\sin\omega[r_1^2 + r_2^2 + 2r_1r_2\cos(\omega_0\tau)]^{1/2}}{[r_1^2 + r_2^2 + 2r_1r_2\cos(\omega_0\tau)]^{1/2}}\cos\omega\tau \times$$

$$\left(E_1E_2(\omega_0^2 r_1 r_2\cos\omega_0\tau + 1)^2 - \frac{m_1^2m_2^2}{2E_1E_2}\right). \tag{19}$$

4.4 The quantum energy loss of the binary

Using the following relations

$$\omega_0\tau = \varphi + 2\pi l, \qquad \varphi \in (-\pi, \pi), \quad l = 0, \pm 1, \pm 2, ... \tag{20}$$

$$\sum_{l=-\infty}^{l=\infty} \cos 2\pi l \frac{\omega}{\omega_0} = \sum_{l=-\infty}^{\infty} \omega_0 \delta(\omega - \omega_0 l), \tag{21}$$

we get for $P_i(\omega, t)$, with ω being restricted to positive:

$$P_i(\omega, t) = \sum_{l=1}^{\infty} \delta(\omega - \omega_0 l) P_{il}(\omega, t). \tag{22}$$

Using the definition of the Bessel function $J_{2l}(z)$

$$J_{2l}(z) = \frac{1}{2\pi}\int_{-\pi}^{\pi} d\varphi \cos\left(z \sin\frac{\varphi}{2}\right)\cos l\varphi, \tag{23}$$

from which the derivatives and their integrals follow, we get for P_{1l} and P_{2l} the following formulas:

$$P_{il} = \frac{2G\omega}{r_i}\Big((E_i^2(v_i^2 - 1) - \frac{m_i^4}{2E_i^2}\Big)\int_0^{2v_i l} dx\, J_{2l}(x) +$$

$$4E_i^2(v_i^2 - 1)v_i^2 J'_{2l}(2v_i l) + 4E_i^2 v_i^4 J'''_{2l}(2v_i l)\Big), \quad i = 1, 2. \tag{24}$$

Using $r_2 = r_1 + \epsilon$, where ϵ is supposed to be small in comparison with radii r_1 and r_2, we obtain

$$[r_1^2 + r_2^2 + 2r_1 r_2 \cos\varphi]^{1/2} \approx 2a \cos\left(\frac{\varphi}{2}\right), \tag{25}$$

with

$$a = r_1\left(1 + \frac{\epsilon}{2r_1}\right). \tag{26}$$

So, instead of eq. (19) we get:

$$P_{12}(\omega, t) = \frac{2G\omega}{a\pi}\int_{-\infty}^{\infty} d\tau \frac{\sin[2\omega a \cos(\omega_0\tau/2)]}{\cos(\omega_0\tau)/2]} \cos\omega\tau \times$$

$$\left(E_1 E_2(\omega_0^2 r_1 r_2 \cos\omega_0\tau + 1)^2 - \frac{m_1^2 m_2^2}{2E_1 E_2}\right). \tag{27}$$

Now, we can approach the evaluation of the energy-loss formula for the binary from the power spectral formulae (24) and (27). The energy loss is defined by the relation

$$-\frac{dU}{dt} = \int P(\omega) d\omega =$$

$$\int d\omega \sum_{i,l} \delta(\omega - \omega_0 l) P_{il} + \int P_{12}(\omega) d\omega = -\frac{d}{dt}(U_1 + U_2 + U_{12}). \tag{28}$$

From the book of formulas (Prudnikov et al., 1983) we have Kapteyn's formula

$$\sum_{l=1}^{\infty} \frac{J_{2l}(2lv)}{l^2} = \frac{v^2}{2}. \tag{29}$$

After differentiating the last relation with respect to v, we have

$$\sum_{l=1}^{\infty} l J_{2l}'''(2lv) = 0. \tag{30}$$

We learn other Kapteyn's formulas (Prudnikov et al., 1983):

$$\sum_{l=1}^{\infty} 2l J_{2l}'(2lv) = \frac{v}{(1-v^2)^2}, \tag{31}$$

and

$$\sum_{l=1}^{\infty} l \int_0^{2lv} J_{2l}(x) dx = \frac{v^3}{3(1-v^2)^3}. \tag{32}$$

So, after application of eqs. (30), (31) and (32) to eqs. (24) and (28), we get:

$$-\frac{dU_i}{dt} = \frac{G m_i^2 v_i^3 \omega_0}{3 r_i (1 - v_i^2)^3}[13 v_i^2 - 15]. \tag{33}$$

Instead of using Kapteyn's formulas for the interference term, we will perform a direct evaluation of the energy loss of the interference term by the ω-integration in (27) (Sokolov et al., 1983). So, after some elementary modification in the ω-integral, we get:

$$-\frac{dU_{12}}{dt} = \int_0^{\infty} P(\omega) d\omega =$$

$$A \int_{-\infty}^{\infty} d\tau \int_{-\infty}^{\infty} d\omega \omega e^{-i\omega\tau} \sin[2\omega a \cos \omega_0 \tau] \left[\frac{B(C \cos \omega_0 \tau + 1)^2 - D}{\cos(\omega_0 \tau / 2)} \right], \tag{34}$$

with

$$A = \frac{G}{a\pi}, \quad B = E_1 E_2, \quad C = v_1 v_2, \quad D = \frac{m_1^2 m_2^2}{2 E_1 E_2}. \tag{35}$$

Using the definition of the δ-function and its derivative, we have, instead of eq. (34), with $v = a\omega_0$:

$$-\frac{dU_{12}}{dt} = A \omega_0 \pi \int_{-\infty}^{\infty} dx \, \frac{[B(C \cos x + 1)^2 - D]}{\cos(x/2)} \times$$

$$\left[\delta'(x - 2v \cos(x/2)) - \delta'(x + 2v \cos(x/2)) \right]. \tag{36}$$

According to the Schwinger article (Schwinger, 1998), we express the delta-function as follows:

$$\delta(x \pm 2v\cos(x/2)) = \sum_{n=0}^{\infty} \frac{(\pm 2v\cos(x/2))^n}{n!} \left(\frac{d}{dx}\right)^n \delta(x). \quad (37)$$

Then

$$\delta'(x \pm 2v\cos(x/2)) = \sum_{n=0}^{\infty} \frac{(\pm 2v\cos(x/2))^n}{n!} \left(\frac{d}{dx}\right)^{n+1} \delta(x) = \quad (38)$$

and it means that

$$\frac{[\delta'(x+2v\cos(x/2)) - \delta'(x-2v\cos(x/2))]}{\cos(x/2)} =$$

$$(-2)\sum_{n=1}^{\infty} \frac{(2v)^{2n-1}\left(\cos(x/2)\right)^{2(n-1)}}{(2n-1)!} \left(\frac{d}{dx}\right)^{2n} \delta(x) \quad (39)$$

Now, we can write eq. (36) in the following form after some elementary operations

$$-\frac{dU_{12}}{dt} = A\omega_0\pi \int_{-\infty}^{\infty} dx\, \Big(B(C\cos x+1)^2 - D\Big) \times$$

$$(-2)\sum_{n=1}^{\infty} \frac{(2v)^{2n-1}\left(\cos(x/2)\right)^{2(n-1)}}{(2n-1)!} \left(\frac{d}{dx}\right)^{2n} \delta(x), \quad (40)$$

where $\big(B(C\cos x+1)^2 - D\big)$ can be written as follows:

$$\Big(B(C\cos x+1)^2 - D\Big) =$$

$$4BC^2(\cos^4(x/2) + [4CB - 4BC^2](\cos^2(x/2) + [BC^2 - 2CB + B - D]. \quad (41)$$

After application of the per partes method, we get from eq. (40) the following mathematical object:

$$-\frac{dU_{12}}{dt} = (-2)A[4BC^2]\omega_0\pi \int_{-\infty}^{\infty} dx\, \delta(x) \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{\left(\cos(x/2)\right)^{2n+2}}{(2n-1)!} -$$

$$2A[4CB - 4BC^2]\omega_0\pi \int_{-\infty}^{\infty} dx\, \delta(x) \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{\left(\cos(x/2)\right)^{2n}}{(2n-1)!} -$$

$$2A[BC^2 - 2CB + B - D]\omega_0\pi \int_{-\infty}^{\infty} dx\, \delta(x) \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{\left(\cos(x/2)\right)^{2(n-1)}}{(2n-1)!}. \quad (42)$$

We get after some elementary operations $\int \delta f(x) = f(0)$

$$J_1 = \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{\left(\cos(x/2)\right)^{2n+2}}{(2n-1)!}\Big|_{x=0} = \sum_{n=0}^{\infty} f(n) v^{2n} = F(v^2), \quad (43)$$

$$J_2 = \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{\left(\cos(x/2)\right)^{2n}}{(2n-1)!}\Big|_{x=0} = \sum_{n=0}^{\infty} g(n) v^{2n} = G(v^2) \quad (44)$$

and

$$J_3 = \sum_{n=1}^{\infty} \left(\frac{d}{dx}\right)^{2n} (2v)^{2n-1} \frac{(\cos(x/2))^{2(n-1)}}{(2n-1)!}|_{x=0} = \sum_{n=0}^{\infty} h(n) v^{2n} = H(v^2) \qquad (45)$$

where f, g, h, F, G, H are functions which must be determined

So we get instead of eq. (41) the following final form

$$-\frac{dU_{12}}{dt} = (-2)A[4BC^2]\omega_0\pi G(v^2) - 2A[4CB - 4BC^2]\omega_0\pi F(v^2) -$$

$$2A[-2CB + BC^2 + B - D]\omega_0\pi H(v^2) \qquad (46)$$

Let us remark that we can use simple approximation in eq. (41) as follows: $(\cos(x/2))^{2n+2} \approx (\cos(x/2))^2, (\cos(x/2))^{2n} \approx (\cos(x/2))^2, (\cos(x/2))^{2(n-1)} \approx (\cos(x/2))^2$. Then, after using the well-known formula

$$\left(\frac{d}{dx}\right)^{2n} \cos^2(x/2) = \frac{1}{2}\cos(x + \pi n) \qquad (47)$$

and

$$\frac{1}{2}\cos(x + \pi n)|_{x=0} = \frac{1}{2}(-1)^n. \qquad (48)$$

So, instead of eq. (46) se have:

$$-\frac{dU_{12}}{dt} = A\omega_0\pi \left\{2BC + BC^2 + B - D\right\} \sum_{n=1}^{\infty} \frac{(2v)^{2n-1}(-1)^n}{(2n-1)!} \qquad (49)$$

5 Discussion and Summary

We have derived the spectral density of gravitons and the total quantum loss of energy of the black hole binary. The same formulas are valid for galaxy binaries which can be modelled as the two-body system. The energy loss is caused by the emission of gravitons during the motion of the two black hole binary around each other under their gravitational interaction. The energy-loss formulas of the production of gravitons are derived here by the Schwinger method. Because the general relativity and theory of gravity do not necessarily contain the last valid words to be written about the nature of gravity and it is not, of course, a quantum theory (Taylor, 1993), they cannot give the answer on the production of gravitons and the quantum energy loss, respectively. So, this article is the original text that discusses the quantum energy loss caused by the production of gravitons by the black hole binary system and by the galaxy binary. It is evident that the production of gravitons by the binary system forms a specific physical situation, where a general relativity can be seriously confronted with the source theory of gravity.

This article is an extended version of an older article by the present author (Pardy, 1983), in which only the spectral formulas were derived. Here we have derived the quantum energy-loss formulas, with no specific assumption concerning the strength of the gravitational field. We hope that future astrophysical observations will confirm the quantum version of the energy loss of the binary black hole and galaxy binary.

There is the fundamental problem concerning the maximal mass of the black hole and galaxy. The theory of the space-time with maximal acceleration constant was derived by author (Pardy 2018; Pardy, 2017). In this theory the maximal acceleration constant is the analogue of the maximal velocity in special theory of relativity. Maximal acceleration, determines the maximal black hole mass where the mass of the black hole is restricted by maximal acceleration of a body falling in the gravity field of the black hole.

The another question is what is the relation of our formulas to the results obtained by LIGO - the Laser Interferometer Gravitational-Wave Observatory. LIGO is the largest and most sensitive interferometer facility ever built. It has been periodically upgraded to increase its sensitivity. The most recent upgrade, Advanced LIGO (2015), detected for the first time the gravitational wave, with sensitivity far above the background noise. The event with number GW150914, was identified with the result of a merger of two black holes at a distance of about 400 Mpc from Earth LIGO, (215). Two additional, significant detections, GW151226 and GW170104, were reported later. We can say that at this time it is not clear if the LIGO results involves information on the spectrum of gravitons calculated in this chapter.

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Experimental trajectories in Euclidean and hyperbolic geometry

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Abstract

The Euler tetrahedron volume formula is used to define dimensionality of space and the Euclidean straight line and area. The double disk modul (DDM) is used to define trajectories on the metrical surfaces. The geodetical paths on the planet Mars can be realized by the Mars double disk modul (MDDM). The relations of generalized Lobačevskii geometry are derived and related to the Einstein equations. It is considered spherical and pseudospherical geometry, Riemann geometry, Lobačevskii and generalized Lobačevskii geometry, Poincaré model, Beltrami model, gravity as deformation of space and Schwinger theory of gravity.

Key words: Trajectory of elementary particle, Euler's tetrahedron formula, double disk modul, spherical and pseudospherical geometry, Riemann geometry, Lobačevskii and generalized Lobačevskii geometry, Poincaré optical model, Beltrami model, gravity as deformation of a medium, Schwinger theory of gravity.

1 Introduction

Trajectories of elementary particles in the Wilson chamber, ATLAS in LHC, or in the further terrestrial and cosmical detectors are the basic ingredients of physics of elementary particles and cosmical rays. No elementary particle can exist without its trajectory. In the particle physics the trajectories of particle are determined by their parameters as mass, charge, spin, velocity and by the influence of the magnetic and electric fields on its motion. We apply here the notion of path also in geometry to define not only straight line, but all geometrical curves including the Peano line, Weierstrass function, stochastic trajectory of the Brownian particle in the thermodynamical medium and so on.

To be pedagogically clear, we start with the axioms of Euclid. The Euclid postulates in modern language are: 1. Each pair of points can be joined by one and only by one straight line segment. 2. Any straight line segment can be indefinitely extended in their direction. 3. There is exactly one circle of any given radius with any given center 4. All right angles are congruent to one another 5. Given a line and a point not on it, there is exactly one line passing through the given point that is parallel to the given line.

Proclus (ca 400 A.D.) defined the parallel line as a set of points at constant distance from given line on one side from a straight line. At present time we know that this is the definition of the equidistant line.

If the straight line and point in the Euclidean geometry is not correctly defined, then consequences of such definitions are not correct in general.

Jordan introduced the line in geometry as the path of a point moving in a space and making a trace in the space. We here respect the Jordan definition with the restriction that our trajectories are performed by so called double disk modul.

We introduce the double disk modul - DDM - which is the basic element of the kinematic geometry and dynamics of the nonholonomous systems (Nejmark et al., 1967).

The mathematical textbooks, or, monographs are written in the clear form. We use here the exact definition and exact theorem formalism. The theorems are presented without proofs because they are possible to prove by insight, or, by the elementary logic. Every theorem can be improved. It can be proved by the logical way and it can be also proved by computer with the artificial intelligence (AI). Every set of elements can be well ordered. Our set of elements are definitions and theorems. The arrangement of our definitions and theorems is not in the final form, because new and new theorems can be created by the methods of creativity (Pardy, 2005) and by the AI. To our knowledge, the world dictionary of the mathematical theorems was not still published.

2 The Euclidean area and volume

Theorem: The point A and B can be joined by the infinite number of lines passing from A to B.

Theorem: There is the shortest distance between A and B forming the segment of the straight line passing from A to B (Hilbert, 1902).

Theorem: The shortest distance between point A and B can be physically realized by the flexible but non-elastic fibre.

Theorem: The segment AB of a straight line can be prolongated in the direction AB, or BA in order to generate the straight line.

Theorem: The prolongation can be easily performed by ruler.

Theorem: If point C is a such point that it does not lie on the segment AB, then if we define AB = c, BC = a, CA = b, then the area of the triangle ABC is given by the Heron formula

$$P = \sqrt{s(s-a)(s-b)(s-c)}, \quad s = \frac{1}{2}(a+b+c). \tag{1}$$

Theorem: The segment of a straight line is a triangle with zero area.

Theorem: If P = 0, then point C lies on AB , or, on the prolongation of AB. If $P \neq 0$, the point C does not lies on AB, or, on the prolongation of AB.

Theorem: The prolongation can be repeated infinite times to create the straight line.

Theorem: The Euclid plane is formed by three points. It means if the point C is not on the prolongation of line AB, then ABC is an triangle and triangle is the element of Euclid plane.

Theorem: The Euclidean sheet is the mathematical object defined by the Hilbert distance axioms.

Theorem: There are only points, straight lines (straight trajectories) and curved lines (curved trajectories) in the Euclidean sheet defined by the Hilbert distance axioms.

Theorem: Adding the point D to the configuration ABC we get tetrahedron with triangles sides d_{ik}.

Theorem: The volume of the tetrahedron ABCD is given by the Euler formula (Callandreau, 1949):

$$V_E^2 = \frac{1}{288} \begin{vmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & d_{12} & d_{13} & d_{14} \\ 1 & d_{21} & 0 & d_{23} & d_{24} \\ 1 & d_{31} & d_{32} & 0 & d_{34} \\ 1 & d_{41} & d_{42} & d_{43} & 0 \end{vmatrix}, \tag{2}$$

where

$$d_{ik} = (x_i - x_k)^2 + (y_i - y_k)^2 + (z_i - z_k)^2, \tag{3}$$

where x_i, y_i, z_i are Cartesian coordinates of points with index i = 1, 2, 3, 4.

Theorem: If a point D is fixed in the space in such a way that $V_E = 0$, then point D lies in the plane ABC.

Theorem: It is possible to construct all points of the Euclid plane using the Euler formula.

Theorem: If point D has a such position with regard to triangle that $V_E \neq 0$, then point D belongs to the 3-dimensional space.

Theorem: The stars forming Cancer, or Crux, or Sagitta, or Libra, are the gigantic cosmological tetrahedrons.

Theorem: The chemical compounds AlF_3, Fe_3C, PH_3, NH_3 form the microscopical tetrahedrons.

Theorem: The nucleus ${}^4_2$He forms the microscopical tetrahedrons.

Theorem: The sub-nuclear tetrahedrons, still not detected by ATLAS, are created during the collisions of protons in LHC, or by collisions of particles in TEVATRON.

Theorem: The sub-nuclear tetrahedrons, still not detected, are integral parts of the cosmical rays.

3 Double disk modul (DDM) and its motion

Definition of DDM: DDM is constructed as a frame AXB with two disks at points A and B and the joint mechanism at point X - so called the bicycle modul. It is supposed for the simplicity that AX = BX = d and the deflection angle of AX from the BX is here denoted as ε. The motion of DDM is supposed to be forward, of backward with regard to vector $\overrightarrow{AX}$. The maximal ε in the direction of clock-vise and anti-clock-vise is $\pi/2$. The trajectory generated by DDM is the track of disk A.

Definition: The side-by-side DDM is defined as an analogue of the DDM with configuration A-X-B with the difference that in the side-by-side modul the elements are arranged as follows: disk A is perpendicular on AX, disk B is perpendicular on BX and AX is parallel with BX. The deflection angle $\varepsilon = 0$.

Theorem: The DDM and the side-by-side DDM is the fundamental component of the kinematic geometry and of the dynamics of the non-holonomous systems (Nejmark et al., 1967).

Theorem: The trajectories generated by the DDM can be realized physically if and only if there is some at least small interaction of the DDM with the plane. The interaction is called friction.

Theorem: The segment AB of line p can be prolongated by DDM.

Theorem: If the deflection angle ε is constant, then the trajectory of the DDM on the Euclidean sheet is a circle.

Theorem: The radius of the circle performed by the DDM with the deflection angle $\varepsilon = \pi/2$ is r = d.

Theorem: Every planar curve can be considered as the trajectory performed by the DDM with variable deflection angle ε.

Theorem: For the symmetrical DDM the trajectory of the disk A is the same as the trajectory of the disk B. Or, $T_{AB} \equiv T_{BA}$.

Theorem: $T_{AB} \neq T_{BA}$ for the non-symmetric DDM.

Theorem: Two linear segments AB and CD are of the same length if the DDM moving from A to B performs the same angle of rotation as in the case it moves from C to D.

Theorem: The trajectory generated by the DDM does not depends on the local velocity and acceleration of DDM.

Theorem: The trajectory generated by the DDM is geodetic for $\varepsilon(t) = 0$ and it is non-geodetic for $\varepsilon(t) \neq 0$.

Theorem: The trajectory generated by DDM moving without friction on the surface is not defined.

Theorem: The Brownian trajectory in statistical physics can be realized by DDM if and only if the deflection angle is stochastic function dependent on time.

Theorem: Trajectory of the disk A of the DDM performed on cone is a circle, or ellipse, or divergent spiral, or convergent spiral.

Theorem: Trajectory of the disk A of the DDM performed on cylinder is a circle, or an ellipse, or the divergent spiral, or the convergent spiral.

Theorem: If p is straight line and disk A of side-by-side DDM follows this line, then disk B, follows the line which is parallel to p.

Theorem: Every area inside of the closed line can be divided by the parallel lines. The division can be performed by side-by-side DDM.

Theorem: If the one disk of DDM is charged and the surface is dielectric medium then the Čerenkov radiation is generated if and only if the velocity of DDM is grater than the speed of light in the dielectric layer.

Theorem: If the one disk of DDM is charged and the surface is graphene sheet, the Smith-Purcell radiation is generated.

Theorem: If the one disk of DDM is charged and the surface is in magnetic field, the synchrotron radiation is generated.

Theorem: If one disk of DDM is charged and the surface is in magnetic field the trajectory of DDM is not geodetic line.

4 Plane trajectories

Theorem: Every plane curve can be realized by the infinitesimally small DDM.

Theorem: Every broken curve can be realized by the DDM.

Theorem: Every Peano curve can be realized by DDM.

Theorem: Every Feynman two dimensional path in quantum mechanics can be realized by DDM.

Theorem: Every Henstock-Kurzweil-Feynman-Pardy two dimensional path in quantum mechanics can be realized by DDM.

Definition: Brownian trajectory of a point particle in the stochastic thermodynamical medium is a fractured curve with no tangent in any point of this trajectory $\mathbf{x}(t)$.

Theorem: The Brownian motion trajectory on a sphere can be realized by DDM if and only if the deflection angle is stochastic.

Theorem: Every classical continual trajectory on sphere can be realized by DDM.

Theorem: The shortest trajectory $y = y(x)$ between two point $A(x_1, y_1)$ and $B(x_2, y_2)$ in the Euclidean plane x-y is $y = ax + b$, a, b being some constants can be find as the solution of the Bernoulli izoperimetric problem of the variational calculus with functional

$$L = \int_{x_1}^{x_2} [1 + y'^2]^{1/2} dx; \quad y' = \frac{dy}{dx} \tag{4}$$

after insertion of it into the Euler-Lagrange equation

$$\frac{\partial L}{\partial y} - \frac{d}{dx}\left(\frac{\partial L}{\partial y'}\right) = 0 \tag{5}$$

and after its solution (Lavrentjev et al., 1950).

Theorem: The massive fiber joining point $A(x_1, y_1)$ and $B(x_2, y_2)$ in the gravitational field is never of the straight line form. It is catenary.

Dirichlet principle: The geometrical form of the catenary is a such that the potential energy of catenary is minimal in the homogeneous gravitational field.

Theorem: The geometrical form of catenary from $A(x_1, y_1)$ to $B(x_2, y_2)$ is determined by the theory of the izoperimetric problem in mechanics. Namely, as problem of the minimum of the potential energy of a massive fiber with length l and linear density $\sigma = 1$, or,

$$V_{potential} = \frac{1}{l} \int_{x_1}^{x_2} y\sqrt{1 + y'^2} dx \tag{6}$$

under the condition the length of the fiber is constant, or

$$\int_{x_1}^{x_2} \sqrt{1+y'^2}dx = l. \tag{7}$$

Theorem: The DDM with the constant deflection angle ε and with AX = XB = d performs on the Euclidean sheet the circular trajectory with the radius

$$r = d/tan(\varepsilon/2). \tag{8}$$

5 Famous plane trajectories

Theorem: DDM can generate all famous plane curves of the analytical geometry. Namely: Astroid, Bicorn, Cardioid, Cartesian, Oval, Cassinian ovals, Catenary, Cayley's sextic, Circle, Cissoid, of Diocles, , Cochleoid, Conchoid, Conchoid of de Sluze, Cycloid, Devil's curve, Double folium, Drer's shell curves, Eight curve, Ellipse, Epicycloid, Epitrochoid, Equiangular Spiral, Fermat's spiral, Folium, Folium of Descartes, Freeth's nephroid, Frequency curve, Hyperbola, Hyperbolic spiral, Hypocycloid, Hypotrochoid, Involute of a circle, Kampyle of eudoxus, Kappa curve, Lam curves, Lemniscate of Bernoulli, Limacon of Pascal, Lissajous curves, Lituus, Neile's parabola, Nephroid, Newton's parabolas, Parabola, Pearls of de Sluze, Pear-shaped quartic, Plateau curves, Pursuit curve, Quadratrix of Hippias, Rhodonea curves, Right strophoid, Serpentine, Sinusoidal spirals, Spiral of Archimedes, Spiric sections, Straight Line, Talbot's curve, Tractrix, Tricuspoid, Trident of Newton, Trifolium, Trisectrix of Maclaurin, Tschirnhaus' Cubic, Watt's curve, Witch of Agnesi.

Theorem: There is a such $\varepsilon(t)$ of the DDM, that DDM generates the function which is continual but not differentiable.

Theorem: There is a such $\varepsilon(t)$ of the DDM, that DDM generates Weierstrass function which is continual but not differentiable. Namely the function

$$f(x) = \sum_{n=0}^{\infty} a^n \cos\left(b^n \pi x\right), \tag{9}$$

where $0 < a < 1$, b is add and $ab > 1 + 3\pi/2$.

Theorem: The Weierstrass function is not trajectory of the Brownian particle which is also continual but not differentiable.

6 The trajectories on the surface

Theorem: If the DDM performs geodetic trajectory from A to B on a surface, then trajectory performed from B to A is also geodetic and it is identical with the former (Parity is conserved).

Theorem: The geodetic line $y = y(x), z = z(x)$ from point $A(x_1, y_1, z_1)$ to point $B(x_2, y_2, z_2)$ on the surface $\varphi(x, y, z) = 0$ is the solution of the izoperimetric problem with the functional

$$F = \int_{x_1}^{x_2} \left\{[1 + y'^2 + z'^2]^{1/2} - \lambda\varphi(x, y, z)\right\} dx; \quad y' = \frac{dy}{dx}, z' = \frac{dz}{dx}, \tag{10}$$

where λ is the Lagrange multiplicator.

Theorem: The DDM can realize every curve on the surface, which is defined by the parametric equation (t = parameter).

$$\mathbf{r} = x(u,v)\mathbf{i} + y(u,v)\mathbf{j} + z(u,v)\mathbf{k}; \quad u = u(t); \quad v = v(t). \tag{11}$$

Theorem: If $\varepsilon(t)$ in DDM is transcendental function, then the trajectory is also transcendental in some cartesian coordinate system.

Theorem: The trajectory with $-\pi/2 < \varepsilon_1(t) < 0$ is on the left side of the trajectory with $\varepsilon(t) = 0$ and the trajectory with $0 < \varepsilon_2(t) < \pi/2$ is on the right of the trajectory with $\varepsilon(t) = 0$.

Theorem: If $\varepsilon_1(t) = -\varepsilon_2(t)$, the trajectories are symmetrical with regard to the trajectory with $\varepsilon(t) = 0$.

Theorem: The DDM with $\varepsilon = \pm\pi/2$ is a compass.

Theorem: The deflection angle ε is zero if and only if the radius created by the DDM is infinite.

Theorem: The curved trajectory generated by DDM is geodetic line if and only if the deflection angle ε is zero and the plane of A and B are perpendicular to the tangential plane of the surface at the touch point.

Theorem: If the trajectory p generated by DDM starts from point A, then the trajectory q started from point $B \neq A$ is not parallel with the trajectory p in general.

Theorem: If the trajectory p generated by DDM is straight line passing through point A and the trajectory q is straight line passing through point B $\neq$ A, Then p is parallel to q if and only if there is common normal to p and q.

7 The Riemann geometry and gravity

Theorem: On the Riemann sphere with the element $ds^2 = g_{ij}dx^i dx^j$, the sum of the interior angles α, β, γ of a triangle ΔABC is $\neq 2\pi$.

Theorem: There is no linear segment on Riemann surface.

Theorem: The shortest line between point A and B on Riemann surface is the geodetic line.

Theorem: The prolongation of the geodetic segment AB on the Rieman surface can be performed by the infinitesimally narrow flexible nonelastic strip partially identical with segment AB.

Theorem: The Brownian motion trajectory on the Riemann surface can be realized by DDM if and only if the deflection angle is stochastic.

Theorem: The Tartaglia et al. (2009) idea that the curved space-time is the result of the deformation of the Minkowski space-time is correct with the definition

$$g_{\mu\nu} = (\eta_{\mu\nu} + 2\varepsilon_{\mu\nu}) \tag{12}$$

with

$$\varepsilon_{\mu\nu} = \eta_{a\nu}\frac{\partial u^a}{\partial x^\mu} + \eta_{b\mu}\frac{\partial u^b}{\partial x^\nu} + \eta_{ab}\frac{\partial u^a}{\partial x^\mu}\frac{\partial u^b}{\partial x^\nu}. \tag{13}$$

Theorem: If the gravity is the deformation of the Minkowski space-time, then it is not deformation of entropy.

8 The trajectories on a sphere

Theorem: There is no linear segment on a sphere.

Theorem: On a sphere with radius R, the sum of the interior angles α, β, γ of a triangle ΔABC, is $> 2\pi$.

Theorem: On the sphere with radius R the area of a triangle ΔABC is $R^2(\alpha + \beta + \gamma - \pi)$.

Theorem: The shortest line between points A and B on a sphere is the geodetic line.

Theorem: The prolongation of the geodetic segment on sphere cannot be performed by method of euclidean geometry.

Theorem: The prolongation of the geodetic segment AB of sphere can be performed by the strip which is infinitesimally narrow, nonelastic with flexibility perpendicular on the surface. The application of the strip is in the direction of the segment consequently many times.

Theorem: The prolongation of the geodetic segment AB can be performed mechanically by the double disk modul DDM starting its motion on the geodetic line.

Theorem: Every classical continual trajectory (curve) on the sphere can be realized by DDM.

Theorem: The DDM trajectory can be simulated by the computer program.

Theorem: Trajectory of the T_A of the disk A performed on a sphere under the condition that the deflection angle is a constant $\varepsilon = const$, is a circle, but the trajectory is not the geodetic line.

Theorem: The disks A and B of the side-by-side DDM form two trajectories which are equidistant.

Theorem: The disks A and B of the side-by-side DDM forms two trajectories which are equidistant but not parallel in general.

Theorem: It is possible to create the trajectory q which is parallel to the trajectory p by the DDM.

9 The Lobačevskii geometry

The Lobačevskii geometry is the integral part of the general geometry called non-euclidean geometry. The name non-Euclidean was used by Gauss to describe a system of geometry which differs from Euclid's in its properties of parallelism. Such a system was developed independently by Bolyai in Hungary and Lobačevskii in Russia, about 120 years ago. Another system, differing more radically from Euclid's, was suggested later by Riemann in Germany and Schlafli in Switzerland. The subject was unified in 1871 by Klein, who gave the names parabolic, hyperbolic, and elliptic to the respective systems of Euclid, Bolyai-Lobačevskii, and Riemann-Shlafli (Coxeter, 1998).

Definition: (of the angle of parallelism by Lobačevskii) Given a point P and a line q. The Intersection of the perpendicular through P let be Q and PQ = x. The intersection of line p passing through P, with q, let be R and QR = k. Then the angle RPQ for perpendicular distance x

$$\Pi(x) = 2\tan^{-1} e^{-x/k} \tag{14}$$

is known as the Lobačevskii formula for the angle of parallelism.(Coxeter, 1998; Lobačevskii, 1914).

Theorem: It is not excluded that the Lobačevskii geometry was created using the appropriate solid state model.

Theorem: The Tartaglia et al. idea (Tartaglia, et al., 2009) is the analogue of the Beltrami trial to find realistic model for the Lobačevskii geometry.

Theorem: Optical geometry with the variable index of refraction is not the Euclidean geometry.

Theorem: Lobačevskii geometry can be realized by the appropriate plane deformation.

Theorem: Lobačevskii geometry is the specification of the Riemann geometry.

Theorem: If the surface is the Euclidean plane with Euclidean metric, then it is not possible to generate the Lobačevskii geometry on it by DDM with constant deflection angle $\varepsilon(t) \equiv 0$.

Theorem: The Poincaré model of the Lobačevskii geometry is the physical one.

Theorem: According to Hilbert (Hilbert, 1903), it is not possible to realize the Lobačevskii geometry globally on sphere with the constant negative curvature.

Theorem: The Beltrami realization of the Lobačevskii geometry is only partial.

Theorem: The Lobačevskii geometry is the partial geometry on the pseudosphere with the parametric equations

$$x = a\sin u\cos v, \quad y = a\sin u\sin v, \quad z = a\left(\ln\tan\frac{u}{2} + \cos u\right). \tag{15}$$

(Kagan, 1947, ibid. 1948; Kagan, 1955; Efimov, 2004; Norden, 1956; Klein, 2004; Fuks, 1951; Manning, 1963).

Theorem: The pseudosphere is the surface generated by the rotation of the tractrix with equation

$$x = a\sin u, \quad y = 0, \quad z = a\left(\ln\tan\frac{u}{2} + \cos u\right). \tag{16}$$

Theorem: The pseudosphere is in the half geodetic coordinates given by the squared element

$$ds^2 = du^2 + \cosh^2\frac{u}{a}dv^2. \tag{17}$$

Theorem: The pseudosphere is in the izothermical coordinates given by the Poincaré squared element

$$ds^2 = \frac{a(dx^2 + dy^2)}{y^2}. \tag{18}$$

Theorem: The Leibniz solution of the tractrix problem is as follows:

$$y = a\frac{\ln(a + \sqrt{a^2 - x^2})}{x} - \sqrt{a^2 - x^2}. \tag{19}$$

Theorem: The Lobačevskii formulas for triangles in his geometry follows from the spherical formulas

$$\cos\frac{a}{r} = \cos\frac{b}{r}\cos\frac{c}{r} + \sin\frac{b}{r}\sin\frac{c}{r}\cos A, \tag{20}$$

$$\frac{\sin A}{\sin a/r} = \frac{\sin B}{\sin b/r} + \frac{\sin C}{\sin c/r}, \tag{21}$$

$$\cos A = -\cos B\cos C + \sin B\sin C\cos(a/r). \tag{22}$$

by transformation $r \to ir$, where r is the radius of sphere and a, b, c are lengths of sides of the triangle on the sphere and A, B, C are appropriate angles.

Theorem: The Lobačevskii relations for the triangle on his plane are as follows:

$$\cosh\frac{a}{r} = \cosh\frac{b}{r}\cosh\frac{c}{r} + \sinh\frac{b}{r}\sinh\frac{c}{r}\cosh A, \tag{23}$$

$$\frac{\sin A}{\sinh a/r} = \frac{\sin B}{\sinh b/r} + \frac{\sin C}{\sinh c/r}, \tag{24}$$

$$\cos A = -\cos B\cos C + \sin B\sin C\cosh(a/r). \tag{25}$$

Theorem: If the $g_{\mu\nu}$ is the metrical tensor of the Lobačevskii geometry, then the tensor of energy-momentum follows from the Einstein gravitational equations

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = \frac{8\pi G}{c^4}T_{\mu\nu}. \tag{26}$$

Theorem: The generalized Lobačevskii formulas for triangles in generalized geometry follow from the spherical formulas (20), (21), (22) by transformation $r \to r + i\varrho$. The new formulae are as follows:

$$\cos\varphi_a\cosh\chi_a + \sin\varphi_a\sinh\chi_a =$$

$$[\cos\varphi_b\cosh\chi_b + \sin\varphi_b\sinh\chi_b][\cos\varphi_c\cosh\chi_c + \sin\varphi_c\sinh\chi_c] \quad +$$

$$[\sin\varphi_b\cosh\chi_b + \cos\varphi_b\sinh\chi_b][\sin\varphi_c\cosh\chi_c + \cos\varphi_c\sinh\chi_c]\cos A, \tag{27}$$

$$\frac{\sin A}{\sin\varphi_a\cosh\chi_a + \cos\varphi_a\sinh\chi_a} =$$

$$\frac{\sin B}{\sin\varphi_b\cosh\chi_b + \cos\varphi_b\sinh\chi_b} \quad +$$

$$\frac{\sin C}{\sin\varphi_c\cosh\chi_c + \cos\varphi_c\sinh\chi_c}, \tag{28}$$

$$\cos A = -\cos B\cos C \quad +$$

$$\sin B\sin C[\cos\varphi_a\cosh\chi_a + \sin\varphi_a\sinh\chi_a], \tag{29}$$

where

$$\varphi_a; \varphi_b; \varphi_c; = \frac{ar}{r^2 + \varrho^2}; \quad \frac{br}{r^2 + \varrho^2}; \quad \frac{cr}{r^2 + \varrho^2} \tag{30}$$

and

$$\chi_a; \chi_b; \chi_c; = \frac{a\varrho}{r^2 + \varrho^2}; \quad \frac{b\varrho}{r^2 + \varrho^2}; \quad \frac{c\varrho}{r^2 + \varrho^2} \tag{31}$$

and ϱ is the new parameter of the triangle on the generalized sphere and A, B, C are appropriate triangle angles.

Theorem: If the $g_{\mu\nu}$ is the metrical tensor of the Lobačevskii-Pardy geometry, with $r \to r + i\varrho$, then the tensor of energy-momentum follows from the Einstein gravitational equations (26).

Theorem: It is not excluded that the Lobačevskii-Pardy triangle relations correspond to processes in the particle physics.

Theorem: The space of velocities in the special theory of relativity is the space of the Lobačevskii geometry (Fok, 1961; Landau et al., 1988).

Theorem: If $\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3}$, are velocities of the three massive points in the special theory of relativity, then these velocities form the triangle in the Lobačevskii space of velocities (Fok, 1961).

Theorem: The trajectories of particle components in the decay of the neutral π-meson (Steinberger at al., 1950)

$$\pi^0 \quad \longrightarrow \quad \gamma \quad + \quad \gamma \tag{32a}$$

creates the Lobačevskii angle of parallelism $\Pi < \pi/2$.

Theorem: The trajectories of particle components in the decay of the neutral K_1^0-meson (Cabbibo et al., 1960; Barger, 1964)

$$K_1^0 \quad \longrightarrow \quad \gamma \quad + \quad \gamma \tag{32b}$$

creates the Lobačevskii angle of parallelism $\Pi < \pi/2$.

Theorem: The trajectories of particle components in the decay of the arbitrary neutral meson

$$neutral \quad meson \quad \longrightarrow \quad \gamma \quad + \quad \gamma \tag{32c}$$

creates the Lobačevskii angle of parallelism $\Pi < \pi/2$.

10 The Poincaré model of the Lobačevskii geometry

Fermat's Theorem: The trajectory of light from point A to B in the optical medium is of the shortest optical length.

Theorem: The trajectory of the optical ray from point A to point B with reflection on the mirror in point C is of the shortest optical length in classical optics.

Theorem: The Descartes statement that the angle of the ray reflection by the mirror is equal to the angle of incident ray on the mirror is correct in classical optics.

Theorem: The Descartes statement that the angle of reflection ray is equal to the angle of incident ray on the mirror is not correct in the crystal optics.

Theorem: The trajectory of light passing from $A(x_1, y_1)$ to $B(x_2, y_2)$ is determined by by the Fermat principle, which states that the time from $A(x_1, y_1)$ to $B(x_2, y_2)$ is the result of the minimum of the functional

$$T(y, y') = \int_{x_1}^{x_2} \frac{ds}{v(y)} = \int_{x_1}^{x_2} \frac{\sqrt{1 + y'^2}}{v(y)} dx, \tag{33}$$

where $v(y)$ is the velocity of light.

Theorem: The functional $T(y, y')$ in the Euler-Lagrange equations

$$T(y, y') - y'T_{y'}(y, y') = C \tag{34}$$

gives for $v = Ay$ the solution in the form of circles forming the Poincaré model of the Lobačevskii geometry:

$$(x - C)^2 + y^2 = r^2. \tag{35}$$

Theorem: The Poincaré circles can be generated by the DDM.

Theorem: If $v = Ay$ in the optical medium, then the plane (x, y) is the Poincaré realization of the Lobačevskii hyperbolic geometry.

Theorem: The Poincaré theorems for circles in his model are analogue of the theorems for straight lines in the Euclidean geometry.

Theorem: The following theorems are valid in the Poincaré model of the Lobačevskii geometry:

Theorem 1:. Only one half-circle passes through two points A, B in the Poincaré plane.

Theorem 2: The curvilinear segment AB in the Poincaré plane is of the shortest length.

Theorem 3: The parallels are two half-circles with the intersections on the x-axes.

Theorem 4: If point $A \notin q$ then there are $q_1 \parallel q$, $q_2 \parallel q$ passing through A, with $q_1 \neq q_2$.

Theorem 5: If point $A \notin q$, $q_1 \parallel q, q_2 \parallel q$, then q_1, q_2 divide the Poincaré plane in four different sectors I, II, II, IV.

Theorem: The optical distance between point A and B is not equivalent to the mechanical distance realized by the nonelastic flexible fibre, or by the DDM.

Theorem: The geometrical form of the optical trajectory between A and B is not identical with the geometrical form of the string stretched between A and B.

Theorem: Einstein deflection of light by the curved space time is possible to interpret as the interaction of light with modified vacuum by the gravitational field.

Theorem: All gravity effects of Einstein theory with the metrical tensor $g_{\mu\nu}$ follows from the theory where the interaction of light with the gravitational field is described by the Schwinger action for the massless spin 2 fields (Schwinger, 1976):

$$W(T) = \frac{1}{2} \int (dx)(dx') \quad \times$$

$$\left(T^{\mu\nu}(x) D_+(x - x') T_{\mu\nu} x') - \frac{1}{2} T(x) D_+(x - x') T(x') \right). \tag{36}$$

where $T^{\mu\nu}$ is the tensor of energy-momentum, $T = T_\nu^\nu$ and $D_+(x - x)$ is the causal propagator of the elementary particle with zero mass.

Theorem: Spin 2 as the quantum phenomenon is not possible to derive from Einstein gravity. Similarly the Maxwell-Boltzmann statistical distribution is not possible to derive from the thermodynamic state equation $pV = RT$, and quantum mechanics is not possible to derive from classical mechanics.

Theorem: The Lobačevskii geometry represented by the trajectories in the optical medium where the velocity of light is $v = const.y$ is equivalent to the existence of the index of refraction $n = const.y/c$ in this medium, c being the velocity of light in vacuum.

Theorem: The Poincaré model of geometry where the light velocity is $v = const.y$ is the interaction model of light with the optical medium.

11 Discussion

We have seen in the article how to create the trajectories and geodetic lines by so called double disk modul (DDM) which is the method replacing the older geometrical method in defining the geodetic lines. The modul in the electronic form can be used to realize the geodetical paths on the planet Mars by the Mars double disk modul (MDDM) - and NASA is able to prove it.

The article involves great amount of the geometrical theorems which were formulated using the DDM. Every theorem can be proved by the rigorous mathematical way but with regard to the simplicity of the theorems, the proofs were not performed. We know that the theorems can be created by the logical combinations of the mathematical ideas and mathematical objects. However, according to Poincaré, only some of such combinations are useful. Namely, only beautiful mathematical theorems are useful.

The article is in no case an analogue of the Pascal, Spinoza, Descartes, Husserl, or Wittgenstein meditations, because their meditations cannot be proved by the mathematical way and they are formulated only on the philosophical platform.

Our approach to the geometry, where the trajectories are created by DDM, is in some sense experimental. We are aware that it is not possible to ascertain that a line is straight without making some measurement, or, without sliding along this line an instrument called a ruler which is a sort of measuring instrument. Or, we know, that the Poincaré model of the Lobačevskii geometry is the optical model based on the index of refraction, which is the consequence of the interaction of light with medium.

Also, space, when considered independently of measuring instruments, has neither metric nor projective properties; it has only topological properties. It is amorphous (Poincaré, 1963). That which cannot be measured cannot be an object of science.

Analogically, the properties of time are those of the measuring instruments. The Bergson definition of time as duration could not be tested by an instrument. The Bergsonian duration, is psychological time and it can be influenced by pharmaceutical interaction.

Some theorems in this article will have the substantial influence of the scientific potential of the society and will have substantial influence on the growth of world economy. At the same time it is not excluded that the kinematic geometry based on DDM will start the reformulation of the differential geometry.

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The synchrotron photons from the wave solution of the Dirac equation

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Abstract

The goal of this article is to show the derivation of the power spectrum of the synchrotron radiation from the Volkov solution of the Dirac equation and from S-matrix. We also generalize the Bargmann-Michel-Telegdi equation for the spin motion in case it involves the radiation term. This equation plays the crucial role in spin motion of protons in LHC and FERMILAB. The axion production in the magnetic field described by the Volkov solution is discussed.

Key words: Volkov equation, synchrotron radiation, quantum effects.

1 Introduction

Around year 1947 Floyd Haber, a young staff member and technician in the laboratory of prof. Pollock, visually observed radiation of electrons moving circularly in the magnetic field of the chamber of an accelerator (Ternov, 1994). It occurred during adjustment of cyclic accelerator-synchrotron which accelerated electrons up to 100 MeV (Elder et al.,). The radiation was observed as a bright luminous patch on the background of the chamber of the synchrotron. It was clearly visible in the daylight. In this way the "electron light" was experimentally revealed for the first time as the radiation of relativistic electrons of large centripetal acceleration. The radiation was identified with the Ivanenko and Pomeranchuk radiation, or with the Schwinger radiation and later was called the synchrotron radiation since it was observed for the first time in synchrotron. The radiation was considered as the mysterious similarly to the Roentgen mysterious x-rays.

A number of theoretical studies on the emission of a relativistic accelerating electron had been carried out long before the cited experiment. The first steps in this line was treaded by Lienard (1898). He used the Larmor formula

$$P = \frac{2}{3}\frac{e^2}{c^3}\left(\frac{d\mathbf{v}}{dt}\right)^2 = \frac{2}{3}\frac{e^2}{m^2c^3}\left(\frac{d\mathbf{p}}{dt}\right)^2, \tag{1}$$

and extended it to the high-velocity particles. He also received the total radiation of an electron following a circle of an circumference $2\pi R$.

In modern physics, Schwinger (1945, 1949) used the relativistic generalization of the Larmor formula to get the total synchrotron radiation. Schwinger also obtained the spectrum of the synchrotron radiation from the method which was based on the electron work on the electromagnetic field, $P = -\int(\mathbf{j}\cdot\mathbf{E})d\mathbf{x}$, where the intensity of electric field he expressed as the subtraction of the retarded and advanced electric field of a moving charge in a magnetic field, $\mathbf{E} = \frac{1}{2}(\mathbf{E}_{ret} - \mathbf{E}_{adv})$, (Schwinger, 1949).

Schott in 1907 was developing the classical theory of electromagnetic radiation of electron moving in the uniform magnetic field. His calculation was based on the Poynting vector. The goal of Schott was to explain the spectrum of radiation of atoms. Of course the theory of Schott was unsuccessful because only quantum theory is adequate to explain the emission spectrum of atoms. On the other hand the activity of Schott was not meaningless because he elaborated the theory of radiation of charged particles moving in the electromagnetic field. His theory appeared to be only of the academical interest for 40 years. Then, it was shown that the theory and specially his formula has deep physical meaning and applicability. His formula is at the present time the integral part of the every textbook on the electromagnetic field.

The classical derivation of the Schott formula is based on the Poynting vector $\mathbf{S}$ (Sokolov et al. 1966)

$$\mathbf{S} = \frac{c}{4\pi}\mathbf{E}\times\mathbf{H}, \tag{2}$$

end $\mathbf{E}$ and $\mathbf{H}$ are intensities of the electromagnetic field of an electron moving in the constant magnetic field, where the magnetic field is in the direction of the axis z. In this case electron moves along the circle with radius R and the electromagnetic field is considered in the wave zone and in a point with the spherical coordinates r, θ, φ. In this case it is possible to show that the nonzero components of the radiated field are $-H_\theta = E_\varphi, H_\theta = E_\theta$ (Sokolov et al. 1966). They are calculated from the vector potential $\mathbf{A}$ which is expressed as the Fourier integral.

The circular classical trajectory of the electron is created by the Lorentz force $F = (e/c)(\mathbf{v}\times\mathbf{H})$. The trajectory is stationary when the radiative reaction is not considered. The radiative reaction causes the transformation of the circular trajectory to the spiral trajectory. In quantum mechanics, the trajectory is stationary when neglecting the interaction of an electron with the vacuum field. The interaction of an electron with the vacuum field, causes the electron jumps from the higher energetic level to the lower ones. In quantum electrodynamics description of the motion of electron in a homogeneous magnetic field, the stationarity of the trajectories is broken by including the mass operator into the wave equation. Then, it is possible from the mass operator to derive the power spectral formula (Schwinger, 1973). Different approach is involved in the Schwinger et al. article (1976).

It was shown that the spectral formula of the synchrotron radiation following from the quasi-classical description of the radiation of electron moving in the magnetic field is given by the following expression (Berestetzkii et al., 1989; (90.24)):

$$P(\omega) = \frac{dI}{d\omega} = -\frac{e^2 m^2 \omega}{\sqrt{\pi}\varepsilon^2}\left\{\int_x^\infty \Phi(\xi)d\xi + \left(\frac{2}{x} + \frac{\hbar\omega}{\varepsilon}\chi x^{1/2}\right)\Phi'(x)\right\}, \tag{3}$$

where

$$x = \left(\frac{mc^2}{\varepsilon}\right)^2 \left(\frac{\varepsilon\omega}{\varepsilon'\omega_0}\right)^{2/3} \stackrel{d}{=} \left(\frac{\hbar\omega}{\varepsilon'\chi}\right)^{2/3}; \quad \varepsilon = c\sqrt{p^2 + m^2c^2} \tag{4}$$

and

$$\omega_0 = \frac{v|e|H}{|\mathbf{p}|} \approx \frac{|e|H}{\varepsilon}. \tag{5}$$

is the basic frequency of circulating electron in the magnetic field. $\Phi(x)$ is so called the Airy function and it will be defined later.

Let us remark that in the classical limit i.e. with $\hbar\omega \ll \varepsilon$, or with $\varepsilon' \approx \varepsilon$, we have $x \ll 1$ and the second term in the round brackets of (3) is very small and equation reduces, after insertion of $\omega = \omega(x)$ from eq. (4) to the formula expressed in the form (Landau et al., 1988; (74.13))

$$I_l = \frac{2e^4H^2}{\sqrt{\pi}c^3m^2}\frac{mc^2}{\varepsilon}\sqrt{u}\left[-\Phi'(u) - \frac{u}{2}\int_u^\infty \Phi(u)du\right], \tag{6}$$

where

$$u = l^{2/3}\left(\frac{mc^2}{\varepsilon}\right)^2, \quad l = \frac{\omega}{\omega_0}, \tag{7}$$

and l is number of the harmonics of the circular trajectory of the electron moving in the constant magnetic field. Let us also remark that formula (6) follows also from the Schott formula if the Bessel functions of it are replaced by the Bessel functions for harmonics with $l \gg 1$.

The emitted radiation corresponds to the energy loss of electron moving in the magnetic field. According to Schwinger (1945), the energy loss is 20 eV per revolution of an electron with energy 10^8 eV and radius 0.5 m.

To calculate the total radiation from the formula (3) it is necessary to integrate over all ω from 0 to ε. However it is better to change variable using the equation (4). Using this equation, we have $\hbar\omega = \varepsilon - \varepsilon' = \varepsilon - \hbar\omega/(\chi x^{3/2})$ and from this equation it may be easy to see that

$$\hbar\omega = \left(1 - \frac{1}{1+\chi x^{3/2}}\right) = \frac{u}{1+u}; \quad u = \chi x^{3/2}. \tag{8}$$

Then, we integrate from 0 to ∞. After two integration per partes of the first term in the braces of formula (3), we get the following result (Berestetzkii et al., 1989; (90.25)):

$$I = -\frac{e^2 m^2 \chi^2}{2\sqrt{\pi}\hbar^2}\int_0^\infty \frac{4 + 5\chi x^{3/2} + 4\chi^2 x^3}{(1+\chi x^{3/2})^4}\Phi'(x) x dx =$$

$$-\frac{e^2 m^2 \chi^2}{2\sqrt{\pi}\hbar^2}\int_0^\infty \frac{4+5u+4u^2}{(1+u)^4}\Phi'(z) z dz; \quad u = \chi z^{3/2}. \tag{9}$$

We will show in the next text how to determine formula (9) from the Volkov solution of the Dirac equation in the magnetic field and from the S-matrix method. From formula (9) follows also the classical expression for the synchrotron radiation.

The opening angle of radiation is not small in case of the nonrelativistic motion. The small opening angle is generated only with high energy electrons as a result of the validity of special relativity optics. According to Winick (1987), if an electron is given a total energy 5 GeV, the opening angle over which synchrotron radiation is emitted is only 0.0001 radian, or about 0.006 degree. This can be regarded as a beam with the nearly parallel rays. This is practically the same as the laser beam situation. The wave length of photons is from zero to infinity. If we want to produce maximal energy of photons at the very short length of photons, it is necessary to consider the relativistic electrons.

It it possible to consider the nonrelativistic motion of a charged particle in the strong electric and magnetic field. The trajectory is a cycloid with the very small radius and it means that the external observer sees the synchrotron radiation from the "straight line", which is perpendicular to the magnetic and electric field. The most intensive radiation is generated at the direction of "straight line" (Pardy, 2003b). The process is realized in the atmosphere of the neutron stars where the magnetic field is extremely strong.

2 The Volkov solution of the Dirac equation in the constant magnetic field

In order to derive the classical limit of the quantum radiation formula, we will suppose that the motion of the Dirac electron is performed in the following four potential:

$$A_\mu = a_\mu \varphi; \quad \varphi = kx; \quad k^2 = 0. \tag{10}$$

From equation (10), it follows that $F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu = a_\mu k_\nu - a_\nu k_\mu = const.$, which means that electron moves in the constant electromagnetic field with the components $\mathbf{E}$ and $\mathbf{H}$. The parameters a and k can be chosen in a such a way that $\mathbf{E} = 0$. So the motion of electron is performed in the constant magnetic field.

The Volkov (1935) solution of the Dirac equation for an electron moving in a field of a plane wave is (Berestetzkii et al., 1989; Pardy, 2003a; Pardy, 2004):

$$\psi_p = \frac{u(p)}{\sqrt{2p_0}}\left[1 + e\frac{(\gamma k)(\gamma A(\varphi))}{2kp}\right]\exp\left[(i/\hbar)S\right] \tag{11}$$

and S is an classical action of an electron moving in the potential $A(\varphi)$.

$$S = -px - \int_0^{kx} \frac{e}{(kp)} \left[(pA) - \frac{e}{2}(A)^2\right] d\varphi. \tag{12}$$

It was shown that for the potential (10) the Volkov wave function is (Berestetzkii et al., 1989):

$$\psi_p = \frac{u(p)}{\sqrt{2p_0}} \left[1 + e\frac{(\gamma k)(\gamma a)}{2kp}\varphi\right] \exp\left[(i/\hbar)S\right] \tag{13}$$

with

$$S = -e\frac{ap}{2kp}\varphi^2 + e^2\frac{a^2}{6kp}\varphi^3 - px. \tag{14}$$

During the following text we will suppose that we will work in the unit system where $c = \hbar = 1$.

3 S-matrix element for photon emission

While the Larmor formula (1) involves explicitly the dependence of the radiation on the derivative of the particle velocity over the time, the quantum field theory works only with the matrix elements and power spectrum must be determined from the correct definition of the matrix element in case that electron is moving in potential (10). The alternative method can be considered and it consists in using the quantization of the Poynting vector (2) in the differential intensity as $dI = (\mathbf{r} \cdot \mathbf{S})d\Omega$. However, to our knowledge, this method was not elaborated and published. Similarly, the gravity radiation was not determined from the general relativistic definition of the Poynting vector.

The situation in the quantum physics differs from the situation in the classical one. The emission of photons by electron moving in the homogeneous magnetic field is the result of the transition of electron from the stationary state with energy E_a to stationary state with energy E_b, where $E_a > E_b$. The transition between stationary states is called spontaneous, however it is stimulated by the interaction of an electron with the virtual electromagnetic field of vacuum, or, in other words, by the interaction of electron with virtual photons. So, it is necessary to find the interaction term of an electron with vacuum photons and to solve the Dirac equation with this term and then to determine the matrix elements of the transition.

The quantum field theory expressed as the source theory was used to solved the synchrotron radiation by Schwinger (1973). In this language and methodology the original action term for the spin-0 charged particle was supplemented by the mass operator in the homogeneous magnetic field and it was shown that this mass operator involves as an integral part the power spectral formula of the synchrotron radiation. Here we use the Volkov solution of the Dirac equation and the S-matrix approach to find the probability of emission and the intensity of the synchrotron radiation. The method is nonperturbative because the Volkov solution of the Dirac equation can be expressed in the nonperturbative form.

While the Feynman diagram approach requires renormalization procedure and the Schwinger source methods requires contact terms as some form of renormalization, our method does not work with renormalization. The wave function of an electron involves the total interaction of an electron with magnetic field.

The question, if the Lorentz-Dirac equation with the radiative term can be derived from the S-matrix approach, or from the Feynman diagram approach is unanswered, and to our knowledge it was not published. On the other hand the more simple Lorentz equation for the charged particle motion in electromagnetic field was derived using the WKB approximation of the Dirac equation together with the Bargmann-Michel-Telegdi equation for the spin motion (Rafanelli and Schiller, 1964; Pardy; 1973).

It is possible to show in the quantum field theory, that the corresponding S-matrix element which describes transition from the state ψ_p to $\psi_{p'}$ with simultaneous emission of photon with polarization e' and four-momentum $k'^{\mu} = (k'_0, \mathbf{k}') = (\omega', \mathbf{k}')$ is given by the following expression (Berestetzkii et al., 1989), with $k' \to -k', S \to -S$, to be in accord with the Ritus article (Ritus, 1979):

$$M = e\int d^4x\bar{\psi}_{p'}(\gamma e'^{*})\psi_p\frac{e^{-ik'x}}{\sqrt{2\omega'}}, \tag{15}$$

where ψ_p is given by the relation

$$\psi_p = \exp i\left\{e\frac{(ap)}{2(kp)}\varphi^2 - e^2\frac{a^2}{6(kp)}\varphi^3 + px\right\}\left[1 + e\frac{(\gamma k)(\gamma a)}{2(kp)}\varphi\right]\frac{u(p)}{\sqrt{2p_0}} \tag{16}$$

and $\bar{\psi}_p$ is the the conjugated function to ψ_p, or,

$$\bar{\psi}_p = \frac{\bar{u}(p)}{\sqrt{2p_0}}\left[1 + e\frac{(\gamma a)(\gamma k)}{2(kp)}\varphi\right]\exp{(i)}\left\{-e\frac{(ap)}{2(kp)}\varphi^2 + e^2\frac{a^2}{6(kp)}\varphi^3 - px\right\}. \tag{17}$$

Afer insertion of eq. (16) and (17) into eq. (15) and putting

$$\exp\left\{i\left(\frac{\alpha\varphi^2}{2} - \frac{i4\beta\varphi^3}{3}\right)\right\} = \int_{-\infty}^{\infty} dse^{is\varphi}A(s,\alpha,\beta) \tag{18}$$

with

$$\alpha = e\left(\frac{ap}{kp} - \frac{ap'}{kp'}\right); \quad \beta = \frac{e^2a^2}{8}\left(\frac{1}{kp} - \frac{1}{kp'}\right), \tag{19}$$

we get (Ritus, 1979):

$$M = e\int_{-\infty}^{\infty}\frac{ds}{\sqrt{2\omega'}}(2\pi)^4\delta(p + sk - p' - k')\bar{u}(p') \quad \times$$

$$\left\{(\gamma e'^{*})A + e\left(\frac{(\gamma a)(\gamma k)(\gamma e'^{*})}{2(kp')} + \frac{(\gamma e'^{*})(\gamma k)(\gamma a)}{2(kp)}\right)i\frac{\partial A}{\partial s} + \frac{e^2a^2(ke'^{*})(\gamma k)}{2(kp)(kp')}\frac{\partial^2 A}{\partial s^2}\right\}u(p). \tag{20}$$

It evidently follows from eq. (18), that

$$A(s,\alpha,\beta) = \frac{1}{2\pi}\int_{-\infty}^{\infty} d\varphi\exp\left\{i\left(\frac{\alpha\varphi^2}{2} - \frac{4\beta\varphi^3}{3} - s\varphi\right)\right\}. \tag{21}$$

The terms $i^n\partial^n A/\partial s^n$ are the Fourier mapping of functions

$$\varphi^n \exp(i\alpha\varphi^2/2 - i4\beta\varphi^3/3). \tag{22}$$

The matrix element M is analogical to the emission of photons generated by the electron in the plane electromagnetic wave $A_\mu = a_\mu \cos(kx)$ which was proved by Ritus (1979), and the difference is in replacing the discrete s by the continual quantity. So the summation over s is replaced by the integration.

Function $A(s, \alpha, \beta)$ can be expressed by the Airy function $\Phi(y)$:

$$A(s, \alpha, \beta) = \frac{1}{\pi}(4\beta)^{-1/3} \exp\left\{-is\frac{\alpha}{8\beta} + i\frac{8\beta}{3}\left(\frac{\alpha}{8\beta}\right)^3\right\}\Phi(y), \tag{23}$$

where the Airy function $\Phi(y)$ is defined by the equation

$$\frac{d^2\Phi}{dy^2} - y\Phi = 0 \tag{24}$$

with the solution

$$\Phi(y) = \frac{1}{2}\int_{-\infty}^{\infty} du\, e^{-i\left(\frac{u^3}{3}+yu\right)} = \int_0^{\infty} du \cos\left(\frac{u^3}{3} + yu\right), \tag{25}$$

where in our case

$$y = (4\beta)^{2/3}\left[\frac{s}{4\beta} - \left(\frac{\alpha}{8\beta}\right)^2\right], \tag{26}$$

where $\beta \geq 0$. Landau et al. (1988) uses the Airy function expressed as $\Phi/\sqrt{\pi}$.

Using the formula (21) it is easy to find the differential equation for $A(s)$:

$$sA - i\alpha A' - 4\beta A'' = 0, \tag{27}$$

where $A' = \partial A/\partial s, A'' = \partial^2 A/\partial s^2$.

The evaluation of the squared matrix elements, which has physical meaning of the probability of the radiation process, involves, as can be seen, the double integral for which we use the identity:

$$\int_{-\infty}^{\infty} ds \int_{-\infty}^{\infty} ds' F(s)\delta(sk + p - p' - k')\delta(s'k + p - p' - k') =$$

$$\int_{-\infty}^{\infty} ds \int_{-\infty}^{\infty} ds' F(s)\frac{\delta(s - s')}{\delta(0)}\delta(sk + p - p' - k') =$$

$$\frac{VT}{(2\pi)^4}\int_{-\infty}^{\infty} ds \frac{F(s)}{\delta(0)}\delta(sk + p - p' - k'). \tag{28}$$

So, now, we are prepared to determine the probability of the emission of photons and we perform it in the following section.

4 Probability of emission of photons

Using the ingredients of the quantum field theory, we get for the probability of the emission of one photon an electron in unit volume per unit time (Ritus, 1979):

$$\sum_{r,r'}\frac{|M|^2}{VT}=\frac{(2\pi)^5e^2}{\delta(0)}\int_{-\infty}^{\infty}\frac{ds}{2p_0p_0'\omega'}\delta(sk+p-p'-k')\quad\times$$

$$\Big\{|pe''^{*}A-ieae''^{*}A'|-2\beta(kk')(|A'|^2+\mathrm{Re}AA''^{*})\Big\},\tag{29}$$

where

$$e''_{\alpha}=e'_{\alpha}-k'_{\alpha}(ke')/(kk');\quad A'=\partial A/\partial s;\quad A''=\partial^2A/\partial s^2.\tag{30}$$

After summation of eq. (29) over directions of polarization e' and using differential equation (27), $\sum|M|^2/VT$ will be expressed only by means of $|A|^2$ and $|A'|^2+\mathrm{Re}AA''^{*}$, which can be expressed using eq. (23) in the following way:

$$|A|^2=\frac{\Phi^2(y)}{\pi^2(4\beta)^{2/3}};\quad |A'|^2+\mathrm{ReAA}''^{*}=\frac{y\Phi^2(y)+\Phi'^2(y)}{\pi^2(4\beta)^{2/3}}.\tag{31}$$

Then, with

$$x=\frac{ea}{m},\quad \chi=-\frac{kp}{m^2}x,\quad \chi'=-\frac{kp'}{m^2}x,\quad \kappa=-\frac{kk'}{m^2}x,\tag{32}$$

we have

$$\sum_{r,r'}\frac{|M|^2}{VT}=\frac{2e^2m^2}{\delta(0)x^2p_0p_0'k_0'}\int_{-\infty}^{\infty}ds\left(\frac{2\chi\chi'}{\kappa}\right)^{2/3}\delta(sk+p-p'-k')\quad\times$$

$$\left\{-\Phi^2(y)+\left(\frac{2\chi\chi'}{\kappa}\right)\left(1+\frac{\kappa^2}{2\chi\chi'}\right)^{2/3}\Big[y\Phi^2(y)+\Phi'^2(y)\Big]\right\}.\tag{33}$$

In order to obtain the probability of the emission of photon by electron, it i necessary to integrate equation (33) over the final states $d^3p'd^3k'(2\pi)^{-6}$ of the electron and photon and the result divide by 1/2 and to average over polarizations of the initial electron. Integration over $\mathbf{p'}$ eliminates space δ-function and the time δ-function can be transformed into the explicit Lorentz invariant form as follows:

$$\delta(sk+p-p'-k')\frac{d^3p'}{p_0'}\quad\to\quad\frac{\delta(sk_0+p_0-p_0'-k_0')}{p_0'}=-\frac{\delta(s-\tilde{s})}{kp'};\quad \tilde{s}=\frac{k'p'}{kp}\tag{34}$$

with the use of the relation

$$p_0'=\sqrt{m^2+(s\mathbf{k}+\mathbf{p}-\mathbf{k}')^2}.\tag{35}$$

Using the equation (34) and after integration over s, we get the differential probability of the emission of photon per unit time:

$$dW=\frac{e^2c}{4\pi^3x\delta(0)\chi'}\left(\frac{2\chi}{u}\right)^{2/3}\quad\times$$

$$\left[-\Phi^2(y) + \left(\frac{2\chi}{u}\right)^{2/3}\left(1+\frac{u^2}{2(1+u)}\right)(y\Phi^2(y)+\Phi'^2(y))\right]\frac{d^3k'}{k'_0}, \tag{36}$$

where

$$u = \frac{\kappa}{\chi'} = \frac{kk'}{kp'}, \quad c = \frac{1}{p_0}. \tag{37}$$

The equation (36) is evidently relativistic and gauge invariant. The further properties are as follows. It does not depend on k'_1, which is the component of the photon momentum along the electric field $\mathbf{E}$. It means it does not depend on ϱ. We use further the transform

$$\frac{d^3k'}{k'_0} = \frac{xm^2\chi' u}{\chi(1+u)^2}d\varrho d\tau du. \tag{38}$$

with the obligate relation (Ritus, 1979):

$$\int_{-\infty}^{\infty} d\varrho = \delta(0). \tag{39}$$

After integration of (36) over ϱ and with regard to (39), we get the probability of emission of photons in variables u, τ without dependence of the localization of the emission the following formula:

$$dW = \frac{e^2m^2c}{2\pi^3(1+u)^2}\left(\frac{u}{2\chi}\right)^{1/3} \quad \times$$

$$\left[-\Phi^2(y) + \left(\frac{2\chi}{u}\right)^{2/3}\left(1+\frac{u^2}{2(1+u)}\right)(y\Phi^2(y)+\Phi'^2(y))\right]dud\tau. \tag{40}$$

The probability (40) has a dimension of $\text{cm}^{-3}\text{s}^{-1}$.

Formula (40) describes the dependence of the distribution of probability on two variables u, τ. If we use equation

$$y\Phi^2(y) + \Phi'^2(y) = \frac{1}{2}\frac{d^2}{dy^2}\Phi^2(y) \tag{41}$$

and the transformation $t = a\tau^2$; $\quad a = \left(\frac{u}{2\chi}\right)^{2/3}, d\tau = \frac{dt}{2\sqrt{at}}$, then, we get with $y = a + t$ the following result

$$\frac{dW}{du} = \frac{e^2m^2c}{2\pi^3(1+u)^2} \quad \times$$

$$\left\{-1 + \left(\frac{2\chi}{u}\right)^{2/3}\left[1+\frac{u^2}{2(1+u)}\right]\frac{1}{2}\frac{d^2}{da^2}\right\}\int_0^{\infty}\frac{dt}{\sqrt{t}}\Phi^2(a+t); \quad a = \left(\frac{u}{2\chi}\right)^{2/3}. \tag{42}$$

Now, let us use the integral transformation (Aspnes, 1966)

$$\int_0^{\infty}\frac{dt}{\sqrt{t}}\Phi^2(a+t) = \frac{\pi}{2}\int_{2^{2/3}a}^{\infty} dy\Phi(y). \tag{43}$$

Then, we get from the formula (42)

$$\frac{dW(\chi,u)}{du} = -\frac{e^2m^2c}{4\pi^2(1+u)^2} \quad \times$$

$$\left\{\int_z^\infty dy\Phi(y) + \frac{2}{z}\left[1+\frac{u^2}{2(1+u)}\right]\Phi'(z)\right\}; \quad z = \left(\frac{u}{\chi}\right)^{2/3}. \tag{44}$$

The last formula can be written easily for small and big u as follows:

$$\frac{dW}{du} = -\Phi'(0)\frac{e^2m^2c}{2\pi^2}\left(\frac{\chi}{u}\right)^{2/3}; \quad u \ll 1, \quad \chi; \tag{45}$$

where

$$\Phi'(0) = -\frac{1}{3^{1/3}}\int_0^\infty x^{-1/3}\sin x\; dx = -\frac{1}{3^{1/3}}\int_0^\infty x^{\mu-1}\sin(ax)\; dx|_{\mu=2/3;a=1} =$$

$$-\frac{1}{3^{1/3}}\frac{\Gamma(\mu)}{a^\mu}\sin\left(\frac{\mu\pi}{2}\right)\Big|_{\mu=2/3;a=1} = -3^{1/6}\frac{\Gamma(2/3)}{2}, \tag{46}$$

$$\frac{dW}{du} = \frac{e^2m^2c}{8\pi^{3/2}u^{3/2}}\sqrt{\chi}\exp\left(\frac{-2u}{3\chi}\right); \quad u \gg 1, \quad \chi. \tag{47}$$

If we integrate the formula (44) over u and using the per partes method in the first term, we get the following formula:

$$W(\chi) = -\frac{e^2m^2c}{8\pi^2}\chi\int_0^\infty dz\frac{5+7u+5u^2}{\sqrt{z}(1+u)^3}\Phi'(z); \quad u = \chi z^{3/2}. \tag{48}$$

The last formula was derived for the first time by Goldman (1964a, 1964b) by the different way. This formula can be expressed approximately for small and big χ as follows (Ritus, 1979):

$$W(\chi) = -\frac{5e^2m^2c}{8\sqrt{3}\pi}\chi\left(1-\frac{8\sqrt{3}}{15}\chi+...\right); \quad \chi \ll 1, \tag{49}$$

$$W(\chi) = -\frac{7\Gamma(2/3)e^2m^2c}{54\pi}(3\chi)^{2/3}\left(1-\frac{45}{28\Gamma(2/3)}(3\chi)^{-2/3}+...\right); \quad \chi \gg 1. \tag{50}$$

5 Intensity of radiation

Ritus (1979) proved that the probability of radiation and the intensity of radiation differs only by the specific term beyond the integral function. So, using the Ritus proof and with regard to eq. (8) we see that the intensity of radiation can be obtained from formula (40) putting $c/p_0 \quad \rightarrow \quad 1$ and by the multiplication by the term $u(1+u)^{-1}$. We get:

$$dI = -\frac{e^2m^2}{2\pi^3}\frac{u}{(1+u)^3} \quad \times$$

$$\left(\frac{u}{2\chi}\right)^{1/3}\left\{-\Phi^2(y)+\left(\frac{2\chi}{u}\right)^{2/3}\left(1+\frac{u^2}{2(1+u)}\right)(y\Phi^2(y)+\Phi'^2(y))\right\}dud\tau. \tag{51}$$

Then the u-distribution over intensity is of the form:

$$\frac{dI}{du} = -\frac{e^2m^2}{4\pi^2}\frac{u}{(1+u)^3}\left\{\int_z^\infty dy\Phi(y) + \frac{2}{z}\left(1+\frac{u^2}{2(1+u)}\right)\Phi'(z))\right\}; \quad z = \left(\frac{u}{\chi}\right)^{2/3}. \quad (52)$$

This formula is a quantum generalization of the classical expression for the spectral distribution of radiation of an ultrarelativistic charged particle in a magnetic field (Landau et al., 1988; (74.13)).

After integration of (52) over u and using the per partes method in the first term, we get the formula of the total radiation of photons by electron in the constant magnetic field. The formula is as follows (Ritus, 1979):

$$I = -\frac{e^2m^2}{2\sqrt{\pi}\hbar^2}\chi^2\int_0^\infty dzz\frac{4+5u+4u^2}{2(1+u)^4}\Phi'(z); \quad u = \chi z^{3/2}. \quad (53)$$

This formula can be transformed with $u = \chi x^{3/2}$ to the following one:

$$I = -\frac{e^2m^2\chi^2}{2\sqrt{\pi}\hbar^2}\int_0^\infty \frac{4+5\chi x^{3/2}+4\chi^2x^3}{(1+\chi x^{3/2})^4}\Phi'(x)xdx. \quad (54)$$

The formula (54) is equivalent with the formula (3) and the formula (52) is identical with the formula (3). There is no doubt that the Schott formula can be derived by the formalism used in this text.

6 Discussion

We have seen how to get the quantum description of the synchrotron radiation from the Volkov solution of the Dirac equation and from the formalism of the relativistic quantum theory of radiation. At the same time we have shown that the quantum synchrotron radiation leads to the classical synchrotron radiation in the classical limit.

The synchrotron radiation evidently influences the motion of the electron in accelerators. The corresponding equation which describes the classical motion is so called the Lorentz-Dirac equation, which differs from the the so called Lorentz equation only by the additional term which describes the radiative corrections. The equation with the radiative term is as follows (Landau et al., 1988):

$$m\frac{dv_\mu}{ds} = \frac{e}{c}F_{\mu\nu}v^\nu + g_\mu, \quad (55)$$

where the radiative term was derived by Landau et al. in the form (Landau et al., 1988)

$$g_\mu = \frac{2e^3}{3mc^3}\frac{\partial F_{\mu\nu}}{\partial x^\alpha}v^\nu v^\alpha - \frac{2e^4}{3m^2c^5}F_{\mu\alpha}F^{\beta\alpha}v_\beta + \frac{2e^4}{3m^2c^5}\left(F_{\alpha\beta}v^\beta\right)\left(F^{\alpha\gamma}v_\gamma\right)v_\mu. \quad (56)$$

Bargmann, Michel and Telegdi (Berestetzkii, 1989;) derived so called BMT equation for motion of spin in the electromagnetic field, in the form

$$\frac{da_\mu}{ds} = 2\mu F_{\mu\nu}a^\nu - 2\mu' v_\mu F^{\nu\lambda}v_\nu a_\lambda, \quad (57)$$

where a_μ is so called axial vector describing the classical spin. It was shown by Rafanelli and Schiller (1964), (Pardy, 1973) that this equation can be derived from the classical limit, i.e. from the WKB solution of the Dirac equation with the anomalous magnetic moment.

It is meaningful to consider the BMT equation with the radiative corrections to express the influence of the synchrotron radiation on the motion of spin. To our knowledge such equation, the generalized BMT equation, was not published and we here present the conjecture of the form of such equation. The equation is of the following form:

$$\frac{da_\mu}{ds} = 2\mu F_{\mu\nu}a^\nu - 2\mu' v_\mu F^{\nu\lambda}v_\nu a_\lambda + g_{(axial)\mu}, \tag{58}$$

where the term $g_{(axial)\mu}$ is generated as the "axialization"' of the radiation term g_μ. Or,

$$g_\mu = \frac{2e^3}{3mc^3}\frac{\partial F_{\mu\nu}}{\partial x^\alpha}v^\nu a^\alpha - \frac{2e^4}{3m^2c^5}F_{\mu\alpha}F^{\beta\alpha}a_\beta + \frac{2e^4}{3m^2c^5}\left(F_{\alpha\beta}v^\beta\right)\left(F^{\alpha\gamma}v_\gamma\right)a_\mu. \tag{59}$$

We are aware that the axialization is not unambiguous and it is evident, that it can be submitted for theoretical investigation. The future physics will give the answer if the equation corresponds to physical reality. Such equation will have fundamental meaning for the work of LHC where the synchrotron radiation influences the spin motion of protons in LHC.

The formalism used in case of the synchrotron radiation can be also applied in the situation where the axion is produced in the magnetic field. Axion was introduced by Peccei and Quinn (1977) as the pseudoscalar particle. It was introduced as the logical necessity of the correct physical theory and it means that there is the great probability that axions will be detected for instance during the experiments on LHC.

One of the corresponding Lagrangian describing the interaction of the axion field a with the electron field ψ is as follows (Skobelev, 1997):

$$\mathcal{L} = -ic\left(\frac{m_a}{f}\right)a(\bar{\psi}\gamma^5\psi), \tag{60}$$

where f is related to the coupling constant.

According to Skobelev (1997) the intensity if emission of axions by the electron moving in the constant electromagnetic magnetic field can be approximated by two formulas which follows from the general theory.

$$I_a = \frac{g^2m^2}{\pi}\chi^4; \quad g = \frac{cm}{f}; \quad \chi \ll 1; \quad \frac{m_a}{m} \ll \chi, \tag{61}$$

and/or

$$I_a = \frac{7\Gamma(2/3)g^2m^2}{2\pi 3^{13/3}}\chi^{2/3}; \quad \chi \gg 1; \quad \frac{m_a}{m} \ll \chi. \tag{62}$$

Axion is used also to explain the absence of the electrical dipole moment of the neutron. Axion is chargeless, spinless and interact with the ordinary matter only very weakly. If it is not confined, then the following decay equation is valid:

$$n \to e + p + \bar{\nu}_e + a, \tag{63}$$

which can be verified in experiment as the proof of the existence of axion in a sense that axion can decay into neutrinos as follows

$$a \to \nu_e + \bar{\nu}_e. \tag{64}$$

On the other hand if we use the plasma of particles $e, p, \bar{\nu}_e, a$, then the inversion equation to (88) is valid:

$$e + p + \bar{\nu}_e + a \to n \tag{65}$$

and this equation can be also used as the proof of the existence of axion. If we prepare the same plasma without axions, then no neutron will be generated. It seems that these simple experiments can be considered as a crucial ones for the proof of the existence of axions.

The decay of neutron and axion can be considered and calculated in the electromagnetic field as was shown by Skobelev (1997; 1999).

Khalilov et al. (1995) calculated production of the of W^- and Z^0 bosons by electron in the intense electromagnetic field. For the first process they used the following matrix element

$$M_{e\to W} = -i\frac{g}{2\sqrt{2}}\int d^4x\bar{\psi}_\nu(1-\gamma^5)\gamma^\mu\psi_e\phi_\mu, \tag{66}$$

where $\psi_\nu, \psi_e, \phi_\mu$ are wave functions of neutrino, electron and W-boson.

In case for the production of the Z-boson Khalilov et al. used the following matrix element

$$M_{e\to Z} = \tilde{g}\int d^4x\bar{\psi}_e\gamma^\lambda(g_V + g_A\gamma^5)\psi_e Z_\lambda. \tag{67}$$

It has been calculated the probability of creation and the total cross-section to every process.

It is evident that all interaction of particle physics occurring in the accelerators and LHC can be immersed into the intense electromagnetic field of laser, or laser pulse or magnetic field. The theoretical investigation can then be performed using the Volkov solution and the S-matrix method. This will obviously become the integral part of the future physics of elementary particles.

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Organized Transnational Crime and Combating Crimes in the Field of Information Technologies (Past and Present)

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Abstract

The article deals with the issue of criminal law aspects of organized crime. The author's vision of the foundations of the concept of organizational and tactical elements of the Ministry of Internal Affairs of Ukraine is presented. Recommendations on prevention and counteraction of transnational computer crimes are provided.

Key words: transnational organized crime, organized transnational cybercrime, transnational crime; criminalistics analysis.

Introduction Organized crime is a complicated transcontinental antisocial phenomenon that endangers the development of the mankind. Its specificity is that it penetrates into all life spheres causing destabilization of political, social, economic activities, creating real threat to safety of all countries. The tendency in growth of organized crime, it's extending the separate states' boundaries, increasing the influence on politics, economy, and also rapid growth of its financial base lead to the situation when a problem of fighting organized crime has become interstate, required coordination in actions, working out united approaches to solving it. The UNO World Conference on transnational organized crime (Naples, 1994) underlining its global character, arose a question about corresponding the national legislation to demands of fighting different forms of organized crime, and working out leading principles, standards of this struggle.

According to international treaties, conventions most countries brought in special laws on fighting organized crime, put amendments to law codes related to increasing the responsibility for crimes committed by organized groups. These laws invariably excreted such indications on organized crime as high level of unity, organizing, substantial, economic base, huge budget, wish to take roots in power and administration organs, relations with shadow economy, serious safety system, etc.

Scientific definitions of this term underline the same features of organized crime.[1] Undoubtedly, all these features are really the criteria for determining organized crime as antisocial phenomenon, which worsen criminal situation in all countries. But one should not forget that organized crime (as any other one, though), is not only social but also complicated law phenomenon, which has a specific criminal-law meaning.

Criminal-law essence of organized crime including common for criminal activity traits has two specific (inherent only for it) features: a) special character and danger of committing crimes; b) the most dangerous forms of group crime. The unity of these two features must determine both the classification of crimes committed by organized groups and limits of responsibility for these crimes, in other words, be a legal basis for the strictest criminal responsibility for them.

The analysis of crimes which make a nuclear of organized crime reflects the aim. Transnational direction of its activity shows that there are the international character crimes, «infringing normal relations between states, causing losses to peaceful cooperation in different fields' of relations (economic, social-cultural, material etc.) and also to organizations and citizens».

Importance of the objects, danger in means of committing crimes, especially big damage, motives, aims define extreme danger of these crimes that allows to refer them to grave and especially grave crimes category. In this connection with it is very import to research the issue of classifying crimes according to their gravity.

Although the analysis of current legislations in different countries allows to draw the following conclusions: a) in some states there are no special provisions on classifying crimes according to their gravity; b) in states whose legislation has such provisions, there is no unique approach and criteria to classify the gravity of crimes. That is why the common understanding of grave or especially grave crime is absent. This shows an absence of unique legal base for mutual efforts in fighting organized crime: its special danger for all world community do not find adequate reflection in national legislation concerning the gravity of the most dangerous crimes.

The problem of classifying crimes according to their gravity despite its fundamentalism for solving all problems of criminal responsibility is not thoroughly studied in science. The significance of such a classification is recognized by not only science, but lawmakers though. Thus, the Criminal Code of New York State in Section A, paragraph 1.05 one of general purposes for its provision defines such objective as "to establish the difference on reasonable basis between serious and petty infringements and fix adequate punishment for them". 2 The necessity in this classification has been evident lately in a process of working out new criminal codes in several countries, in Ukraine, Spain. It is necessary to note that criteria for such characteristic are the society danger level (maximum criterion), and type, kind of punishment (formal criterion). These are the criteria for defining grave or especially grave crimes as one of standards for unifying transnational organized criminality notion. As an example, we may use Article 12, Part 4 and 5, the Criminal Code of Ukraine.

Second standard in unifying definition of organized crime in national legislation must be separation of group criminality forms, which are typical for it, and reflect its special danger. We think such forms of complicity should be organized group and criminal organization, distinguishing by too high a unity level, stable relations of its members, strict role distribution. National legislation firstly, should have definitions of these forms as it has been done in new

Criminal Code of Ukraine, secondly, to define their most severe legal consequences. As such consequences the CC of Ukraine of 2001 defines an independent crime - “creating a criminal organization for committing grave or especially grave crimes, also being in charge of such group or participation in it” (Article 230), and as a result in most grave and especially grave crimes committing them by an organized group or criminal organization is a special qualifying circumstance [1-4].

Like other similar revolutionary technologies, Internet brings huge potential as for progress as for abuses, attacks in the net, fraud, software pirates, industrial espionage, children pornography trade - they are only some crimes committed in the global net.

Initial investigating actions related to detecting transnational computer crimes (cybercrimes), cause special difficulties, that relates to many problems.

The results and analysis of conducted research of law enforcement organs practical activity concerning investigating computer crimes testify that computer equipment study SHOULD be carried out in criminalistic laboratory conditions when professionals with necessary training will do this work.

Let us consider some typical mistakes that are often made while carrying out inquiry actions related to computer information and computers themselves. Several rules of working with computers, expropriated when investigating crimes in computer information sphere, can be distinguished, we also can propose general recommendations which may be useful when processing computer evidence in DOS or Windows operational systems.

Error #1. Erroneous work with a computer. First and general rule that to be mandatory implemented is never and under any conditions not to work on the seized computer. This rule considers an seized computer as an object for professionals’ studying. That is why one should not even turn it on until transferring to experts, as it is absolutely prohibited to run any programs on such a computer without using necessary safety measures (e.g., protection from modification or creating backup files). If computer has a protection on run up system (e.g. — password), then turning the computer on can cause destroying the information on hard disk. Turning such computer on, using its own operational system is not allowed. This is explained simple enough: a criminal has no difficulty in installing a program for wiping the information off on hard or floppy disk, recording such “traps” by operational system modification. For example, simple DIR command used for displaying disk’s catalogue can be changed to format hard disk. Then the data and the destroying program itself are deleted nobody can tell for sure whether the "suspected" computer was specially equipped with these programs, or this was a result of negligence in handling computer evidence [5, 7].

Error #2. Letting access of computer owner or user to computer. Admitting an owner of computer that is being studied for helping in its work is a serious mistake. Many foreign sources describe cases when suspected on a questioning, concerning computer evidence was granted an access to seized computer. Later, they told their friends as they coded files in the policemen's presence and policemen did not even suspect anything. Considering these consequences, quite quickly computer specialists started to create back up files of computer information before granting access to it [6, 7].

Error #3. Absence of computer scanning for viruses and macro-viruses. To scan a computer for viruses and macro-viruses, it is necessary to load a computer not from operational system in it, but from prepared in advance floppy disk, or from experts' hard disk. All information carriers - floppy disk, hard disk, some others are subjected to check up. Specialist attracted to inquiry actions using special software should do this work.

It is necessary not to allow the court to accuse the investigator: in special virus's infection of a computer, or in incompetence when carrying out inquiry actions or just in negligence, because it is hardly possible to prove that the virus existed in the computer before its examining, such an accusation will doubt the expert's work and probability his conclusions. These are the most typical errors when examining computer in investigating computer crimes. But described list does not include all mistakes that are possible in the process of extracting and studying computer in-formation. This is easily explained: lack of experience in investigating similar cases in our country. At the same time Western Europe countries, the USA especially, have rich experience in investigating complicated computer crimes. This experience should be more thoroughly studied to avoid many mistakes [7].

Conclusions To prevent errors in carrying out the inquiry actions at the first investigation stage which can cause losing or destroying computer information one should keep to some preventive measures as:

First, one should make a reserve copy of information. When searching and seized computer, magnet carriers (hard disk, floppy disk), and information there are some common problems connected with specific character of seized technical means. It is necessary to foresee safety measures, which criminal takes to destroy computer information. For example, he can use special equipment, which under special conditions create strong magnetic field and thus delete magnet records. During the search all electronic evidence in computer or computer system should be collected so that later the court would admit them. World practice testifies that in many cases under the pressure of defense lawyers in court electronic evidence are not considered. To guarantee their recognition as evidence, one should strictly keep to criminal-procedural legislation requirements standard methods of extracting them. As a rule, computer evidence is kept creating an exact copy from original (primary evidence) before somehow analyzing it. But it is not enough to make computer files copies using only standard programs of reserve copying. Physical evidence can exist as deleted or hidden files, and data, connected with these files, can be saved only with the help of special software, they can be Safe Back type programs, for floppy disks DOS Disk copy may be enough. Magnetic carries which are intended for copying the information, should be prepared in advance (you should be sure they do not contain any information). Carriers should be kept in special wrapping or wrapped in clean paper. You should remember that information could be completely spoilt by humidity, temperature or electrostatic (magnetic) fields. Find and copy temporary files. Many text editors and databases software create temporary files as software normal work by-product. Most computer users do not realize the importance of creating such files, as the program in the end of work usually deletes them. But the data inside these deleted files may be most useful. Files could be recovered especially if an output file was coded, or a document was typed [5-7].

Check Swap File. Microsoft Windows popularity brought some additional means for studying computer information. Swap File works as disk memory or huge database, many different temporary information pieces or even all the document text may be found in this Swap File.

Compare duplicates of text documents. Duplicates of text files may often be found on hard disk or floppy disk. These may be slightly changed version of one document that may have value as evidence. These divergences can be easily identified with the help of modern text editors.

Check and analyze computer network. Computers may be linked with each at other in computer network (e.g. local network), that in its turn may be linked to global computer networks (e.g. Internet). That is why there is possible that certain information (which can be used as evidence) can be transferred through the net to another place. This place can be situated abroad or on the territory of several countries [5-7].

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HAMPTON COURT PALACE AND 'ANNE OF THE THOUSAND DAYS'

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My mistress and friend:
I and my heart put ourselves in your hands…
King Henrich VIII

Abstract

This year marks the 500th anniversary of the coronation of Anne Boleyn as Queen of England , on 1 June 1533. In Tudor history, 7th September 1533, Queen Anne Boleyn, second wife of King Henry VIII, gave birth to Queen Elizabeth I. And this year marks the 500th anniversary of Elizabeth I's birth. In 2022, on the March 4 marked 500 years to the day of Anne's first recorded appearance at the English court in 1522. On September 1, 1532, Henry VIII had taken an unprecedented step: He had elevated a woman into England's hereditary nobility. It was both a gift of love and compensation for enduring years of frustration while Henry tried to put an end to his marriage to Catherine of Aragon. *The article devoted to Hampton Court Palace and Anne Boleyn* the Queen of England from 1533 to 1536 as the second wife of King Henrich VIII. Anne Boleyn is called 'Anne of the Thousand Days' because Henrich VIII replaced her after roughly three years. Anne who waited seven years to marry the King was dismissed and disgraced within a third of that time. Despite ruling for just three years during the Tudor dynasty, Anne Boleyn is one of the most famous queens in British History. She played a major role in the English Reformation along with Henry VIII. The author presents the events of Tudor history before Anne Boleyn's coronation, which will be described in the next article.

The author presents Hampton Court Palace in London and its History.

Key words: Tudor history, Hampton Court Palace, London, Anne Boleyn, King Henrich VIII of England, professional oriented foreign language teaching environment, students, university, the rose 'Anne Boleyn', intercultural and professional competencies.

Fig. 2. Hampton Court. Main Entrance.

Fig. 3. The roses *Anne Boleyn*.

Fig. 1. Anne Boleyn standing beside a Portrait of Henry VIII by David Mossman 1825–1901.

Anne Boleyn (Fig. 1, 4) the most famous mistress in history who won Henry VIII's heart and the crown away from Catherine of Aragon (Catherine of Aragon (Fig. 5) is somewhat of a forgotten figure in the Tudor-sphere. She is often passed over in the drama shows, and thought of as plain or even boring. But she was an incredibly interesting figure in European history, **see the video [22]).** Henry VIII split the English church from Rome for Anne Boleyn but later grew tired of his second Queen and had her beheaded. Her legacy was being mother to one of the greatest Queens in history, Elizabeth I. The fact that she was intelligent and educated and a talented writer, she gave generously to the poor and charitable causes and supported education shows how badly her image is spun in history **(see the video [121; 77]).**

During the last time we published a series of articles on Anne Boleyn and Henry VIII exploring Tudor history [73; 74; 75].

Anne Boleyn is called 'Anne of the Thousand Days' because King Henrich VIII of England replaced her after roughly three years. Anne who waited nearly a decade to marry the king was dismissed and disgraced within a third of that time [117; 8; 12].

She was Queen of England from 28.05. 1533 to 17.05. 1536, as the second wife of King Henry VIII (**see the video [14]).**

Thus, *in 2022, on the March 4 marks 500 years to the day of Anne's first recorded appearance at the English court in 1522* [83] (Fig. 1, 4, 7), **see the video [122].**

A Tudor gentlewoman generally received her position at court as servant to the queen due to her social status or her relationship to the king or queen. She might be, 1) a relative of the king or queen, 2) a friend (often from childhood) of the queen, 3) the daughter, sister or wife of a gentleman in service to the king, 4) the daughter, sister or wife of a nobleman, 5) or, a noblewoman in her own right. The female attendants of a Tudor queen were technically considered court officials not personal servants, in part, because final approval of their appointment lay with the sovereign. The queen-consort could suggest names, but the final decision rested with Henry VIII. Once chosen, their responsibilities were manifold: they supervised the domestic household of the queen, officiated at court functions, entertained ambassadors and other important guests, and generally were at the beck and call of their mistress, the queen. They often had daily contact with the king and members of his council and for that reason were chosen with care [20, p. 10].

Anne's uncle, **Thomas Howard, the Duke of Norfolk (1473–1554)**, was also a crucial character in her life (Fig. 6). An ambitious man from birth, Thomas brought Anne into court as Catherine of Aragon's (Henry's first wife (Fig. 5) lady-in-waiting, hoping that Henry would desire for Anne to be his next mistress. While Anne becoming Queen was never an explicit goal, his ambition to benefit from her position in court was clear. Once the Great Matter was made public, Howard openly campaigned at court for Anne to have more power and titles [83].

On September 1, 1532, Henry VIII had taken an unprecedented step: He had elevated a woman into England's hereditary nobility. It was both a gift of love and compensation for enduring years of frustration while Henry tried to put an end to his marriage to Catherine of Aragon **(see the videos [46]).**

In 1532, a new Venetian ambassador described Anne as 'not one of the handsomest women in the world. She is of middling stature, with a swarthy complexion, long neck, wide mouth, bosom not much raised, and in fact has nothing but the King's great appetite, and her eyes, which are black and beautiful – and take great effect on those who served the Queen when she was on the throne. She lives like a queen, and the King accompanies her to Mass – and everywhere.' [11].

At first, Tudor history went hand in hand with Catholicism. England was under

Fig. 4. Anne Boleyn and Henry VIII.

Fig. 5. Catherine of Aragon, early 1530.

Fig. 6. Thomas Howard, the Duke of Norfolk by Hans Holbein, c. 1539.

the heavy influence of Rome, and Catholic rites were observed by all. However, in 1527, to the surprise of all, Henry VIII petitioned to divorce his wife of 24 years, Catherine of Aragon (Fig. 5), **see the video [9; 23].** This was because Catherine had only provided Henry with a daughter, Mary, and not the male heir so desperately coveted. When met with refusal from the pope, Henry then made his second drastic decision and broke away from the Catholic Church. Thus, the Reformation had begun. Notable changes during this era include the dissolution of monasteries and the 1534 *Act of Supremacy* which states "that the king would be 'accepted and reputed

Fig. 7. Anne Boleyn by Hans Holbein (1536).

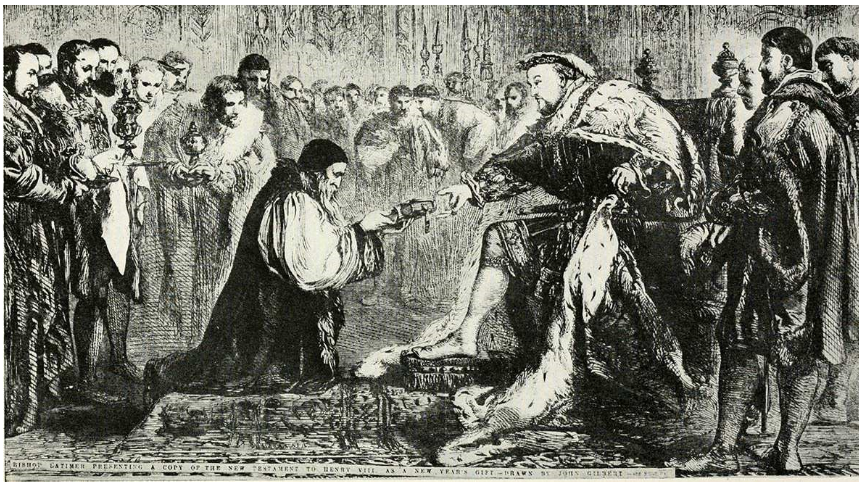

Fig. 8. King Henry the VIII receiving the Bible.

the only supreme head in earth of the Church of England" [46] (Fig. 8), **see the video [52].**

At last, 2023 year marks the 500th anniversary of the coronation of Anne Boleyn as Queen of England, on 1 June 1533. In Tudor history, 7th September 1533, Queen Anne Boleyn, second wife of King Henry VIII, gave birth to Queen Elizabeth I. And this year marks the 500th anniversary of Elizabeth I's birth.

Anne Boleyn has been called "the most influential and important queen consort England has ever had" [113, p. xv], as she provided the occasion for Henry VIII to annul his marriage to Catherine of Aragon and declare the English church's independence from the Vatican [8]. Catherine of Aragon was at the centre of one of Englands most turbulent periods in history. Catherine of course was the first (and longest serving) wife of Henry VIII. They married on 11 June 1509 and their marriage was annulled on the 23 May 1533 **(see the videos [24; 25]).** This video will concentrate on Catherine's final days up until her death and will look at a couple of alternative paths European history could have taken if Catherine's choices had been different to those she actually made.

Once *Anne Boleyn had been officially crowned as Queen of England on the 1st of June 1533,* Henry became intent on turning the tide against the popular opinion that Anne was a devious woman. By 1534, the Treason Act was passed in Parliament. The act stated that it was high treason to maliciously wish or attempt any bodily harm to be done or committed to the king's most royal person, the queen's or the heirs' apparent. Whether this was an act of love to protect his wife and queen, or a covert attempt to ensure that his decision to break from the Church wouldn't result in uprisings, is uncertain [83].

Fig. 9. Anne Boleyn (gravid) by Hans Holbein (1536).

Anne's pregnancy (Fig. 9) ensured her almost complete protection from all who would speak against her. Henry had wasted no time using his new power, and abandoned a most loyal wife and queen in the hope that a new wife would surely give him the son he so desperately wanted. The quickness of the pregnancy led Henry to believe that God had finally forgiven him for marrying Catherine, and that his next legitimate child would indeed be a son [83].

Thus, Henry and Anne formally married on 25 January 1533, after a secret wedding on 14 November 1532 (Fig. 10, 11). On 23 May 1533, the newly appointed

Archbishop of Canterbury Thomas Crammer declared Henry and Catherine's marriage null and void; five days later (in 1533), he declared Henry and Anne's marriage valid. Shortly afterwards, Clement excommunicated Henry and Cranmer. As a result of this marriage and these excommunications, the first break between the Church of England and the Catholic Church took place, and the king took control of the Church of England. Anne was crowned Queen of England on 1 June 1533 (Fig. 12). On 7 September 1533, she gave birth to the future Queen Elizabeth I [8].

On 19 May 1536 Anne Boleyn was beheaded in Tower **(see the video [15])**.

Fig. 10. Henry and Anne's secret wedding.

Fig. 11. A secret wedding. *The Tudors* [99].

Fig. 12. The Queen Anne [93]. *The Other Boleyn Girl* (2008).

Hampton Court Palace, where Anne Boleyn entertained, Jane Seymour died **(see the video [57])**, and Catherine Howard **(see the video [69])**, was arrested for adultery, was home to Henry VIII and his six wives (Fig. 13), **see the video [44; 86].**

History of Hampton Court Palace begins more than a thousand years ago. Nestled into a bend in the River Thames and below the Surrey hills The area of the castle was a prime spot for a homestead. Hampton is the Saxon word for a settlement at the Bend in the river. So we can date the name back centuries, and activity in the area for just as long **(see the video [18],** Fig. 14.

Fig. 13. Henry VIII and his wives.

By 1533 Henry had changed the English history, broken with Rome and annulled his marriage to Catherine of Aragon (video [469]), and could marry Anne (Fig. 16).

Hampton Court Palace, one of two remaining Tudor Palaces, is a magnificent sprawl of red-brick buildings and wonderful gardens nestling beside the River Thames in south-west London [120], **see the video [55]** (Fig. 14; 15, 18).

Fig. 14. Hampton Court Palace (London). The Great Gatehouse and King's Beasts [40; 43].

The history of Hampton Court Palace is in fact the tale of two palaces... a magnificent Tudor palace, created by *Cardinal Wolsey* (1473–1530) (Fig. 17, 18) and later made infamous by Henry VIII, alongside an elegant baroque palace built (Fig. 25) by *William III* (1650–1702) (Fig. 23) and *Mary II* (1662–1694) (Fig. 24) nearly 200 years later. (see **the video [36]).**

Cardinal Wolsey first started building Hampton Court in 1514. His plan (Fig. 17) was to build a grand residence to host King Henry VIII and his court but also make an impression when hosting monarchs from Europe… King Henry VIII made it his official royal residence [70], **see the video [42]**.

Fig. 15. The views of Hampton Court Palace.

Fig. 16. Geneviève Bujold as Anne Boleyn [17].

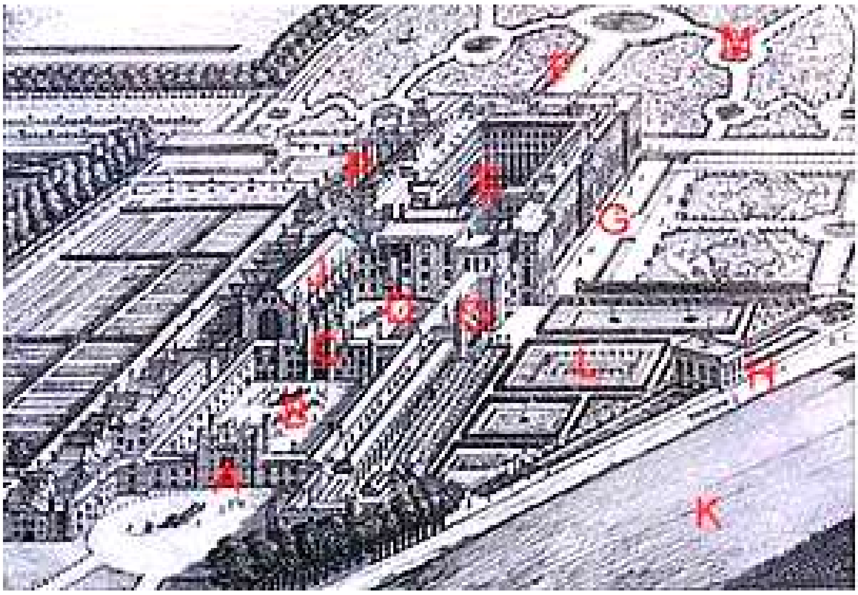

Fig. 18. Cardinal Wolsey.

Fig. 17. Hampton Court Palace: **A:** West Front & Main Entrance; **B:** Base Court; **C**: Clock Tower; **D**: Clock Court, **E**: Fountain Court; **F:** East Front; **G:** South Front; **H:** Banqueting House; **J**: Great Hall; **K:** River Thames; **L:** Pond Gardens; **M:** East Gardens; **O:** Cardinal Wolsey's Rooms; **P:** Chapel [401] **(see the video [62]).**

Hampton Court Palace was originally built for Cardinal Wolsey from about 1514–1527, one of Henry VIIIs most important favourites (Fig. 19), but when he fell from grace and was executed, the King took it for himself. It is here that many of the wives of Henry were courted.

Fig. 19. Henry VIII with Anne Boleyn at Cardinal Wolsey's ball, by Karl von Piloty.

During Anne's rise to power, Cardinal Wolsey was essential to the King in negotiating the Great Matter with Rome (Fig. 20; 21; 22). However, the consistent pushback led Anne to believe that Wolsey had a personal vendetta against her. This was magnified when, as a result of Wolsey's

Fig. 22. ***Anne of the Thousand Days*** **(1969). Henry VIII played by Richard Burton [17].**

Fig. 20. Henry VIII, Anne and Cardinal Wolsey. **Fig. 21. A papal edict to leave Anne.**

would move against Wolsey. He was dismissed from efforts, a papal edict was sent to Henry in October 1530, ordering him to leave Anne. Anne's rage was palpable, and the only way that the King could calm Anne and keep her was by agreeing that he office in 1529 and blamed Anne, who he called "the night Crow," always in a position to "caw into the king's private ear" **(see the video 58]).** Whether fortunately or unfortunately, Wolsey died on his way to be sentenced, where he might have been executed for treason [83].

Cardinal Thomas Wolsey (Fig. 18) was a longtime favorite and confidante of Henry VIII. Due to his elevated status, Wolsey was able to amass a great fortune that he used to build Hampton Court Palace **(see the video [19]).** However, he fell out of favor with Henry VIII because he couldn't deliver the King's request to divorce Katherine of Aragon (lovesick Henry VIII desperately wanted to marry Anne Boleyn [26])… To appease the King, Wolsey was forced to hand over Hampton Court Palace to Henry VIII in 1529. Stripped of his titles, Wolsey met an untimely death a year later.

Henry VIII greatly enlarged Hampton Court Palace and turned it into a splendid place for lavish extravaganzas. Luxurious accommodations for guests and residences for staff members were added to provide ample lodging for the sizeable court [41].

Queen Elizabeth I (1533–1603) also lived here but no member of the Royal family has lived at this site since the 18th century.

In the following century when William III and Mary I (1689–1702) (Fig. 23, 24) took the throne in 1689, they commissioned Sir Christopher Wren to build an elegant new baroque palace (**see the video [55]).**

Thus, King William III (1650–1702) built onto it an enormous extension in the Baroque style (Fig. 23, 24, 25), which was meant to rival the magnificent Versailles Palace in France. The Palace therefore has two distinct architectural styles, Tudor (Fig. 14; 15) and Baroque (Fig. 25).

Fig. 25. Hampton Court Palace. Architectural style Baroque.

Fig. 24. Mary II Queen of England, Scotland and Ireland (1662–1694).

Fig. 23. King William III.

Later, Georgian kings and princes occupied the splendid interiors. When the royals left in 1737, impoverished 'grace and favour' aristocrats moved in. Queen Victoria (Fig. 26) opened the palace to the public in 1838.

Fig. 26. Queen Victoria (1837–1901).

It has remained a magnet for millions of visitors, drawn to the grandeur, the ghosts and the fabulous art collection **(see the video [39)].**

The Palace is now a major tourist attraction, and is supported by an independent charity **(see the video [36]).**

Anyone entering Hampton Court Palace through the Great Gatehouse must first cross the Moat Bridge with The King's Beasts on it (Fig. 27) (**see the video [42].**

When the House of Lancaster overcame the House of York following the Wars of the Roses, a formidable dynasty was born. Henry VII, following his matrimonial union with Elizabeth of York to unite the houses, was keen to emphasise the legitimacy of his reign. He looked to the medieval tradition of heraldry to display motifs and symbols wherever possible, reinforcing his rightful position on the English throne to his subjects as well as rival claimants.

Henry VIII continued his father's commitment to legitimising the Tudor dynasty. One such place that heavily features heraldic symbols is Hampton Court Palace – one of the king's most famous residences and a place he used for pleasure and celebration [98], **see the video [37].**

The **King's Beasts** are a series of 10 statues of heraldic animals that stand on the bridge over a moat leading to the Great Gatehouse in Hampton Court Palace (Fig. 27). These statues were commissioned by King Henry VIII to represent his ancestry and that of his third wife Jane Semour (Fig. 13). The animals are: the Lion of England (Fig.27), the Seymour lion (Fig. 29), the Royal dragon (Fig. 29), the black bull of Clarence (Fig. 29, 35), the Yale of Beaufort (Fig. 32), the white lion of Mortimer, the White Greyhound of Richmond (Fig. 31), the Tudor dragon (Fig. 33), the Seymour panther (Fig. 30), and the Seymour unicorn (Fig. 34). The original statues where destroyed by renovations in the late 17th century, and new sculptures following the original specifications were erected in the early 20th century [60], **see the video [96].**

Fig. 29. The King's Beasts on the bridge.

Fig. 27. The King's Beasts before the Great Gatehouse.

Fig. 28. The Lion of England.

30. Fig. 31. Fig. 32. Fig. 33. Fig. 34. Fig. 35.

Fig. 30. The Seymour panther, Fig. 31. The White Greyhound of Richmond, Fig. 32. The Yale of Beaufort, Fig. 33. The Tudor Dragon, Fig. 34. The Seymour unicorn, 35. The black bull of Clarence [98].

David Lawrence has designed all ten coins in The Royal Tudor Beasts Collection (Fig. 36). Although he is a seasoned coinage artist, the project presented an interesting brief. He was asked to depict the heraldic beasts – loaded with the symbolic meaning that lies behind heraldry - in a natural and realistic way.

Launching in 2021, the British Royal Mint have announced their next exciting line of commemorative gold, silver, and platinum coins [107], **see the video [30].**

Fig. 36. Coins of The Royal Tudor Beasts.

Ten stone beasts line the Moat Bridge of Hampton Court Palace representing the lineage of Henry VIII and his third wife Jane Seymour. Consisting of real beasts and mythical creatures, we honour the heraldic symbols of one of the nation's most powerful dynasties in The Royal Tudor Beasts Collection (Fig. 36), e.g., *the Lion of England* is one of the oldest and most iconic beasts in heraldic art. Used on the shield of England for as long as one has existed, the lion first appeared in heraldry in the twelfth century.

The Yale of Beaufort: With the body of a goat, tusks of a boar and tail of a lion, the Yale of Beaufort is one of the most peculiar of the ten heraldic guardians chosen by Henry VIII to guard Hampton Court Palace. *The Yale of Beaufort* supporting a shield displaying the Marriage auqmentation of honour granted in 1536 by King Henry VIII to his 3rd wife Jane Seymour (**see the video [57]).**

The Seymour panther (Fig. 30, 36): symbolising the strength of the union between Henry VIII and his third wife, Jane Seymour. The Seymour Panther was given to Jane Seymour, Henry VIII's third wife, by the king from the royal treasury of beasts. Although the stone beast is depicted as a ferocious animal, with flames coming from its mouth and ears, the Seymour Panther symbolised a peaceful and loving union between the king and consort who bore him the male heir he so desperately yearned for. The Seymour Panther supports a shield bearing the Seymour Wings, which are conjoined in lure, meaning they are joined together with their tips pointing downwards. Wings used in heraldry symbolise peace, flight, freedom and spiritual transport, as well as denoting protection. The wings conjoined in lure on Jane Seymour's arms are the most well-known in heraldic tradition [98].

The black bull of Clarence is a symbol of power [97; 98], **see the video [30],** Fig. 35.

The set of Queen's Beasts at the coronation of Queen Elizabeth II replaced the three Seymour items and one of the dragons by the gryphon of Edward III, the horse of Hanover, the falcon of the Plantagenets, and the unicorn of Scotland [34].

On rare occasions Historic Royal Palaces allows members to explore the rooftops of Hampton Court Palace **(see the video [111]).** From here we can inspect parts of the Palace that are hidden from the normal visitor (Fig. 37): the nursery apartments for Henry VIII's children, a courtyard now blocked, the intricate brickwork of the amazing chimneys (about 250) (Fig. 38), **see the videos [27; 108])** and close up, the famous golden clock ([45], Fig. 39). With a bit of imagination we can see the footings of parts of the Tudor Palace which had been demolished centuries ago.

Thankfully it was a lack of money which prevented a complete rebuild of the old Palace in Georgian times. Stretching below you are the fountains, their spray forming rainbows in the sunshine, the sparkling blue Thames River flowing past the Palace's beautifully maintained gardens [80] **(see the video [35]).**



Fig. 37. The rooftops of Hampton Court Palace. 38. Decorative Tudor Chimneys. Fig. 39. Hampton Court Palace [45] Astronomical Clock from Tudor times.

Anne Boleyn first joined the English court on 4 March 1522 when she participated in the *Chateau Vert* **(see the video [124])** pageant organised by Cardinal Wolsey. Though Henry VIII was also present and participated in the performance, their encounter was hardly love at first sight. The pageant took place in the Great Chamber of York Place, the Cardinal's London townhouse in Westminster. The room had been specially decorated for the spectacle with arras and torches and with the 'Green Castle' standing at one end of the chamber. In the castle's towers stood eight ladies dressed in white satin. Their names – Beauty, Honour, Perseverance, Kindness, Constance, Bounty, Mercy, and Pity – were embroidered in gold on their dresses. Anne Boleyn played the role of Perseverance (Fig. 40) and her sister, Mary, the role of Kindness. The ladies were guarded by young choir boys playing the role of the seven vices – Danger, Disdain, Jealousy, Vindictiveness, Scorn, Malebouche and Strangeness. The pageant began with the entrance of eight lords dressed in blue satin and cloth of gold. The men, who represented the courtly male virtues – Amoress, Nobleness, Youth, Attendance, Loyalty, Pleasure, Gentleness and Liberty – asked for the ladies' freedom. This request was refused so with Henry VIII at the lead, the men attacked **(see the video [125]).**

Fig. 40. Anne Boleyn as 'Perseverance'. *The Tudors* (2007–2010) [99].

The lords threw dates, oranges "and other fruites made for pleasure" whilst the ladies defended the castle with rose water and "comfittes". Eventually the Vices surrendered and the lords took the ladies by their hands and led them out of the castle to dance. No evidence survives indicating that Anne made any impression on the King during this performance. At the time of the pageant, Henry was just beginning his affair with Anne's older sister, Mary, and it was not until years later that Henry began showing an interest towards the younger Boleyn. However, Anne's role as Perseverance seems appropriate considering her refusal to settle for the position of mistress and her eventual rise to queen [79], **see the video [6].**

By the 1530s, the King Henry VIII Palace was a not just a palace, but it was also a hotel, theatre and vast leisure complex. He used the palace to show his power and wealth, with expensive art, lavish banquets and extravagant court life [54; 126].

I'd just like to note that Anne Boleyn caught Henry VIII's attention in 1522 during a court masque where she played "Perseverance" (Fig. 41, **see the video [125]).** It is said he was instantly besotted with her. The courtship of Henry VIII and Anne Boleyn would take place over the course of five years. King Henry originally courted Anne to become his mistress but she refused his offers holding out for marriage. The letters the king wrote to her between 1527 and 1529 testify to the ardor she aroused in him.

"I Promise…to take you as my sole mistress, casting off all others than yourself out of mind and affection, and to serve you only" – Henry VIII

Henry and Anne both exchanged gifts (Fig. 42, 43) and Henry wrote a series of 17 letters to profess his love for her (he even drew love hearts around her initials!).

Fig. 41. Natalie Dormner as Anne Boleyn. *The Tudors* (2007–2010).

Fig. 42. The ship with the diamond.

Fig. 43. Miniature Whistle Pendant (gold) made 1525–1530.

By family tradition, this trinket (Fig. 43) was Henry VIII's first gift to Anne Boleyn (born 1501, died 1536), the earliest of many tokens of love. A later example of jewels exchanged between them is detailed in their letters. During their courtship, Henry wrote to Anne that 'seeing I cannot be present in person with you I send you the nearest thing to that possible, that is, my picture set in bracelets, with the whole device, which you know already, wishing myself in their place when it shall please you.' In reply, Anne sent a jewel symbolic of her own difficult situation, representing a ship tossed about on a stormy sea with a lonely damsel on board [66], **(see the video [53]),** Fig. 42.

The Jewel Anne Boleyn sent to Henry depicting a woman on a ship in a storm tossed sea signifying that she was willing to brave the tempest with Henry and he was the diamond guiding the ship as her protector [59], (Fig. 42, 44).

"Mine own sweetheart…wishing myself (especially an evening) in my sweetheart's arms, whose pretty dukkys I trust shortly to kiss" – King Henry VIII [70].

"My lover, my confidante, my soul-mate. Yes, my soul-mate. My soul, alone too long, needed this fellow wanderer. Together we would make a whole. And, wandering stars no more, joined, blaze through the sky…" Henry referring to Anne (The Autobiography of Henry VIII by Margaret George)

Fig. 44. Henry VIII, Anne Boleyn and Cardinal Wolsey.

Nowadays, the term "soul mate" may seem a bit cliché, contrived even. Not only is this because the idea of finding one's soul mate seems unlikely, but also because of the misuse or overuse of the term. For many, "soul mates" are two people who fall deeply in love with each other and remain together for all their lives, much like a fairy tale. Reality, however, proves to be far from a fairy tale. Even soul mates don't always receive their happy ending. The most beautiful and promising of love stories can end in tragedy [85; 28].

Henry fell madly in love with a woman who was not the golden, pale ideal of feminine Renaissance beauty, but a woman whose mind and inner being held its ideals, a woman whose years on the continent, as Suzannah Lipscomb describes, "transformed her from a teenage girl into an extremely desirable woman. The Anne that emerges back in England is one who has been shaped by many different influences – who is both pious and worldly, who's both sophisticated and something of an innocent. She's one who can play musical instruments, who can sing, who can dance, who can speak French, who is sophisticated and witty; who's been exposed to a world of cosmopolitan glamour. And she's such an attractive prospect because – precisely because – she is so complex" [67].

Henry VIII moved into Hampton Court Palace in 1528.

Wolsey, a quiet word, if you please … A little birdie tells me you're building a rather grand palace on the river?

But, your majesty, I was keeping it as a surprise for your birthday.

Good man, Wolsey. I knew I could trust you. Keep it up!

King Henry and Cardinal Wolsey [2]

Fig. 45. 'Me and My King' Henry VIII and Cardinal Wolsey by Sir John Gilbert c. 1886.

The Palace is now a major tourist attraction, and is supported by an independent charity, Historic Royal Palaces.

When we enter Hampton Court Palace head straight and we'll be wandering through the 16th-century Great Courtyard. Note the Tudor wine fountain (Fig. 46), (**see the video [44]).**

Fig. 46. On entering the "Base court".

Fig. 47. The Tudor wine fountain [40].

This is a **modern recreation of a fountain that poured out wine not water** (Fig. 47, **see the video [51])**. This was originally constructed in France at an event called "The Field of Cloth of Gold" by Henry to show off to the King Francis I of France. Francis was slightly younger than Henry and his biggest rival. At this meeting Henry constructed a flat packed palace and numerous, huge marquees to give the impression that he was "the main man", vastly superior to Francis in every way. Francis constructed 300 tents with many of them having golden thread which, whenever they caught the suns's rays gave a golden shimmer and hence the name of the event. At Leeds castle in Kent, there is a painting showing Henry's *Embarkation from Dover* (Fig. 48). The painting is full of people, supplies and ships [38; 123].

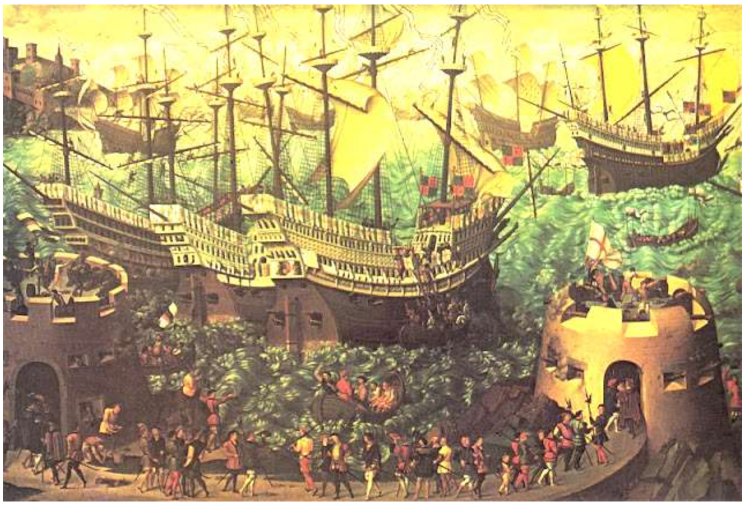

Fig. 48. ***Embarkation from Dover c. 1540.***

In 1520 King Henry VIII stayed at Leeds Castle with Queen Catherine of Aragon and an entourage of 5000 people. This was the best-documented royal visit to Leeds Castle and was a stop off between Greenwich and northern France for a ceremonial meeting with Francis I of France. This meeting became known from its magnificence as the Field of Cloth of Gold (the extensive use of cloth of gold, which was woven with real gold thread and silk, would later give the site of the meeting its name) and was part of unsuccessful diplomatic attempts by Francis to woo the English away from their alliance with the Holy Roman Emperor Charles V **(see the video [1]).**

King Henry VIII travelled from London to Dover with an entourage of 3,997 people set out from Greenwich Palace on Sunday 21 May, 1520 and reached Leeds Castle on Monday 22nd May on the way to France. Queen Catherine of Aragon, Henry's first wife, travelled in the same cavalcade accompanied by a personal suite numbering 1,175.

Henry VIII rested in Priory while all the 27 ships were loaded, sailed across to France, unloaded, returned and reloaded. The hulls of the ships were too deep to come right inshore and so, small rowing boats were used to take the people to the ships, and they then had to climb up rope ladders to get on board. Once on board they hung their coats of arms on the side of the ship. This represented the passenger list and was a record of who was on which ship. A copy of the painting of the "Embarkation from Dover" hangs in the Henry VIII Banqueting Hall at Leeds Castle. Henry VIII commissioned the paintings and in all probability the artist had not even visited Dover. They were pained around 1540, at least 20 years after the event [5; 88].

From the 7th to 24th June 1520, King Henry VIII of England and King Francis I of France take part in a diplomatic tournament known as the 'Field of the Cloth of Gold'. The two monarchs were in their youth when they hosted this glorious event. They entertained each other and the over 12,000 attendees through fantastic banquets and grandiose spectacles. All was richly decorated in a spectacular display of wealth, most notably with wildly expensive cloths of gold **(see the video [92]), (**Fig. 49).

Fig. 49. *The Field of the Cloth of Gold* c. 1545 [87].

The extravagance of the two kings knew no bounds, with Henry's encampment featuring a gilt fountain that ran with wine and claret (Fig. 46, 47).

In this context, we can now see why the fountain was full of wine [38].

We found a celebration in music of the Meeting *The Field of Cloth of Gold* in 1520 of Henry Vlll of England and François I of France **(listening to [89]),** Fig. 49.

England in the 1520s is a heartbeat from disaster. If the King dies without a male heir, the country could be destroyed by civil war. Henry VIII wants to annul his marriage of twenty years and marry Anne Boleyn (Fig. 50). The Pope and most of Europe oppose him. Into this impasse steps Thomas Cromwell (1485–1540): a wholly original man, a charmer, and a bully, both idealist and opportunist, astute in reading people, and implacable in his ambition [103] (Fig. 51), **see the video [105].**

Fig. 50. Anne Boleyn.

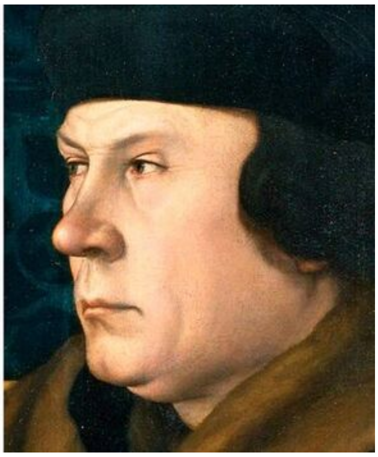

Fig. 51. Thomas Cromwell.

After the downfall of Cardinal Wolsey (in 1529), his secretary, Thomas Cromwell, finds himself amongst the treachery and intrigue of King Henry VIII's court and soon becomes a close advisor to the King, a role fraught with danger [116]. **(see the movie *Wolf Hall* [115]),** Fig. 52.

Fig. 53. Irene Papas as Katherine of Aragon in *Anne of the Thousand Days* (1969).

Fig. 52. Damian Lewis as Henry VIII (right) and Sir Mark Rylance as Thomas Cromwell in the BBC TV adaptation of *Wolf Hall* (2015).

In 1522, Anne Boleyn entered the court of King Henry VIII as one of the ladies-in-waiting to Henry's wife, Katherine of Aragon, daughter of Ferdinand and Isabella of Spain (**see the video [48],** Fig. 53). By 1523, she was betrothed to Henry Percy, 6th Earl of Northumberland, but this was broken by Cardinal Wolsey, due to the King's interest in Anne Boleyn **(see the video [82]).** During her time at court, Henry VIII began pursuing and later courting Anne Boleyn. It was his love for Anne Boleyn (Fig. 54) that prompted a long and bitter divorce battle between Henry and Katherine **(see the video [21]),** which ended with Henry breaking with the Catholic Church and starting the Church of England [26], **see the video [50].**

While still married to Catherine, Henry had begun wooing a court beauty, Anne Boleyn, and was determined to marry her. A lady-in-waiting to Catherine, Anne was sophisticated, charming, and confident. She is commonly believed to be the wife he loved the most. As his advisers worked on "the King's great matter" of the divorce, the couple had to wait seven years to be married – though the two flaunted their relationship in court. He wrote her love letters, which still exist today: "I hope soon to see you again," he wrote, "which will be to me a greater comfort than all the precious jewels in the world."[114], **see the video [47].**

Fig. 54. Henry decided Anne Boleyn would be more likely to bear fertile heirs than his first wife Catherine of Aragon.

On 30th November 1529, Henry VIII was reproached by the two women in his life: his wife, Catherine of Aragon, and the woman he wanted to marry, Anne Boleyn. An angry Catherine of Aragon confronted her husband regarding his treatment of her, which she considered "the pains of Purgatory on earth" (Fig. 55), and then when the King sought comfort from Anne Boleyn, she reproached him for giving Catherine the "upper hand" [4; 31].

On this day in history, St Andrews Day (30th November) 1529, Queen Catherine of Aragon confronted her husband, Henry VIII, about his treatment of her.

Fig. 55. Catherine of Aragon and her husband Henry VIII in *Anne of the Thousand Days* (1969) [17].

Eustace Chapuys gave a full report of the meeting between Catherine and Henry in a letter to CharlesV, writing that Catherine said "that she had long been suffering the pains of Purgatory on earth, and that she was very badly treated by his refusing to dine with and visit her in her apartments." The King replied that she had no right to complain, "for she was mistress in her own household, where she could do what she pleased" and explained that he had not dined with her because he had been busy with "affairs of government".

He then went on to address her complaint about not visiting her apartments, saying that "she ought to know that he was not her legitimate husband, as innumerable doctors and canonists, all men of honour and probity, and even his own almoner, Doctor Lee, who had once known her in Spain, were ready to maintain" and that "should not the Pope, in conformity with the above opinions so expressed, declare their marriage null and void, then in that case he (the King) would denounce the Pope as a heretic, and marry whom he pleased" [4].

On 21st June 1529 King Henry VIII and his first wife Catherine of Aragon appeared in front of Cardinals Wolsey and Campeggio at the Legatine Court at Blackfriars. In 1528, Cardinal Wolsey had been made the Pope’s vice-regent in order "to take cognisance of all matters concerning the King’s divorce" and Campeggio had been made papal legate and sent to England to help Wolsey with the case.

George Cavendish, Wolsey’s gentleman-usher, described how the King sat under a cloth of estate and Catherine "sat some distance beneath the king". Also present were Stephen Gardiner as "scribe"; the Archbishop of Canterbury (William

Warham), Richard Sampson and Thomas Abel as counsellors for the King, and John Fisher (Bishop of Rochester) and Cuthbert Tunstall (Bishop of St Asaph) as counsellors for the Queen. The papal commission was read out to the court and the crier officially summoned the King to court, crying "King Henry of England, come into the court." The King rose and responded "Here, my lords." The crier then called, "Catherine, Queen of England, come into the court." (Fig. 56) [3].

Fig. 56. Katherine of Aragon Denounced Before King Henry VIII and His Council by Laslett John Pott,1888. Style Romanticism.

Rather than simply confirming her attendance, Catherine got up, approached the King and knelt at his feet. In "broken English" (Fig. 57), she then made what David Starkey calls "the speech of her life":

"Sir, I beseech you for all the loves that hath been between us, and for the love of God, let me have justice and right, take of me some pity and compassion, for I am a poor woman, and a stranger born out of your dominion. I have here no assured friend, and much less indifferent counsel. I flee to you as to the head of justice within this realm.

Alas! Sir, wherein have I offended you, or what occasion of displeasure? Have I designed against your will and pleasure; intending (as I perceive) to put me from you? I take God ansd all the world to witness, that I have been to you a true, humble and obedient wife, ever comfortable to your will and pleasure, that never said or did any thing to the contrary thereof, being always well pleased and contented with all things wherein you had any delight or dalliance, whether it were in little or much. I never grudged in word or countenance, or showed a visage or spark of discontentation. I loved all those whom ye loved, only for your sake, whether I had cause or no, and whether they were my friends or my enemies. This twenty years I have been your true wife or more, and by me ye have had divers children, although it hath pleased God to call them out of this world, which hath been no default in me"... [3], see **the video [102].**

Fig. 57. Catherine of Aragon pleads her case against divorce from Henry VIII. Painting by Henry Nelson O'Neil.

Cardinal Wolsey then asked the King to confirm that Wolsey was not “the chief inventor or first mover of this matter” and the King replied, “Nay, my lord Cardinal, I can well excuse you herein. Ye have been rather against me.” The King explained that his doubts about his marriage had been sparked off during negotiations over a potential marriage between his daughter mary and the Duke of Orleans. The French ambassador had apparently wanted assurance that Mary was legitimate, considering that the Queen had formerly been married to Henry's brother. This query had then made the King begin to doubt the validity of his marriage and ponder whether it was better for the country for him to take another wife.

After hearing from both side, the court was then adjourned for the day [3].

England in the 1520s is a heartbeat from disaster. If the King dies without a male heir, the country could be destroyed by civil war. Henry VIII wants to annul his marriage of twenty years and marry Anne Boleyn. The Pope and most of Europe oppose him. Into this impasse steps Thomas Cromwell: a wholly original man, a charmer, and a bully, both idealist and opportunist, astute in reading people, and implacable in his ambition… After the downfall of Cardinal Wolsey (in 1529), his secretary, Thomas Cromwell **(see the video [103]),** finds himself amongst the treachery and intrigue of King Henry VIII's court and soon becomes a close advisor to the King, a role fraught with danger [116].

In 1531, King Henry VIII has proposed a bill which will make him the Head of the Church in England and allow him to marry Anne Boleyn.

Not that Henry’s desire for Anne could be seen as the only reason for him to put aside Katherine. Above all things, Henry wanted a legitimate male heir which Katherine was no longer able to provide and there was no reason to think he couldn’t have a fruitful and successful marriage with Anne. However, as time drew on and Anne’s notoriety grew, she had to double down on the divorce proceedings and cementing her position as queen in waiting [29].

Henry petitioned a papal annulment on the grounds that his marriage to Catherine was unholy because of an Old Testament ban on marrying the widow of one’s brother. The Pope denied his request, which caused King Henry VIII to seek out other options and decided that he didn’t need the pope’s permission on matters pertaining to the church in England [16].

Fig. 58. Henry VIII, Catherine and their daughter Mary. *The Tudors* (2007).

On July 11, 1531, Henry sent Catherine to live in relative isolation in Ludlow, and she was cut off from all contact with their daughter, Mary. She never saw Henry or her daughter Mary in person again [104], (**see the video [104]),** Fig. 58.

In 1532, Henry obtained the support of Francis I, the French king, for his actions, and secretly married Anne Boleyn. Whether she became pregnant before or after that ceremony is not certain, but she was definitely pregnant before the wedding ceremony on January 25, 1533. Catherine's household was moved several times to different locations on Henry's orders, and such close friends as her long-time companion (from before Catherine's marriage to Henry) Maria de Salinas were forbidden contact with Mary.

On the night of January 6, Catherine dictated letters to be sent to Mary and to Henry, and she died on January 7 1536, in the arms of her friend Maria. Henry and Anne were said to celebrate upon hearing of Catherine's death [61] **(see the video [95]).**

On hearing the news of Catherine of Aragon's death, Henry VIII cried out "God be praised that we are free from all suspicion of war!" and then celebrated by dressing in "yellow, from top to toe, except for the white feather he had in his bonnet".


Fig. 59. Anne Boleyn in yellow.
***The Tudors* (2007) [99].**

Eric Ives, in "The Life and Death of Anne Boleyn", writes of how, on Sunday 8th January 1536, both Anne Boleyn and Henry VIII appeared at court dressed "from top to toe" in "joyful yellow" and that they "triumphantly paraded" their daughter Elizabeth to church; however, it is not really clear who was dressed in yellow that day.

Eustace Chapuys, the Imperial Ambassador, reported to his master, Charles V that "On the following day, Sunday, the King was clad all over in yellow, from top to toe, except the white feather he had in his bonnet, and the Little Bastard was conducted to mass with trumpets and other great triumphs", making no mention of Anne. The chronicler Edward Hall, however, puts Anne in yellow, writing that "Quene Anne ware yelowe for the mournyng…"[118]. Yellow was the colour of mourning in Spain, Catherine’s homeland [65], **see the video [10] (Fig. 59).**

Catherine of Aragon was Queen of England as the first wife of King Henry VIII from their marriage on 11 June 1509 until their annulment on 23 May 1533 **(see the video [94]).**

At this point, Henry’s attempt to rid himself of Katherine and marry Anne had been going on for six years and Anne still hadn’t slept with him. There was no sign that their relationship had deteriorated and when Henry took her, as his wife in all but name, to Calais to meet the French king. It’s likely that here, or shortly after, they slept together for the first time and Anne soon fell pregnant which rather hastened their need to get married. After six years of political wrangling, Katherine and Henry’s marriage was quickly dissolved on paper and Anne just as quickly married (1533) [29], see the **video [14].**

King Henry VIII of England’s divorce, or annulment, of Catherine of Aragon in 1533 is one of the most infamous separations in history. And while we nearly all know the end result of the divorce proceedings, in hindsight who had the stronger case? [32; 31; 33].

Henry and Anne were by all accounts happy. While marital rape wasn't exactly recognised during Tudor times, there is no recorded instance, rumour, or even whisper of a rumour that Henry was in any way violent to Anne. Granted, it's a bit weird to say that of a man who had two of his wives beheaded, but of all the things Henry VIII was, violent rapist is possibly undeserved. At any rate, at the time of their wedding, Henry and Anne were very happy together [29].

The couple spent Christmas (1532) together at Greenwich Palace. Not long after, Anne realised she was pregnant **(see the video [100]).** Since they didn't want the child to be born out of wedlock, and even though Henry was still married to Catherine in the eyes of the Catholic Church, a chaplain wed them secretly in January of 1533 [16] (Fig. 60)

Fig. 60. Secretly Wedding on January 25, 1533.

Anne was pregnant when they finally said "I do" in January 1533, and some months later she gave birth to Elizabeth I (07.09. 1533). Later, she had two stillborn children and suffered a miscarriage in 1536; the foetus appeared to be male. Henry still did not have his heir [402].

Fig. 61. On June 01, 1533. Coronation. *The Tudors* (2007) [99].

Fig. 62. Rosa Anne Boleyn.

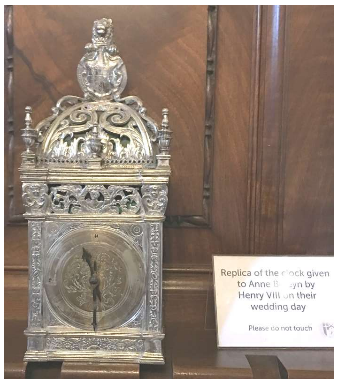

Fig. 63. The clock given to Anne by Henry VIII on their wedding day, 1533.

In early 1533, after her wedding to Henry, Anne was queen in everything (Fig. 60). *(We found Anne Boleyn's wedding song came back to life 500 years on* [63]). Cranmer now proposed a radical way to legalise the situation. In April Parliament passed the first of the laws that would lead England to officially reject Catholicism and establish the Protestant Church of England. The Act in Restraint of Appeals deprived the pope of his authority to judge Henry's marital dispute. This meant that Catherine could no longer appeal to Rome to overturn the decisions of England's religious authorities. On May 23, Archbishop Cranmer summoned an ecclesiastical tribunal that declared the king's union with Catherine null and void;

five days later the wedding between Henry and Anne was confirmed to be valid and legitimate [16].

Thus, In May 1533, the King's marriage to Katherine of Aragon was finally annulled and Anne Boleyn (whom he had married the previous January) was crowned Queen of England on the 1st June that year **(see the video [101]),** Fig. 61.

So the marriage that Anne Boleyn had held out for so long, finally took place and made her Henry's wife. Anne's patience, courage and cleverness were finally rewarded [81]. She was tied to a mind-boggling powerful man who refused to let his wishes be crossed: Anna had to give Henry VIII a son.

This ushered in one of the most turbulent periods in British history. Having failed to secure the Pope's permission for the annulment, Henry broke with Rome and established a separate Church of England over which he was the Supreme Head.

In Tudor history, 7th September 1533, Queen Anne Boleyn, second wife of King Henry VIII, gave birth to a healthy baby girl at Greenwich Palace. This daughter would, of course, grow up to be Queen Elizabeth I **(see the video 112]).**

Anne Boleyn was Henry VIII's queen consort from 1533 to her execution in 1536 after being the Queen of England for only 1000 days [117] **(see the video [13],** **(**Fig. 63, 64).

Fig. 63. Henry and Anne were very happy together. ***Anne of the Thousand Days*** **(1969) [17].**

Fig. 64. Hampton Court main entrance or 'Great Gate'.

Throughout time there has been much controversy and debate over the life of Anne Boleyn, and there is especially much unknown around her marriage to King Henry VIII. Annes has captured the hearts of many in the modern world and the mystery that surrounds her draws people in. People want to know as much as they can about Anne and her life and the world that she lived in and they want to be able to understand her actions and decisions. Anne was a Tudor woman who had spent some of her teenage years at the French court. She was determined, educated, witty and courageous and after nearly 500 years, Anne Boleyn still has the ability to provoke emotions and questions and inspiration. Anne then went onto become a lady in waiting for Queen Claude of France. Anne was young and sophisticated swell as educated, intelligent and stylish beyond the typical English lady. But Annes upbringing in a foreign court isn't what we are looking at today. In fact we were focusing on her marriage to King Henry VIII **(see the video [119]).**

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Translation of the Title and Abstract to the Author's Language

УДК 94:273.4]:929(410)"1533/1536"

Петько Л. Гемптон-корт палац і «тисяча днів королеви Анни».

У 2023 році виповнюється 500 років від дня коронації Анни Болейн як королеви Англії, що відбулося 1 червня 1533 року. В історії Тюдорів 7 вересня 1533 року знаменна дата – королева Анна Болейн, друга дружина короля Генріха VIII, народила майбутню королеву Англії Єлизавету I, через що цього року буде проводитися святкування 500-річчя від дня народження Єлизавети I.

Рік тому, у 2022 році 4 березня виповнилося 500 років із дня першої зафіксованої появи Анни Болейн при англійському дворі у 1522 р. і через десять років поспіль, 1 вересня 1532 року, король Генріх VIII зробив безпрецедентний крок в історії: підніс жінку до статусу спадкового дворянства Англії. Це був і подарунок любові, і компенсація за роки розчарування, поки Генріх VIII намагався розірвати свій шлюб з іспанською принцесою Катериною Арагонською, тому це розлучення короля Англії Генріха VIII з Катериною Арагонською у 1533 р. стало одним із найганебніших розлучень в історії.

Статтю присвячено Гемптон-Корт палацу та Анні Болейн, королеві Англії з 1533 по 1536 роки, яка була другою дружиною короля Генріха VIII, цей період її життя називають «тисяча днів королеви Анни», тому що Генріх VIII стратив її приблизно через три роки. Анна, яка чекала шість років, щоб вийти заміж за короля, була звільнена та зганьблена протягом третини цього часу. Незважаючи на те, що Анна Болейн правила лише три роки за часів династії Тюдорів, вона стала однією з найвідоміших королев в історії Великобританії. Вона відіграла важливу роль в англійській Реформації разом з Генріхом VIII.

Автор освітлює події історії Тюдорів до коронації Анни Болейн: розлучення з Катериною Арагонською, таємне весілля з Анною Болейн. Подальший шлях Анни Болейн у Гемптон-Корт палаці буде висвітлено у наступній доробці.

Представлено Гемптон-Корт палац у Лондоні та його історію часів Анни Болейн.

Ключові слова: історія Тюдорів, палац Хемптон-Корт, Лондон, Анна Болейн, король Англії Генріх VIII, Катерина Арагонська, професійно орієнтоване іншомовне освітній простір, троянда «Анна Болейн», навчання іноземної мови, студенти, університет, міжкультурна та професійна компетентністі.

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Specificity of Organizational and Methodological Ensuring the Learning Process in the Information and Educational Environment

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Abstract

The article identifies the main trends characterizing the modern educational space; analyzed the content characteristics of the informational educational environment as a pedagogical system that combines informational educational resources, computer learning tools, educational process management tools, pedagogical techniques, methods and technologies.

Based on the analysis of the scientific works of leading scientists, the main characteristics of the informational educational environment (variability, contextuality, polyfunctionality, adaptability) are determined, and their explanation is given; the functions of the informational educational environment are determined and the structure is substantiated. It has been proven that the information and educational environment consists of the goals and tasks of the organization of the project process, as well as the program-methodical (normative support for the functioning of the educational system), information-knowledge (a set of competencies), communication (interaction of the subjects of the educational process), technological (modern teaching aids) components.

The specifics of the use of advanced educational technologies in the information and educational environment are clarified.

The conclusion that the information and educational environment of higher education institutions in modern conditions solves the following tasks is substantiated: improving the quality of education and the level of professional competence formation; ensuring the availability of educational services; lifelong learning; preparing students for the use of information technologies in an open digital society; increasing the efficiency of the education system in general.

Keywords: information and educational environment, variability, contextuality, didactic approaches, educational technologies, didactic approaches, information and communication technologies

The cultural and historical stage of modern development is associated with the formation of an information society, the introduction of new information technologies into the educational process. Digitization and computerization of education today is a necessary and mandatory condition for the creation of the intellectual base of a modern information society, which determines the organization and development of the information educational environment of higher education institutions, which should ensure the achievement of the planned results of mastering the basic educational program, individual development of students, including the development systems of basic competencies, social values, which form the basis of lifelong education.

Many works are devoted to consideration of various aspects of the functioning of the educational environment (including electronic, informational and educational).

The works of S. Gural, I. Zakharov, S. Zenkin, E. Polat, V. Soldatkin, E. Skibitsky, etc. are devoted to the analysis of the peculiarities of the organization of learning in the electronic educational environment.

The educational environment as a factor of educational influence was the subject of research by N. Shchurkov. V. Bederkhanova considered the educational and informational environment as a factor in the professional formation of an individual.

A number of scientists' works are devoted to the problem of building productive relationships between participants in the educational environment. For example, V. Yasvin studied the formation of personality in the educational environment, V. Rubtsov - the educational environment as a form of cooperation between subjects of learning, D. Ivanov - the educational environment as a product of the activity of its subjects.

The subject of scientific investigations by M. Skurativska and S. Popadyuk is the virtual educational environment as an organized system of information, technological, didactic resources, various forms of computer and telecommunication interaction of educational subjects [11]

We will analyze the modern scientific field of interpretations of the studied phenomenon

Thus, R. Gurevich understands the informational and educational environment as a pedagogical system that integrates informational educational resources and means of managing the educational process aimed at forming an intellectually developed personality with the necessary set of competencies in demand on the labor market [6].

V. Bykov, in turn, as a complete system consisting of a set of subsystems that function and provide pedagogical interaction of participants in the educational process on the basis of modern information-technical and educational-methodical means [3, p. 243-246].

As a set of conditions that contribute to the emergence and development of the processes of information-educational interaction between students and teachers within the framework of learning technology, as well as form cognitive activity in the process of filling the components of the environment with subject content, P. Atamachuk interprets the category "information-educational environment" [1, p.15].

Note that most definitions of the information and educational environment are interpreted from the standpoint of a systemic approach, according to which the environment is a system of interconnected, mutually determined components that form a single whole that performs a qualitatively new function that is not inherent to its individual elements. Thus, Y. Bekh and A. Sleptsov [2] consider a system as a set of objects with their relations and connections, which has the following characteristics: integrity, connectivity, function [2].

According to E. Chornobai, the information and educational environment consists of the goals and objectives of the organization of the project process, as well as the program-methodical (normative support for the functioning of the educational system), information-knowledge (a set of competencies), communication (interaction of the subjects of the educational process) and technological (modern teaching aids) components.

In turn, O. Uvarov includes an information block in the structure of the information and educational environment, which contains information systems, services, and tools that are used when solving certain tasks. We share this position of the author and emphasize the systematic construction of the components of the information and educational environment.

Close to the above is the position of L. Kartashov and V. Yurzhenko, who define the information and educational environment as a pedagogical system that integrates the electronic campus of the educational institution, means of managing the educational process, pedagogical technologies and ensures the formation of an intellectually developed, socially significant, a creative personality who possesses the necessary level of professional knowledge, abilities and skills for a successful life and future professional activity in the information society [8, p.12].

Thus, the essential specific functions of the information and educational environment as a subsystem of the educational process include those that: 1) ensure the openness of the system of modernization and informatization of its subsystems; 2) perform specific functions (informational; interactive; communication; coordinating; developmental; culture-forming;

vocational orientation); 3) structurally include content (informational, educational, methodical resources), technological (tools, means of IT activities and communications) and organizational (organizational structures) components [8, p.18].

We also share the opinion of M. Skurativska and S. Popadyuk, who claim that the studied phenomenon "is formed by educational subjects, not technical means or electronic manuals, and accordingly, its functioning is not possible without the communication of students, teachers, facilitators, administrators , developers of distance courses, etc." [11, p. 252].

Therefore, close to our understanding of the conceptual essence of the educational and information environment is the definition of S. Leshchuk, who interprets it as a system of information and communication and traditional means aimed at organizing and conducting an educational process focused on personal learning in the conditions of the information society [9].

Analyzing the organizational and methodological support of training in the information and educational environment, it should be noted that this is training using various resources: distance learning, webinars, electronic textbooks, electronic training manuals, virtual simulators, specially created educational resources on various platforms, etc. others At the same time, the information and educational environment includes: - digital educational resources; modern pedagogical technologies; - organizational forms of informational interaction between teachers and students, including telecommunication means; - technological means of communication and information technologies, equipment, various databases. And, accordingly, it should provide the possibility of computerization of: - informational and methodical activities; - planning of the educational process and resource provision; - preservation and placement of materials of the educational process; - monitoring.

Let's consider the characteristics of the information and educational environment from the point of view of its didactic potential. One of the main ones is the subject assignment of the environment, which determines its characteristics such as: variability, contextuality, polyfunctionality, adaptability.

In particular, variability, reflecting the essential nature of the modernization of higher pedagogical education, creates opportunities for individualization of learning, building one's own educational route, and creative mastering of normative competencies. It is fundamentally important that each pupil/student, acting in the information and educational environment, achieves the necessary (defined by the standards) educational results, following his individual educational trajectory. At the same time, training assumes the presence of invariant and variable components in the content of education. The functions of the invariant are that a certain basic content, which will serve as a starting point during the "immersion" of the student in the information space must be mastered. And which aspects of the studied material to expand, master more deeply, the subject himself decides, acting first in a specially organized informational and educational environment, and then in the informational and educational space. Thereby constructing a variable part of the content of education, based on one's cognitive needs and interests.

The variability associated with the increase in the complexity of the information and communication environment as a result of structural and functional differentiation based on the implementation of modern achievements in the field of informatization is becoming more and more obvious with the strengthening of the openness of education, the development of the interaction of formal and informal education.

The contextuality of the informational and educational environment means the meaningful actualization of the content of education by "immersion" in the professional context. At the same time, there is a combination of the situational context of inter-subject interaction, the cultural context and the personal context (mutual exchange of opinions of the subjects of activity) [7]. Accordingly, contextuality implies the orientation of educational activities to future professional activity, which allows avoiding contradictions between professional education and real professional activity (O.O. Verbytskyi).

We are convinced that a specific property of the information and educational environment, which allows to organize the learning process in a new way, is interactivity, which enables the subjects of education (students, teachers, experts) to actively interact with each other, as well as with software tools to achieve their goals. Therefore, interactivity provides a certain level of pedagogical interaction - the unity of the pedagogical influence, its active perception by the pupil/student, generates the subject's own activity, in particular directed at himself.

The characteristics of the information and educational environment considered above also determine the main line of deployment of the educational process (definition of the purpose of education, didactic principles, methods and forms).

Let's emphasize that in the conditions of learning in the information and educational environment, the leading didactic approach changes from the traditional "knowledge" approach (the goal of education is the transfer of a certain system of knowledge, skills, and abilities) to a competency-based approach with elements of personal orientation (the formation of the ability to solve life problems, applying existing knowledge , ability, skills) [5]. The competence paradigm is focused on the formation of the ability to independently find new knowledge necessary for practice in the information environment, to be able to apply it practically to obtain an effective result in professional (practical and scientific-theoretical) activities, to make unconventional decisions, to act independently, creatively, mastering one of the key competences in the knowledge society is the ability to study [10].

Accordingly, the leading function of the teacher becomes the organizational (managerial) one, related to the creation of conditions for pupils/students to master the necessary knowledge and skills. In essence, we are talking about the implementation of the technology of tutor support in education, in which the teacher performs the function of a "navigator", a mentor who helps the student/pupil to choose his path of acquiring knowledge and accompanies him on this path, providing pedagogical support.

Taking into account the fact that a characteristic feature of the information and educational environment is, according to S.K. Gural and O.S. Lazareva, the redistribution of information flows - the dialogue between the teacher and the student is mediated by the virtual environment, which acts as the third component of education, it will be appropriate to find out how the studied environment affects the specifics of the use of educational technologies.

Educational technologies include technologies of project activities, modular learning, group work, situational analysis, cases, game technologies, web quests, distance learning, heuristic telecommunication olympiads, wiki technologies, development of intelligence maps, etc. We see that some technologies cannot be implemented without the use of computer tools - these technologies belong to information and communication (ICT), other technologies can be implemented without ICT.

When comparing educational technologies with the opportunities that appear when they are used in the information and educational environment, three groups of technologies are identified:

1. Educational technologies, the use of which in the information and educational environment does not change their essence, but makes them more convenient to use (for example, in the technology of modular learning, when used in the environment, the verification of the achievement of the goal can be more effectively organized, the information and education environment in the technology of intelligence cards increases their visualization).

2. Educational technologies, the use of which in the information and educational environment expands their ability to influence the personality being formed (for example, project-based learning, which is implemented taking into account the possibilities of the environment, involves searching for information in it, network communication, participation in the project of subjects, which are in remote access).

3. Educational technologies, the use of which is possible only in the information and educational environment (wiki technology, web quests, distance learning, telecommunication heuristic olympiads, etc.).

At the same time, as V. Kungurtseva rightly observes, the use of modern educational technologies (information, communication) allows to improve the quality of training of qualified specialists by:

1. Providing access to current information. This direction is particularly relevant due to the rapid aging of information and the need for constant updating of available data.

2. Implementation of full-format interaction of students in the distance learning system.

Full-format interaction is carried out thanks to the use of modern multimedia equipment, which allows each participant of the interaction to take an active part in the learning process.

3. Initiation of joint activity of the participants of the educational space. The implementation of many types of joint activities becomes possible through network technologies and the use of a number of universal office application programs, such as word processors with network online interaction functions, graphic editors, a number of programs for preparing presentations, etc.

In general, the analysis of modern pedagogical practice makes it possible to conclude that the process of restructuring the learning process, its acquisition of specificity in the information and educational environment, has only just begun. Basically, the possibilities of the environment are used only in the aspect of ICT as a means of learning, which make the learning process more interesting, emotionally rich, convenient in implementation, but do not change its essence. The development of new-generation textbooks, which ensure the implementation of new functions of the learning process in the information and educational environment, will greatly contribute to the restructuring of the learning process.

The above provides grounds for asserting that the information and educational environment of higher education institutions in modern conditions solves the following tasks: improving the quality of education and the level of formation of students' professional competence; ensuring the availability of educational services; lifelong learning; preparing students for the use of information technologies in an open digital society; increasing the efficiency of the education system in general.

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Pedagogical Principles and Conditions for Forming Cultural Competence of Future Music Teachers: The Context of Music History

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Abstract

The article is devoted to the problem of forming cultural competence of future musicians-pedagogues in the process of professional training, in particular, during the studying music history. The purpose of the article is to outline the pedagogical principles that will contribute to forming cultural competence of future Music teachers, as well as the necessary and sufficient pedagogical conditions, methods of implementation are the basis for the appropriate methodology. Cultural competence is defined as an acquired professional quality and personal integral phenomenon, which reflects preparation in performance, musicology and music pedagogy, a valuable attitude towards art and a profession, and readiness to apply what has been acquired into practice in dialogue with others. The potential of cultural competence in music and historical training the future music teacher has been clarified. The holistic awareness of art, the connection of art with other areas of knowledge, and with life as a source of artistic images are emphasized. Dominant pedagogical principles for forming cultural competence are singled out (culture of conformity based on the cultural approach, artistic integration, the practical and active orientation of the educational process, actualization of a person's creative resources, dialogues, the connection of the process of learning art with the history of mankind and the history of one's country and national culture). Pedagogical conditions for forming cultural competence in future music teachers are described. The unifying role of the conditions for forming an attitude towards partnership and communication in the cultural and educational environment (artistic during interpretive activity and interpersonal) is substantiated. A conclusion is made about the subjectivity of future music teachers, so pedagogical conditions acquire mean in gout side it. Moreover, it is concluded that the further development of methods should aim at the implementation of each pedagogical condition in view of the essence and structure of cultural competence. Studying artistic communication in the digital environment will be our future prospect.

Key words: Music history, cultural competence, potential of cultural competence, pedagogical principles, pedagogical conditions, future Music teachers.

Актуальність дослідження. Виокремлення педагогічних принципів і прогнозування педагогічних умов освітнього процесу для формування певних особистісних та професійних якостей його суб'єктів завжди концептуально спрямовують на розроблення методик, технологій для впливу на динаміку якості цього процесу і досліджуваного феномену. Від взаємозв'язку чинників залежить досягнення мети підготовки вчителів у будь-якій національній освіті. Одна з авторок статті презентує освіту Китаю, навчаючись в Україні. Нині китайська музична освіта відкрита до інновацій з інших країн при збереженні національної самобутності. Україна нині у сфері музичної освіти перебуває на етапі реформування. Культурна компетентність виокремлюється як стрижнева серед ключових компетентностей у документах і методичних матеріалах (Закон України «Про освіту», концептуальні документи «Нової української школи»), низці наукових досліджень (Джонсон Р. Бойд, О. Комаровська, О. Локшина, Р. Майєрс, О . Овчарук, О. Олексюк, О. Пометун, Дж. Равен, О. Савченко та ін.). Актуалізується культурологічний підхід до освіти. Цей досвід буде цікавим для Китаю. Через те, стаття зосереджена на прикладі підготовки вчителів музики в українських закладах вищої мистецько-педагогічної освіти.

Мета статті – окреслити педагогічні принципи, дотримання яких сприятиме формуванню культурної компетентності учителів музики, та необхідні педагогічні умови, реалізація яких є підґрунтям для відповідної методики.

Виклад основного матеріалу. На підставі переліку ключових компетентностей в Рекомендаціях Ради Європи (2006) [10] та аналізу джерел [1; 3; 5; 8] *культурну компетентність розуміємо як міждисциплінарну і системоутворювальну щодо решти компетентностей, пронизуючи їхній зміст*. Дієвою основою для культурної компетентності є мистецтво і мистецька освіта. Для вчителів музики культурна компетентність є фаховою, постає як особистісне інтегральне утворення, що віддзеркалює підготовленість з усіх напрямів: виконавство, історія і теорія музичного мистецтва, музично-педагогічна підготовка, охоплюючи знання та уміння, ціннісне ставлення до того, що пізнається, і конкретно до професії, готовність застосовувати набуте на практиці, в діалозі з іншими [11]. Набуття культурної компетентності розширює межі підготовки в одному виді мистецтва. Для вчителя музики це «вихід за межі» музичного мистецтва в театр, живопис, кіно, танець, архітектуру та інші [13]. Сформованість культурної компетентності виявляє себе в музичній і загально художній розвиненості; мотивації до пізнання й ціннісному ставленні до професії вчителя музики, який є вчителем мистецтва; готовності удосконалюватись як музикант, так і в педагогічній діяльності та прогнозувати саморозвиток; у відкритості до мистецької комунікації в професії [2; 4].

Розглянемо культурно-компетентнісний потенціал історико-музикознавчої підготовки, яка створює базу для виконавських інтерпретацій, розуміння історико-стильових процесів, застосування набутих знань у педагогічній діяльності.

Як зазначає В. Редя, «завдання історії музики і як науки, і як навчального предмету – встановити логіку музичного процесу, логіку зміни музичних стилів» [9, с. 60]. Авторка наводить влучний вислів Ю. Чекана стосовно того, що історія музики є «людським минулим у його музичні проєкції» [там само].

В українських вишах курс історії музики є розгорнутим, охоплює зарубіжну і українську музику в хронологічній послідовності, зрозуміло за певною варіативністю у структуруванні, виборі персоналій і творів тощо.

Щодо залучення інших мистецтв, то це, зазвичай, не позначається в програмах українських закладах вищої освіти (ЗВО). Проте зміст шкільної освіти вимагає від учителя музики широкого мистецького світогляду: освітні стандарти в Україні спираються на інтегративне навчання мистецтва, тоді як типові освітні та модельні програми зорієнтовані на курс «Мистецтво», а не на окремі предмети. Тому, учитель музики має готуватись до того, аби бути учителем мистецтва, опановуючи музику у зв'язках з іншими мистецтвами та різними проявами життя і знання.

У китайській музичній освіті орієнтиром підготовки вчителя музики залишається поглиблене вивчення саме музики [11]. А втім, китайська філософія і національний світогляд як раз містять цілісну художню картину світу [15].

Тобто *культурно-компетентнісний потенціал* музично-історичної підготовки майбутніх учителів музичного мистецтва ідентичний компетентнісному потенціалу пізнання мистецтва як сфери творчості людини: аксіоматично, що в художні образи втілюють усе, що людину хвилює. Отже, такий потенціал полягає у можливості цілісного опанування логіки музичних процесів, стилів із сучасним розумінням музичних цінностей; у формуванні цілісних уявлень і про музичні процеси, і про їхній зв’язок з життям та іншими позамистецькими сферами знання; у зв’язках музичного мистецтва з національними традиціями, у взаємозумовленості знань з історії музики та інших мистецтв з музичним виконавством, музично-педагогічною діяльністю, інших можливих видах діяльності (просвітництво, волонтерство, арт-терапія, менеджмент, звукорежисура тощо).

Тож, можемо виокремити педагогічні принципи, дотримання яких забезпечить результативність набуття культурної компетентності, як-от:

– *культуровідповідності* й *опори на культурологічний підхід* у підготовці педагога-музиканта, що передбачає посилення фахової підготовки ціннісними смислами пізнанням музики, активізацію вироблення особистісного ставлення до музики в контексті інших мистецтв, коли «культурологічна спрямованість змісту мистецької освіти реалізується на основі процесуальної змістової складових освітнього процесу» [5, с. 130];

– *мистецької інтеграції,* що випливає з викликів сучасного знання до інтегральності і цілісності уявлень тих, хто їх здобуває; а разом це апріорі умовлено цілісністю свідомості;

– *практико-діяльнісної орієнтованості освітнього процесу і*, зокрема його історико-музикознавчої складової, що означає націленість здобутих знань, аналітичних умінь та ін. на виконавську творчість, на педагогічну та інші види професійної діяльності; це випливає із сутності феномену компетентності;

– *актуалізації креативних ресурсів особистості,* що виявляється у визнанні унікальності і майбутнього педагога-музиканта, і його майбутніх учнів; означає прийняття інтересів, уподобань, цінностей тощо. Особливо це стосується аналітичних інтерпретаційних умінь як практичної складової історико-музикознавчої підготовки, а також проєктування на інші напрями підготовки та майбутньої професійної діяльності;

– *діалогічності* фахової, зокрема історико-музикознавчої *підготовки* вчителя музики та художнього пізнання загалом*;*

– *зв'язку пізнання мистецтва з історією людства та історією країни і національної культури,* що є пріоритетом.

Таким чином, визначаємо такі *педагогічні умови* формування культурної компетентності як результату вивчення курсів з історії музики:

1) організаційне забезпечення опанування цінностей з історії музики націлено на практичне застосування у виконавській, музично-педагогічній, лекторській,

менеджерській та ін. діяльності, що відбувається в культурно-освітньому середовищі закладу/факультету; створення сприятливої атмосфери для цього [14];

2) системне спонукання студентів-музикантів до самостійної практичної реалізації змісту історії музики шляхом передбачення і планування своєї індивідуальної участі в мистецькому житті факультету або кафедри саме як процесуально-змістової складової підготовки з історії музики;

3) акцентування у змісті курсів з історії музики пріоритетності національного-центрованого погляду на художню картину світу шляхом встановлення зв’язків знань з музичного та інших мистецтв з історією людства та історією своєї країни;

4) перманентне націлювання студентів-музикантів на самомоніторинг досягнень з історії музики в їхньому зіставленні з вже набутими студентами іншими ключовими компетентностями, які вони зможуть застосовувати як під час навчання, так і у подальшій діяльності музиканта.

Висновки і перспективи. Як бачимо з викладеного вищк, педагогічні умови взаємозумовлені, а головне, – містять об’єднувальну діалогічну основу. Отже, умовно можемо виокремити *об’єднувальну педагогічну умову* – формування в майбутніх вчителів музики *установки на партнерство і комунікацію* в культурно-освітньому середовищі: *художню* під час аналітико-інтерпретаційної діяльності творів, *міжособистісну* (в продукуванні та вираженні думок, творчих ідей, виконавських інтерпретацій; у *колективній проєктній діяльності*, для розвитку організаційних здібностей, самостійності й критичності мислення тощо).

Разом реалізація педагогічних умов зіставна із сутністю культурної компетентності, що потребує розроблення конкретних методів і форм. Зрозуміло, що виокремлені педагогічні умови мають сенс при умові врахування того, що майбутні музиканти-педагоги здобувають освіту в певному культурно-освітньому середовищі, суб’єктами якого вони є [2], а отже, перспективним постає розроблення положень щодо такого середовища і функцій суб’єктів у ньому. Безумовно, нагальну потребу має розроблення способів формування культурної компетентності, що побудована на діалозі, в цифровому середовищі, яке своєю чергою суттєво обмежує саме художню міжособистісну комунікацію

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Translation of the Title, Abstract and References to the Author's Language

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Чжоу Тінтін, Комаровська Оксана. **Педагогічні принципи й умови формування культурної компетентності у майбутніх вчителів музичного мистецтва: контекст історії музики.**

Стаття присвячена проблемі формування культурної компетентності майбутніх музикантів-педагогів у процесі фахової підготовки, зокрема під час вивчення історії музичного мистецтва. *Мета статті* – окреслити педагогічні принципи, дотримання яких сприятиме формуванню культурної компетентності майбутніх учителів музики, а також необхідні і достатні педагогічні умови, способи реалізації яких є підґрунтям для відповідної методики.

Культурна компетентність розглядається як набута фахова якість та особистісне інтегральне утворення, що віддзеркалює підготовленість з виконавства, музикознавства, музичної педагогіки, ціннісне ставлення до мистецтва і до професії, готовність застосовувати набуте на практиці в діалозі з іншими. *З'ясовано* культурно-компетентнісний потенціал музично-історичної підготовки вчителя музики. *Проакцентовано* аспект цілісного пізнання мистецтва, зв'язку мистецтва з іншими сферами знань та з життям як джерелом художніх образів. *Виокремлено* домінантні педагогічні принципи для формування культурної компетентності (культуро відповідності, опори на культурологічний підхід, мистецької інтеграції, практико-діяльнісної орієнтованості освітнього процесу, актуалізації креативних ресурсів особистості, діалогічності, зв’язку процесу пізнання мистецтва з історією людства та історією своєї країни та національної культури). *Описано* педагогічні умови формування культурної компетентності майбутніх учителів музичного мистецтва. Обґрунтовано об’єднувальну роль умови формування установки на партнерство і комунікацію в культурно-освітньому середовищі: художню під час інтерпретаційної діяльності і міжособистісну. *Зроблено висновок* про суб’єктність майбутніх педагогів-музикантів, поза якою педагогічні умови набувають сенсу. А також про те, що подальше розроблення методик має націлюватися на реалізацію кожної педагогічної умови з огляду на сутність і структуру культурної компетентності. Перспективним є дослідження художньої комунікації в цифровому середовищі.

Key words: історія музики, культурна компетентність, культурно-компетентнісний потенціал, педагогічні принципи, педагогічні умови, студенти-музиканти, майбутні вчителі музичного мистецтва.

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Formation of Moral and Patriotic Feelings in Pre-School Children

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Abstract

The actual problem of education is the moral and patriotic upbringing of the child was aimed at the formation of: value orientations, interests and needs, and a moral position. After all, at an early age, the foundations of the moral development of the individual are laid, and ideas, feelings, and habits are also developed, which direct its further improvement in the future life.

In our country, the structure of education is focused primarily on the personality of the child and on the importance of creating the right conditions for his development. To date, the most important task of today's pedagogy is the formation of a highly moral personality through the education of moral feelings. The multifacetedness and significance of education and the instillation of these feelings in the formation of a child's personality caused close attention to research that is relevant in our modern time.

In modern society, there is a discrepancy between the construction of the educational process within the framework of the implementation of the requirements of the educational program of the preschool education institution on moral and patriotic education and the insufficient methodological development of the problem of forming moral foundations and patriotic ideas in the personality of the preschool child. Therefore, gaps appear in the child's development, which are very difficult to compensate for at the next stages of education and upbringing.

Accordingly, the article analyzes the approaches to understanding the concepts of "Morality" and "Patriotism" as one whole component and each concept separately in scientific and psychological and pedagogical literature. The content of the concept we are researching with its purpose and content is indicated and scientifically substantiated, the characteristic features of the formation of moral and patriotic feelings are highlighted, and their content is outlined as a key link in the field of education and training. The legal framework was considered. The specified features of the age we are studying and its characteristic nuances and characteristics. The concept of "moral and patriotic feelings" was considered through the prism of the three-dimensional model "Educator-Parent-Children" as a component of the studied category. The main problems and gaps in the educator's work are explained on the basis of the conducted research, which was substantiated and recorded in our article. Relevant methodical recommendations for parents and educators are provided. Our assumptions have been confirmed and recorded that the process of forming moral ideas should be complex, be present in all activities of preschoolers, and be carried out in specially organized classes.

The prospects for further research into the issues that were recorded in our research and led to the writing of the article are outlined.

Key words: moral and patriotic feelings, morality, patriotism, preschool age, three-dimensional model of education.

Постановка проблеми. Проблематикою нашого дослідження є низький рівень сформованості моральності у старших дошкільників, адже основними проблемами гармонійного духовного розвитку особистості дитини стало домінування матеріальних цінностей над духовними, спотворення уявлень про добро, милосердя, справедливість. Саме тому з'явились прогалини у формуванні патріотичних почуттів, адже поняття патріотичності витікає з поняття моральності і є одним цілим компонентом. Забезпечення морального та патріотичного виховання – одна з найактуальніших і найскладніших проблем, яка повинна вирішуватися усіма, хто має відношення до дітей. На кожному щаблі розвитку дитини [11]. У сучасному суспільстві існує невідповідність між побудовою освітнього процесу в рамках реалізації вимог освітньої програми закладу дошкільної освіти з морального та патріотичного виховання і недостатньою методичною розробленістю проблеми формування моральних основ та патріотичних уявлень у особистості дитини дошкільного віку. Тому з'являються прогалини у розвитку дитини, які на наступних етапах навчання і виховання дуже складно компенсувати.

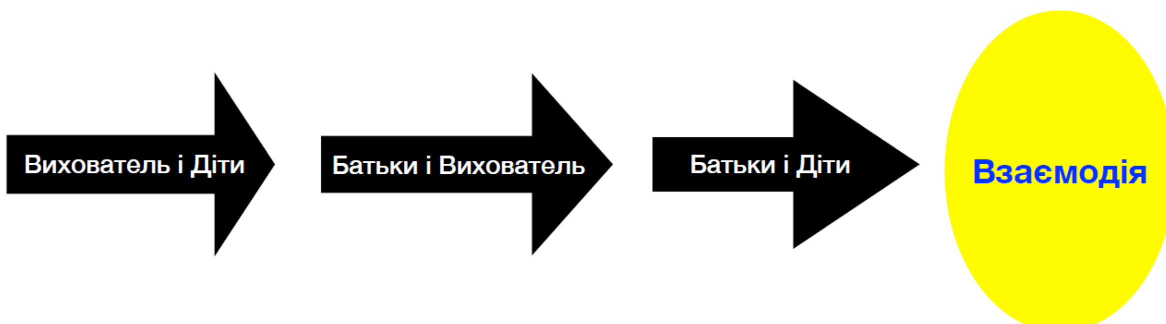
Гіпотеза статті. Отже, виходячи з основної проблематики нашого дослідження ми дійшли висновку що, морально - патріотичне виховання дошкільників необхідно здійснювати при виконанні всіх розділів парціальної програми з наймолодшого віку. Воно включає виховання в дітей любові до рідних, близьких, Батьківщини, почуття дружби, товариськості, колективізму, поваги до старших, турботи про молодших, навичок культурної поведінки, відповідального ставлення до виконання доручень і обов'язків, готовності працювати для загального блага. Дітей потрібно вчити бути правдивими, чесними, формувати навички утримуватись від небажаних вчинків.

Найбільш ефективним у морально - етичному вихованні дошкільників є поєднання моральної суті вчинків і подій з організацією досвіду поведінки дітей. Програмні завдання вихователь повинен здійснювати в різних видах діяльності: під час занять, ігор, посильної праці, у повсякденному житті. [9].

Вирішити завдання та проблематику низького рівня сформованості морально-патріотичного виховання неможливо без співпраці як вихователя з дітьми так і вихователя з батьками, а потім вже взаємодії батьків з дитиною. Тобто має бути така тривимірна модель співпраці [3].

Тому надзвичайно вагомими та актуальними є питання педагогічної просвіти батьків щодо морально-патріотичного виховання дітей. Необхідно встановлювати довірливі взаємини з батьками вихованців, ознайомлювати їх зі змістом морального виховання дітей цього віку, з методами та прийомами виховного впливу, акцентувати увагу на важливості гуманного і в той же час вимогливого ставлення до дитини. Вихователі мають запрошувати батьків на заняття, проводити індивідуальні консультації та бесіди, організовувати обмін досвідом сімейного виховання, забезпечувати активність батьків на батьківських зборах.

Важливо спрямувати зусилля на те, щоб набуті знання, вміння, навички стали для дітей нормою і правилом у повсякденному житті як у дитячому садку так і за його межами. Також від себе вважаємо за потрібне надати методичні рекомендації для батьків і вихователів з метою просвіти та допомоги дорослим більш гуманно та уважно ставитись до дитини, її потреб, розвивати її кращі сторони, виховувати моральну, відповідальну, патріотично обізнану гуманну людину яка любить свою Батьківшину. [9].



Об'єктом дослідження є: форумвання морально патріотичних почуттів у дітей передшкільного віку. **Предмет дослідження** – надання та застосування створених нами методичних рекомендацій у роботу з дітьми передшкільного віку. **Метою публікації** є створення методичних рекомендацій для вихователів та батьків з метою формування морально-патріотичних почуттів у дітей передшкільного віку.

Методи дослідження. **Загальнонаукові методи**. ***(Теоретичні методи педагогічного дослідження).***

Аналіз і синтез. Ці методи наукового пізнання не існують ізольовано один від одного. аналіз є уявним або фактичним розкладанням цілого педагогічного явища чи процесу на частини. синтез - відновлювання цілісності розглядуваного педагогічного явища чи процесу в усьому різноманітті його виявів. Методи аналізу і синтезу застосовують у теоретичних дослідженнях під час визначення проблеми пошуку, формулювання гіпотези, завдань дослідження. Використовують їх і з метою коригування експерименту. Не обходиться без них і при підведенні підсумків дослідно-пошукової роботи, формулюванні висновків і рекомендацій.

Індукція та дедукція У процесі використання цих методів відбувається перехід знання про одиничне та окреме у знання про загальне, і навпаки. У педагогічному дослідженні його використовують для з'ясування причинно-наслідкових зв'язків між педагогічними явищами, узагальнення емпіричних даних на основі логічних міркувань від конкретного до загального.

Порівняння. Як метод педагогічного дослідження порівняння полягає в зіставленні отриманих результатів дослідження з наміченими цілями. У процесі дослідження отримані результати порівнюють не тільки з цілями, а й зі станом об'єкта до початку дослідження, що дає змогу простежити динаміку досліджуваного явища.

Класифікація. Завданням її є логічний розподіл педагогічних фактів, явищ, процесів за притаманною для певної групи ознакою.

Узагальнення. За своєю сутністю воно є логічною операцією, в результаті якої відбувається перехід від одиничного до загального, від менш загального до більш загального судження, знання, оцінки [11; с.28].

Спеціально – наукові методи. (*Методи емпіричного дослідження).*

Метод Спостереження. Метод психологічного дослідження, що складається в навмисному, систематичному і цілеспрямованому сприйнятті і фіксації проявів поведінки, отримання суджень про суб'єктивні психічні явища, що спостерігається. (Спостереження за довільною поведінкою дошкільника у спеціально створенному середовищі за акцентом на формування морально-патріотичних почуттів).[5; с.31].

Метод Експерименту. Цей метод характеризується, як цілеспрямоване і активне втручання у хід процесу, що вивчається, відповідні зміни об’єкта чи його відтворення успеціально створених і контрольованих умовах. Основними стадіями здійснення експерименту є: планування і будова; контроль; інтерпретація результатів. Експеримент має дві взаємопов’язані функції: дослідну перевірку гіпотез і теорій, а також формування нових наукових концепцій. (У нашому дослідженні висвітлено умови формування морально-патріотичних почуттів та які фактори впливають на моральність дошкільника та на патріотизм). [5; с.34].

Відповідно до мети, предмета й гіпотези визначено такі основні завдання дослідження:

1. Розглянути основні підходи до визначення понятть «мораль» та «патріотизм» як одного цілого.
2. На підставі аналізу та підбору наукової літератури виявити та розкрити теоретичні засади особливостей дітей передшкільного віку.
3. Провести експеремент щодо сформованості у вихователів компетентностей з приводу вміння формувати у дітей старшого дошкільного віку морально-патріотичних почуттів.
4. Створити методичні рекомендації для батьків і вихователів з метою формування моральних почуттів як основної ланки появи патріотизму.

Аналіз останніх досліджень.

Загальні проблеми морального та патріотичного виховання досліджували видатні педагоги та психологи: Л. Божович, В. Скутіна, В. Сухомлинський , І. Харламов, Н. Гавриш. Проблемою культури патріотичної поведінки особистості дошкільника займалися мислителі та педагоги: А. Анісімов, В. Кремень, Т. Поніманська, В. Шинкарук [2]. Про важливість формування морально зрілої особистості займались: І. Каїров, С. Литвиненко, Н. Міронова, Ю. Ступак, Л. Фесюкова.

Виклад основного матеріалу дослідження.

З перших років життя моральне та патріотичне виховання дитини було спрямоване на формування: ціннісних орієнтирів, інтересів і потреб, та моральної позиції. Адже вже в ранньому віці закладаються основи морального розвитку особистості й також розвиваються уявлення, почуття та звички, які спрямовують подальше її вдосконалення в майбутньому житті [2]. В нашій країні, структура освіти орієнтується в першу чергу на особистість дитини та на важливості створення правильних умов її розвитку. На сьогоднішній день найважливішим завданням педагогіки сьогодення є формування високоморальної особистості шляхом виховання моральних почуттів. Багатогранність і значущість виховання та прищеплення цих почуттів у становленні особистості дитини, зумовило пильну увагу до дослідження яке є актуальним у наш сучасний час [1]. Вченими проблема морального виховання особистості дитини розглядається з різних сторін, та в певних аспектах: виховання моральної свідомості (В. Зибковець, І. Маренко), виховання моральної культури особистості (В. Бачінін Т. Гуменникова), формування моральної активності дітей (І. Зайцева, Л. Крайнова), характеристика емоцій і почуттів та їх класифікація (Є. Богданов, К. Ушинський, О. Чебикін). У своїх наукових працях дослідили та висвітлили загальні проблеми формування морально-патріотчно зрілої у майбутньому особи, як одного цілого компонента такі видатні педагоги та психологи: Л. Божович, В. Скутіна, В. Сухомлинський, І.Харламов. Також данний аспект розглядається у нормативних документах таких як БКДО, Закон України «Про дошкільну освіту» тощо [6]. На всіх етапах розвитку суспільства мораль, як і право, політика, традиції, звичаї, табу - є важливим регулятором людської поведінки, людських відносин, а моральність (моральна практика) - одним із критеріїв оцінки чеснот людини. З позицій гуманістичної свідомості, основою особистості є її моральний розвиток, який виявляється у «сповідуваній» нею системі поглядів, уявлень, норм, оцінок, що регулюють її поведінку. Моральна особистість узгоджує власні дії з інтересами інших людей, керується у власних помислах критеріями загальнолюдських цінностей, відповідає за власні вчинки не лише перед законом, людьми, а й перед власною совістю [7]. *Мораль (від лат. moralis - моральний, від mos (moris)* - звичай, воля, закон, властивість) - система поглядів, уявлень, норм, оцінок, які регулюють поведінку людей; форма суспільної свідомості [12]. Моральне ж виховання передбачає різноманітні впливи на думки, почуття, соціальну практику індивіда, його самовдосконалення. Цей процес поєднує в собі такі особливості: цілеспрямованість (полягає в чіткій окресленості мети педагогічних впливів); багатофакторність (передбачає враховування усіх чинників, які відіграю ть суттєву роль у процесі виховання); віддаленість у часі результатів роботи (виховання є тривалим процесом, результати якого не можуть бути досягнутими відразу); неперервність (полягає в систематичності взаємовпливів вихователя і вихованця); визначальна роль педагога (педагог має бути моральним взірцем для дитини); цілісність (передбачає внутрішню єдність усіх виховних засобів і впливів щодо формування моральної культури людини) [10]. Зміст морального виховання підпорядкований вічним цінностям і конкретним потребам суспільства, які з плином часу змінюються. Засноване воно на принципах рівноцінності особистостей вихователя та дитини, гуманістичності змісту та засобів виховання, довіри та поваги в процесі виховання, створення позитивної, емоційної атмосфери творчої взаємодії вихователя і дитини. Також доцільно зауважити на важливості формування патріотизму у дітей передшкільного віку. Дошкільне дитинство є надзвичайно важливим періодом у становленні особистості. Саме в цьому віці в дошкільника закладаються першооснови свідомості й самосвідомості; розпочинається процес національно-культурної ідентифікації, а саме усвідомлення себе як частини великої і давньої нації.

Разом із тим, дошкільний вік має свої потенційні можливості для формування вищих моральних почуттів до яких і відноситься почуття патріотизму [4]. Психологи та педагоги вважають, що найсприятливіший вік для початку формування патріотичних почуттів дитини – п’ятий рік життя, коли активізується інтерес особистості до соціального світу, суспільних явищ, близького оточення. Однак, навіть в старшому дошкільному віці діти ще недостатньо усвідомлюють, що таке «патріотизм», і це є важливою проблемою. *Патріотизм* – це природна прихильність і любов до рідної землі, мови, культури; глибоке моральне почуття, показник і виразник найвищих проявів духовного світу людини [2]. В наш час шалених обертів набирає спрага таких духовних орієнтирів як моральність, чистота мислення і серця, культура і духовність. І надзвичайно важливо сьогодні дати дітям, маленьким громадянам України, уявлення про державу, закон, права та обов’язки, формувати людські чесноти. Патріотичне виховання дітей здійснюється відповідно до вимог та настанов програми з виховання їх у дошкільному закладі. Зміст цієї роботи визначається з урахуванням віку дітей, кола їхніх знань, психічних особливостей, національної своєрідності, умов побуту та навколишнього середовища та відповідно принципам патріотичного виховання [5; с.71]. Тобто ми можемо зробити висновок, що зміст морального та патріотичного виховання підпорядкований вічним цінностям і конкретним потребам суспільства, які з плином часу змінюються. Засноване воно на принципах рівноцінності особистостей вихователя та дитини, гуманістичності змісту та засобів виховання, довіри та поваги в процесі виховання, створення позитивної, емоційної атмосфери творчої взаємодії вихователя і дитини [8].

Структуру морально-патріотичних почуттів можна представити через відношення до:

1. Себе: національна самосвідомість, честь, гідність, щирість, доброта, терплячість, чесність, порядність.

2. Людей: національний такт, милосердя, благородство, справедливість, гостинність, відкритість, щедрість, готовність допомогти; усвідомлення своєї належності до українського народу як його представника; відповідальність перед своєю нацією;

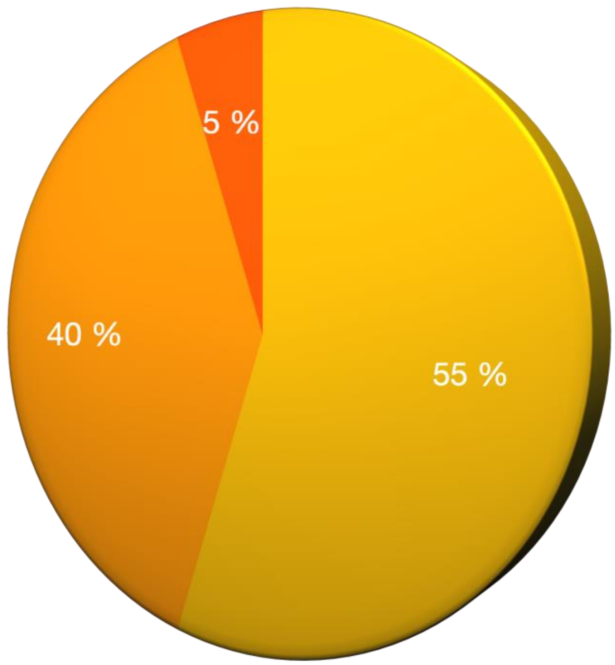
3. Батьківщини: віра, надія, любов, громадянська відповідальність, вірність, готовність стати на захист, бажання працювати для розвитку країни, підносити її міжнародний авторитет, повага до Конституції та законів держави; гордість за успіхи держави, біль за невдачі, суспільна активність та ініціативність;

4. Національних цінностей: володіння українською мовою, бажання й потреба в накопиченні, збереженні та передачі родинних і національних звичаїв, традицій, обрядів; дбайливе ставлення до національних багатств, до рідної природи; сприяння розвиткові духовного життя українського народу; шанобливе ставлення до національних та державних символів; почуття дбайливого господаря своєї землі [1].

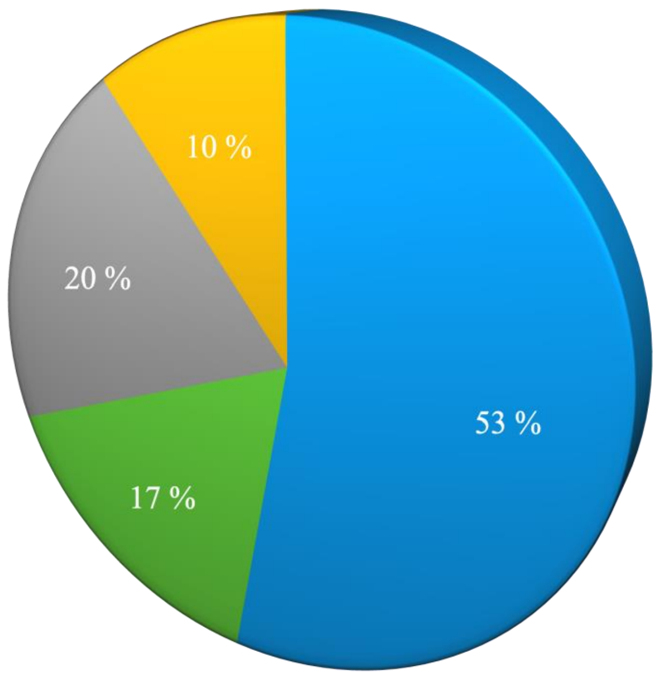
В патріотично-моральних почуттях відбивається особистісне ставлення особистості до своєї держави, її минулого, майбутнього та сьогодення [7; с.17].

Організація емпіричного дослідження.

Емпіричне дослідження проводилося на базі **ЗДО № 241** "Лелеченя" м. Кривий Ріг Дніпропетровської області. Респондентами виступили діти передшкільного віку (24 осіб), вихователі (2 осіб) та 18 батьків. У межах дослідження здійснювалося виконання таких завдань: 1) дослідження професійної компетентності працівників ЗДО з проблеми морального та патріотичного виховання старших дошкільників. 2) перевірка дотримання вимог програми розвитку дітей дошкільного віку "Українське дошкілля" щодо морального та патріотичного виховання. 3) виявлення співпраці ЗДО з родинами вихованців щодо формування морального виховання та патріотичної свідомості в умовах сім’ї. Для вирішення завдань були застосовані методи дослідження: анкетування вихователів дошкільного закладу, бесіда з дітьми "Моє ставлення до хороших і поганих вчинків", бесіда з вихователями стосовно визначення рівня включеності батьків у співпрацю, інтерв’ю з вихователями і батьками, спостереження за виконанням змісту, форм, методів роботи вихователя щодо формування моральних та патріотичних якостей дітей старшого дошкільного віку. Аналізуючи дані, отримані у процесі анкетування вихователів ЗДО, які працюють у старших групах, нами було встановлено, що 55 % вихователів знають про важливість морального виховання як основи формування патріотичних пучуттів, 40 % вихователів мають практичні вміння щодо формування моральної поведінки у дітей старшого дошкільного віку, 5 % застосовують активні методики щодо формування морально- патріотичних почуттів.



Це дає нам можливість зробити висновок, що професійна компетентність вихователів з питань морально-патріотичного виховання дошкільників знаходиться на середньому рівні, це говорить про те що вихователі не надають важливості цьому аспекту формування особистості дитини передшкільного віку. Спостерігаючи за дотриманням вимог чинних програм розвитку дітей та використанням вихователем змісту, форм, методів щодо формування моральних якостей у дітей старшого дошкільного віку, ми зазначаємо, що методи та методики у формуванні морального та патріотичного виховання використовується недостатнього. Проаналізувавши плани роботи вихователів, ми дійшли висновку, що врахування вимог чинних програм наявні у їх роботі, але вони не застосовуються повною мірою, є не систематичними і актуальними для формування моральних якостей у дітей, а у подальшому й у формуванні патріотизму. Метод спостереження та експеременту дозволив нам детально вивчити вибір педагогічно- доцільної поведінки вихователя у відповідь на негативні моральні прояви поведінки дітей: вихователі переважно не реагують на будь-які вияви поведінки, іноді наполягали на своєму, не зважали на слова, бажання, прохання дитини; принижують дитину при інших, караючи її; байдуже забирають дитину у батьків. Метод аналізу та синтезу дав нам змогу зрозуміти як вихователями дошкільного закладу щодо дотриманням вимог чинних програм, щодо формування моральних якостей у дітей старшого дошкільного віку як основи фундаменту формування патріотичних почуттів, ми визначили ієрархію якостей, які обрали вихователі, і які на їх думку, мають бути виражені у поведінці дитини старшого дошкільного віку. Більшість вихователів – 53 % наголосили на тому, що, перш за все, у дітей потрібно формувати чесність, 17 % вихователів зазначили риси, які не стосуються морального виховання, 20 % вихователів відзначили таку моральну рису як справедливість, і всього 10 % вихователів відзначили порядність як необхідну моральну рису для старших дошкільників.



Таким чином, вихователі ЗДО намагаються у своїй роботі дотримуватися всіх вимог чинних програм розвитку дітей щодо використання змісту, форм і методів у формуванні моральних якостей як основного щабля у формуванні патріотизму у дітей старшого дошкільного віку. Разом з тим ми відмічаємо, вихователі не вказали перелік методів роботи, які необхідно використовувати у роботі саме зі старшими дошкільниками, а також лише частково схарактеризували моральний портрет старшого дошкільника (називаючи такі моральні риси як чесність, справедливість, порядність), а деякі з них вказували особистісні риси (впевненість, самостійність, цілеспрямованість тощо). Отже, результати проведеного нами дослідження дотримання педагогічних умов засвоєння дошкільниками моральної поведінки, як основи формування моральної поведінки засвідчили, що практика ЗДО нині не повною мірою відповідає зазначеним педагогічн.им умовам організації та проведення виховної роботи з дітьми, просвітницької роботи збатьками та професійної компетентності у контексті формування моральних рис у дітей. Також в організації процесу морального виховання в ЗДО спостерігаються організаційно-методичні труднощі пов'язані з добором, адаптацією, розробкою та доцільним використанням різних форм морально- просвітницької роботи з батьками вихованців. Також одним із факторів низького рівня морального виховання дошкільників є недостатнє застосування методів та засобів у щоденній роботі вихователя ЗДО, які фіксуються в державних програмах, якими мають користуватись сучасні дошкільні заклади. Разом з тим дана проблема потребує подальшого вивчення задля вдосконалення державних програм дошкільного виховання, що у свою чергу підвищить рівень морального виховання дошкільників а у подальшому сформує причетність до патріотизму. Нами з метою просвіти вихователів та батьків з приводу формування моральності як основної центральної ланки у формуванні патріотичності було сформованно методичні рекомендації, пропонуємо їх розглянути.

Для вихователів:

- Співробітники мають проявляти повагу до особистості кожної дитини, доброзичливо ставитись до неї.
- Поводитись з дітьми ласкаво, з посмішкою здійснюючи тактильний контакт: гладячи по голові, обіймаючи, тощо.

- Поводитись тепло з дітьми під час різних режимних моментів, зокрема вранці при зустрічі з дитиною, під час їжі, підготовки до сну, переодяганні.

- Прагнути встановити з дітьми довірчі відносини, проявляти увагу до їх настрою, бажань, досягнень і невдач.

- Заохочувати самостійність дітей у виконанні режимних процедур, враховувати їх індивідуальні особливості: відношення до тієї чи іншої їжі, звички, темперамент і ін.

- Реагувати на ініціативу дітей в спілкуванні, враховувати їх потребу в підтримці дорослих.

- Вислуховувати дітей з увагою і пошаною, відповідати на питання і прохання дітей ввічливо, обговорювати їх проблеми доброзичливо.

- Заспокоювати і підбадьорювати засмучених дітей, прагнути позбавити дитину від негативних переживань.

<u>Для батьків:</u>

- Відноситись до скарг дітей з розумінням, навчаючи їх соціально прийнятним формам взаємодії. - Не обмежувати природний галас дітей: жваву діяльність, гру, сміх, вільну розмову та ін. - Пропонувати дітям зразки діяльності, не наполягаючи на їх точному відтворенні. - Спілкуватись з дітьми, вибираючи позицію «очі на одному рівні». - Відгукуватись на будь-яке прохання дитини про спільну діяльність, а у разі неможливості її здійснення спокійно пояснити причину. - Підтримувати позитивне самовідчуття дітей, сприяючи формуванню у них знань про свої можливості і здібності. - Заохочувати дітей висловлювати свої думки і відчуття, розповідати про події, учасниками яких вони були, про друзів, мрії, переживання тощо.

- Ділиться своїми переживаннями, розповідають дитині про себе. - Виражати осуд тільки до окремих дій дитини, а не до її особистості.

Висновки.

На основі вивченої і проаналізованої нами психолого-педагогічної літератури, ми можемо зробити висновок, що моральне виховання – це в першу чергу цілеспрямована взаємодія дорослої людини й дитини з метою формування моральних почуттів і якостей, засвоєння моральних норм і правил, розвитку моральних мотивів і навичок поведінки. У подальшому з морально зрілої та сформованої особистості виростає патріотично свідома людина. Сформовані в дошкільному віці основи моральної спрямованості та патріотичні основи особистості дитини значною мірою визначають її подальше життя, а виправити допущені батьками, вихователями помилки у вихованні дітей важко або неможливо. Моральне виховання з перших років життя дитини спрямоване на формування її моральної позиції, ціннісних орієнтирів, інтересів і потреб, оскільки, на цьому етапі закладаються основи морального розвитку особистості, розвиваються уявлення, почуття, звички, які спрямовують подальше її вдосконалення. Також, ми виявили, що важлива правильно побудованаі організована комплексна методика роботи з метою формування морально-патріотичних почуттів, яка будуватиметься на досвіді вихователя з роками, щоб було доступно як для дітей так і для вихователя, саме тоді буде дійсно гідний результат праці вихователя. Наші припущення підтверджують, що процес формування моральних уявлень повинен носити комплексний характер, бути присутнім у всіх видах діяльності дошкільнят, здійснюватися у спеціально організованих заняттях. Враховуючи опрацьовані джерела, було сформовано методичні рекомендації в роботі за основу якої взята тривимірна модель: «вихователь-батьки-діти». Ми всі прагнемо, щоб наші діти виросли чесними, добрими, щасливими. І як би хотілося, щоб виховане в дитинстві чуття до добраі зла назавжди залишилося в людині. Щоб була сформована причетність до родових відносин та любов до рідної землі і Батьківщини [2; с.277]. Отже, можемо зробити висновок, що при правильній методичній роботі у дітей з'являється бажання наслідувати добрі вчинки, робити добро людям, радувати дорослих і товаришів. творів; якщо робота ведеться планомірно, систематично, якщо правильно підбираються методи и системи тоді активно відбувається розвиток моральних якостей та формується патріотизм.

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Translation of the title, author’s name and references list to author’s language

ФОРМУВАННЯ МОРАЛЬНО-ПАТРІОТИЧНИХ ПОЧУТТІВ У ДІТЕЙ ПЕРДШКІЛЬНОГО ВІКУ

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Анотація

Актуальною проблемою освіти є моральне та патріотичне виховання дитини було спрямоване на формування: ціннісних орієнтирів, інтересів і потреб, та моральної позиції. Адже вже в ранньому віці закладаються основи морального розвитку особистості й також розвиваються уявлення, почуття та звички, які спрямовують подальше її вдосконалення в майбутньому житті.

В нашій країні, структура освіти орієнтується в першу чергу на особистість дитини та на важливості створення правильних умов її розвитку. На сьогоднішній день найважливішим завданням педагогіки сьогодення є формування високоморальної особистості шляхом виховання моральних почуттів. Багатогранність і значущість виховання та прищеплення цих почуттів у становленні особистості дитини, зумовило пильну увагу до дослідження яке є актуальним у наш сучасний час.

У сучасному суспільстві існує невідповідність між побудовою освітнього процесу в рамках реалізації вимог освітньої програми закладу дошкільної освіти з морального та патріотичного виховання і недостатньою методичною розробленістю проблеми формування моральних основ та патріотичних уявлень у особистості дитини дошкільного віку. Тому з'являються прогалини у розвитку дитини, які на наступних етапах навчання і виховання дуже складно компенсувати.

Відповідно, у статті проаналізовано підходи до розуміння понять «Мораль» та «Патріотизм» як одного цілого компонета так и кожного поняття окремо у науковій та психолого-педагогічній літературі. Зазначено та науково обгрунтовано зміст досліджуваного нами поняття з метою та змістом, виокремлено характерні особливості формування морально-патріотичних почуттів, окреслено їх зміст як ключової ланки у галузі навчання і виховання. Розглянута нормативно-правова база. Зазначені особливості досліджуваного нами віку та його характерні нюанси та характерстики. Розглянуто поняття «морально-патріотичних почуттів» через призму тривимірної моделі «Вихователь-Батьки-Діти» як складника досліджуваної категорії. Витлумачено основні проблеми та прогалини у роботі вихователя на основі проведеного дослідження, яке було обгрунтоване та зафіксоване у нашій статті. Надані доречні методичні рекомендації для батьків та вихователів.

Підтверджені та зафіксовані наші припущення, що процес формування моральних уявлень повинен носити комплексний характер, бути присутнім у всіх видах діяльності дошкільнят, здійснюватися у спеціально організованих заняттях.

Окреслено перспективи подальшого дослідження проблематики яка була зафіксована в нашому дослідженні і зумовила напряму написання статті.

Ключові слова: морально-патріотичні почуття, моральність, патріотизм, передшкільний вік, тривимірна модель виховання.

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Contemporary Sculptors of Kharkiv

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Abstract

Based on the analysis of scientific literature and based on their own experience, the authors of the article pay attention to specific features of Kharkiv sculpture as an important cultural center. In the article the authors aimed to familiarize readers with modern sculptors with their works both in classical and more avant-garde manner, with the influence of sculpture on the formation of the specifics of the urban environment, to create a beautiful attractive and unique image of the city.

The work is addressed to scholars, employees of the system of higher artistic and pedagogical education, and students.

Keywords: volume, art, sculpture, architecture, style, image, monument.

Kharkiv is the largest industrial center of Ukraine. Of course, the city is far from the size of New York or Tokyo, but the words "the largest city" also apply to it. It is only necessary to specify that Kharkiv is the largest city at the 50th parallel of northern latitude. In the city garden named after Shevchenko. Shevchenko Garden there is a Monument to the 50th parallel - an original sign symbolizing this statement.

The city is more than 300 years old, and during this time its appearance has changed significantly. Many famous sculptors have made efforts to this end. Sculpture changes our perception of the environment. It appeals to the subconscious, the senses and memory, surprising viewers with a rich form or an austere idea. Inspiring or shocking. According to reports, one of the earliest architects who created in Kharkov is Peter Antonovich Yaroslavsky, born in 1750. He was born in the Sumy region, but was educated at the Kharkov Collegium. This city later became the most native for him.

The first sculptural works in Kharkov were created not earlier than the end of XIX - beginning of XX century. This is due to the fact that only in the XIX century Kharkov turned from a peripheral town into an important regional center. The earliest surviving sculptures can be considered the monument to N.V. Gogol (1904) by sculptor B.V. Eduards and the majestic monument to the figure of national Enlightenment V. Karazin (1907, sculptor I. Andreoletti), with whose name the opening of the Kharkov Imperial University is connected.

Since ancient times, monuments and sculptures have been indicators of the power and wealth of kingdoms and empires. It is hard to imagine a city that has no monuments and sculptures at all, and no authentic works of architecture. Streets and squares would be deserted, there would be nothing to stop your eyes at when walking, it is impossible to admire the beauty, and tourists have nothing to look at.

Modern sculptors and architects are working on improving the appearance of Kharkov. We will tell about some of them in this article.

Igor Pavlovich Yastrebov is a sculptor who is known not only in Kharkov. His works can be seen in other cities and countries. Yastrebov's monuments have long become a business card of Kharkiv: it is a monument to the Warrior-liberator on August 23rd Street - a holy place for Kharkiv citizens, a monument to Skovoroda near the Pedagogical University, a monument in honor of the 2000th anniversary of the Nativity of Christ on the territory of the Pokrovsky Monastery and others.

The monument to the Warrior-Liberator, which the citizens call simply "Soldier" and has become one of the symbols of the city, turned 52 years old. It is dedicated to the events of 1943, but we can also say that it is a monument to all the soldiers who fought for the freedom of the Motherland in different periods of history.

In 1943, the following events unfolded on this spot. A few days before the liberation of the city, German troops began to erect defensive fortifications. They stood not far from the place where the monument is located today. The soldiers of the Kharkov Rifle Division were able to break through the defense and liberate the city. It happened on August 23, 1943. At the place where the battles were fought, fifteen years later, the street August 23 appeared. In the 80s it was decided to install a monument to the liberators.

Kharkov monument performed by Igor Yastrebov is unique in style. Like a giant wing fluttering in the wind the cloak-tent behind his back! The soldier, for all his monumental statics, is not "frozen" at all, because his hand with a machine gun (as with a cross!) is pointing upwards, his broad step is a step into the future. There is no sorrow in it, but triumph.

Yastrebov created many sculptural works - these are memorials, monuments to historical figures, monuments, plaques, easel portraits and compositions. Igor Pavlovich's works are original, they have philosophical undertones, the highest professionalism, but most importantly - a piece of the master's soul.

His works are kept in Kharkiv Art Museum, National Shevchenko Museum in Kanev, Odessa Art Gallery.

Monument to the Liberator Warrior (sculptor I. P. Yastrebov)

Continues the work of his father his son, Sergei Yastrebov, whose works also belong to the symbols of our city. One of them is a decorative composition called "Music by N.V. Lysenko", which is installed at the entrance to the KHATOB. The sculpture is made in the classical style, it harmoniously combines sculptural art and music. The composition consists of 4 sculptures of people, each of which reflects the dynamics of music. These are the artists spinning in a lively action - a young Ukrainian woman with a wreath on her head playing a tambourine, a violinist accompanying her, a young shepherd boy with a tinkling horn and a Cossack in trousers dancing gopak. The monument depicts flowers symbolizing the brightness of the Ukrainian steppes, among which the waves of the Lopan River can be seen.

Sculptural composition "Lysenko's Music" (sculptor S.I. Yastrebov)

Another famous sculptural work in Kharkov is the monument to the popular singer, composer, actor Vladimir Vysotsky. It is installed near the Palace of Sports on Petr Grigorenko Avenue. Together they formed a whole complex, which was named "Vertical". The name was given in honor of the movie, in which Vysotsky played the main role.

A year before the monument was erected, a competition was announced. As a result, the victory went to the project, which was worked on by Kharkiv sculptor Alexander Demchenko and architect Viktor Livshits. The legendary artist is depicted with a guitar in his hand. The figure stands on a pedestal, which is made in the form of a crumpled sheet of paper. On the pedestal are carved excerpts of verses written by Vysotsky. The total height of the monument is 5.2 meters. The monument weighs about 2.5 tons.

Monument to Vladimir Vysotsky (sculptor Alexander Demchenko)

To the joy of many Kharkiv citizens, in recent years the image of Kharkiv has begun to change - new monuments, memorial plaques are installed, historical buildings are reconstructed or rebuilt. Many of these architectural constructions are creations of the famous Kharkiv sculptor Alexander Ridny.

Alexander Ridny is an artist of avant-garde traditions. He is a sculptor in himself. On the one hand, he is known as the creator of many official monuments in the city, and on the other hand, he is a creative person, whose work strikes with unexpectedness, freshness of view, experiment. It is hard to imagine that one person combines academicism and endless search for himself.

After the reconstruction of Constitution Square, its main decoration became a 17-meter bronze sculpture of a winged woman resembling the ancient Greek goddess of victory Nika. According to the chief architect of the city Sergiy Chechelnitsky, "Nika on a balloon" was born as a result of winning the contest of projects, in which professionals from different cities of Ukraine, Russia and even the USA took part. The monument is based on the sculpture of the goddess Nika, who stands on a balloon and holds a wreath. The authors of the sculpture are Oleksandr Ridnyi and Anna Ivanova.

Monument of Independence of Ukraine is the second highest monument in Kharkiv after the Soldier on August 23rd Street. The height of the figure is about 6 meters, the ball - about 2.5 meters, the pedestal - 8 meters. The total height of the monument is 16.5 m.

Monument of Independence of Ukraine (sculptor Alexander Ridnyi)

The theme of love has occupied writers, artists and sculptors since ancient times. In Kharkov this theme is revealed by the Monument to Lovers, installed in the park near the subway station "Beketova Architektora".

The original sculpture depicts a young boy and girl standing at a distance, but reaching for each other. The lovers stand on fragments of a sphere resembling a planet. They are far away from each other, but still their souls touch in a tender kiss. The jets of the fountain are beating around the lovers. This place has become a favorite of the citizens, and romantic dates and photo shoots are often arranged here.

Monument to Lovers (sculptor Dmytro Ivanchenko)

The Ukrainian cultural space today combines different generations and different ideologies; both professionally educated artists and talented amateurs coexist in it. All of them work in a variety of genres, techniques and choose their own ways of self-expression.

The works of Shaulis, Lizogub, Sarazhin are united by the theme of corporeality, in which each author in his own way builds the relationship between parts and the whole, using the human body as the most complete and at the same time fragmentary whole.

Sergey Shaulis was born in 1985 in Kharkiv. In 2016 he graduated from the Kharkiv State Academy of Design and Arts, Faculty of Fine Arts, specializing in Monumental Sculpture, where he also completed postgraduate studies. His works are in private collections in Ukraine, Finland, Holland, England, Germany, Israel, Belgium, USA, Australia.

Sergey tells: "This series, "Man without a core", was born back in 2006. It is about difficult moments in life when we change our choices. When you don't know what to do, where to go. These works were born in such a search. They are not negative. I created them when I myself changed my profession and started sculpting. There are eight works in this series. Only four of them have been presented to the public so far. I mostly work with series. When an idea comes up, I see not just one work, but five or seven objects at a time, so I have an exhibition concept".

The emotional state of a person, all its shades and halftones, which are between white and black, are the main subject of the artists' research. With the help of new approaches to the art of sculpture and modern use of ancient pottery techniques, the authors create not just original images, but try to convey a special turning point, which they call "The Starting Point".

Alexander Miroshnichenko and Sergei Shaulis in their own manner explore the correlation between the pressure of the outside world and internal tension. The new images of Shaulis' sculptures "without a rod" and the complex symbolism of Miroshnichenko's ceramic works suggest that it is the combination of absolute euphoria and an extremely colorful palette of diverse feelings that results in the tangle of emotions, thoughts and actions that is commonly referred to as Man.

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Ballroom Dance in the Soviet Ukraine from the End of 1950s to 1980s

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Abstract

The article is dedicated to the processes of formation and development of ballroom dance in Soviet Ukraine from the end of 1950s to the 1980s. It was demonstrated that ballroom dance in this period went through several stages of implementation of ballroom dances in the child and adult repertoire, formation of ballroom dance troops (clubs, studios, ensembles, etc.), construction of system of ballroom dancing “khudozhnia samodiialnist”, implementation of sport forms of competition, but with the mandatory “soviet program”. It was stressed that “soviet program” of ballroom dances is formed of dances which are made on bases of national dances, but with the principle of ballroom dance. For the creation of soviet ballroom dance as independent phenomenon which was opposing to the western ballroom choreography mechanism of national regulation and ideological pressure was applied. However, the fact of ballroom-sport dancing spreading in the USSR testifies to the processes of democratization and liberalization in art, extension of diapason of prohibited forms of art activity in the sphere of choreography.

Keywords: ballroom dance, choreography, Soviet Ukraine, dance.

Актуальність дослідження. Сучасні тенденції розвитку бального танцю в Україні неможливо розглядати поза процесами ґенези та розвитку бально-танцювальної художньої самодіяльності радянського періоду. Виявлення позитивного досвіду та негативних аспектів функціонування системи аматорського бального танцювання в Радянській Україні сприятиме об’єктивному осмисленню нинішніх мистецьких процесів у сфері хореографії. Сьогодні, в ситуації постійно зростаючої популярності бального танцю та наявного дисонансу між практичними досягненнями у цій сфері та її теоретичним осмисленням, представлена наукова розвідка є актуальною.

Аналіз публікацій. В останні роки пожвавився науковий дискурс бальної хореографії, зокрема окремим аспектам аматорського танцювання в зазначений період присвячено ряд праць: Т. Благова аналізує функціонування бального танцю в системі хореографічної освіти [3], І. Климчук торкається проблеми формування національної ідентичності в Радянській Україні 1960–1980-х рр. засобами бального танцю [4], Т. Павлюк висвітлює проблеми бального танцю УРСР як складника хореографічної культури СРСР [5], Н. Терешенко досліджує естетико-виховний потенціал бальної хореографії в Радянській Україні [6] та ін. Однак комплексного дослідження, присвяченого бальному танцю в художній самодіяльності УРСР наприкінці 1950-х – у 1980-х рр. проведено не було.

Мета – виявити особливості функціонування бально-танцювальної художньої самодіяльності в Радянській Україні наприкінці 1950-х – у 1980-х рр.

Виклад основного матеріалу. Інституціоналізація бального танцю в системі художньої самодіяльності в Радянській Україні розпочалася наприкінці 1950-х років та була пов'язана з процесами послаблення тоталітарної системи СРСР, певною лібералізацією та демократизацією у другій половині 1950-х – на початку 1960-х. У цей період так званої «відлиги» пожвавилися, порівняно з е етапом сталінського правління, міжнародні зв'язки, було послаблено мистецьку цензуру. Після проведення у столиці СРСР міжнародного конкурсу з бальних танців, де свою майстерність продемонстрували бальні пари не лише з країн соціалістичного табору, а й капіталістичних, розпочалося поступове проникнення бальної хореографії у систему художньої самодіяльності, у тому числі і в УРСР.

У другій половині 1950-х років в Радянській Україні існувала розгалужена мережа художньої самодіяльності, де вагоме місце посідали танцювальні осередки. Але це були гуртки, студії, ансамблі та ін. переважно народного танцю, рідше – класичного, що пов'язано з національно-культурною політикою, обраною СРСР у 1930-х рр. Однак після 1957 року спостерігалися певні кроки на шляху жанрового урізноманітнення танцювальної художньої самодіяльності та відкриття осередків бального танцю. Так, в Україні спочатку рекомендували ввести до репертуару хореографічних колективів, що братимуть участь в олімпіаді художньої самодіяльності, бальні танці в сценічній обробці, про що 1958 року Республіканський комітет художнього виховання дітей Міністерства освіти УРСР видав «Вказівки про проведення олімпіад художньої самодіяльності учнів шкіл УРСР у 1958 р.» [6, с. 94].

На хвилі зростаючою популярності бального танцювання у молоді, за свідченням Н. Терешенко, «Республіканський комітет художнього виховання дітей Міністерства освіти УРСР у 1963 році розглянув питання про організацію в школах занять із бального танцю» [6, с. 94]. Тобто, бальний танець офіційно визнавався «радянським», а не «буржуазним», як це тривало упродовж попередніх трьох десятиліть, також дозволялося створення гуртків бального танцю. Але заняття бальними танцями мало стати дієвим засобом виховання радянської людини, фактично формування радянської ідентичності у дітей. Задля цього необхідно було пришвидшити введення до репертуару нових радянських бальних танців.

Популяризації бальних танців як важливого засобу виховання школярів та учнів позашкільних закладів сприяли конкурси «На краще виконання бального танцю», один з перших з яких регулювався положенням Республіканського учбово-методичного кабінету художнього виховання дітей Міністерства освіти УРСР, виданим 22 грудня 1966 року. Такі конкурси були проведені в усіх областях Радянської України та засвідчили зацікавленість бальними танцями в середовищі учасників художньої самодіяльності.

За свідченням І. Антипової, завідувача хореографічним відділом Центрального Будинку народної творчості Києві, «у липні 1968 р. відбувся перший республіканський конкурс виконавців бальних танців учнів середніх шкіл України. На конкурсі виконувались бальні танці, створені на основі народних… Багато колективів та окремих виконавців виявили неабиякі артистичні здібності, зокрема учасники дитячих колективів Київського республіканського Будинку піонерів, клубу харківського тракторного заводу, Бердянського районного Будинку піонерів Запорізької області тощо» [2, с. 94]. Серед названих нею танців – «Український бальний», «Каблучки», «Піонерська полька», «Український ліричний». Наведені свідчення демонструють, що рекомендації щодо формування радянського бального танцю виконувалися, колективи демонстрували результати синтезування елементів народного та бального танців, що позиціонувалося як культурне досягнення. Можна зауважити невідповідність природи бального танцювання народній естетиці, адже воно упродовж століть позиціонувалося як аристократичне, палацове, салонне урочисте танцювання, але це не бралося до уваги можновладцями.

І. Климчук наполягає на хибності такого шляху: «Фактично, стилізовані під народні бальні танці ставали зброєю ідеологічної боротьби за вкорінення цієї тенденції у вітчизняній культурі бального танцювання. І якщо в народно-сценічній хореографії та балетному театрі явища синтезування класичного танцю з народним мали позитивні наслідки, то в бальній хореографії викликали різкий супротив» [4, с. 268].

Створення бальних танців на основі народних стало специфічним проявом ідеологічного впливу радянської влади на процеси поширення бальної хореографії, адже у 1960-х рр. неможливо було ізолюватися від активних процесів розвитку бальних танців в Європі. Державні органи проводили планомірну роботу по стимулюванню створення радянських бальних танців у 1970-х – 1980-х роках (наприклад, введення обов'язкової «радянської» програми на всіх змаганнях бальних танців, що з початку 1970-х років регулярно проводилися в УРСР).

Загалом, бальні танці за радянських часів диференціювали за п'ятьма групами: історико-побутові, радянські бальні танці (у змаганнях – «танці радянської програми»), міжнародні класичні бальні танці («стандарт»), латиноамериканські танці («латина»), сучасні модні парні танці. Т. Павлюк зауважує, що «ця класифікація ілюструвала формальний за своєю сутністю характер розвитку радянської бальної хореографії, в якій панувала плутанина у визначенні основних жанрів, стильових особливостей та своєрідності художньої образності, притаманних даному виду хореографічного мистецтва» [5, с. 63].

Задля розвитку бального танцю у середовищі художньої самодіяльності Міністерство культури УРСР наприкінці 1980 року видало наказ «Про план заходів щодо подальшого розвитку бальної хореографії та масової танцювальної культури», де були передбачені кроки, що мали сприяти підвищенню не лише танцювальної культури колективів та окремих виконавців, а й ідейно-художнього рівня репертуару. Прикладом реалізації цього наказу можна назвати популяризацію бальної хореографії на обласному телебаченні Дніпропетровщини, де систематично транслювалися програми «Сонячне коло» та «У танцювальному залі».

Попри констатування активних процесів поширення бальної хореографії в середовищі художньої самодіяльності, кількість колективів бального танцю не могла зрівнятися з кількістю колективів народного, а з початку 1980-х років вже спостерігалися процеси зменшення колективів бального танцю. За статистичними данними, станом на кінець 1983 року в УРСР функціонувало 17399 самодіяльних танцювальних осередки (шкіл, студій, ансамблів та ін.), серед яких лише 759 колективів бального танцю. В аналітичні довідці про розвиток хореографічного жанру у державних клубних установах Української СРСР за 1983 рік зазначено, що мистецтво бального танцю в республіці є популярним серед молоді, але констатувалося зменшення кількості колективів на 179 порівняно з попереднім роком [1, с. 6]. Заради справедливості варто зауважити, що зменшення відбулося і в колективах інших різновидів хореографії. Ці процеси пов'язані із загальною ситуацією стагнації у радянській культурі, зменшенням державних асигнувань на підтримку художньої самодіяльності.

Тенденції зменшення кількості колективів танцювальної художньої самодіяльності не припинялися практично до розпаду СРСР та утворення незалежної держави Україна, де створено нову клубну структуру колективів спортивного бального танцю. Процесам трансформації системи функціонування колективів бального танцю початку 1990-х років необхідно присвятити окреме дослідження.

Висновки. Бальний танець в Радянській Україні упродовж кінця 1950-х – 1980-х рр. пройшов декілька етапів від впровадження бальних танців у дитячий та дорослий репертуар, становлення колективів власне бального танцю (гуртки, студії, ансамблі та ін.) до формування системи бально-танцювальної художньої самодіяльності та запровадження спортивних форм змагань, але з обов'язковою «радянською програмою», що складалась з танців, поставлених на основі народних, але за принципом бальних. Задля створення радянського бального танцю як самостійного феномену, опозиційного західній бальній хореографії, було застосовано механізми державного регулювання та ідеологічного тиску. Однак вже сам факт поширення бально-спортивного танцювання в УРСР свідчить про процеси демократизації та лібералізації у мистецтві, розширення діапазону дозволених форм художньої діяльності у сфері хореографії.

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