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The Roots Of Theoretical Physics In Bulgaria

Abstract

The roots of theoretical physics in Bulgaria have examined. We show some physical scientific ideas created in the University of Sofia in the first half of 20 century. Bulgarian theoretical results in meteorology (Stayco Staycow), analytical mechanics (Ivan Tzenoff), ballistics (Kyrill Popoff), astronomy (Nicola Boneff), physical chemistry (Ivan N. Stranski) and classical dynamics (Georgi I. Maneff) are presented. Evaluations of the theory of Maneff have cited, and the historical evidences about theoretical education and specialisation abroad have collected in this article.

22.1 Introduction

Theoretical physics has a short and remarkable history in Bulgaria. Dissemination of theoretical physics started in our literature and University during the 19 century. Ph.D. thesis "De Psychrometria" was the first book in the field of mathematical physics came in Bulgarian private libraries [1]. Demetrius Mutieff (04.09.1818 – 13.01.1864) evaluated different methods for measuring air humidity [2] under Paul Erman's leadership [3], and became doctor on the University of Berlin (1842) [4]. Dr. Mutieff edited (1857 – 1858) the first science journal "Bulgarian Books", published by the "Municipality of Bulgarian Literature" in Tsarigrad – predecessor of Bulgarian Academy of Sciences [5].

Faculty of Physics and Mathematics [6] is the place, where theoretical physics increased from 1889. Higher School in Sofia (1888) later University (1904) had eight semesters training, two university exam, five expe-

rimental physical departments (Experimental Physics – 1889, Astronomy – 1892, Atomic Physics – 1919 Meteorology – 1920, and Technical physics – 1939), and five mathematical departments (High analysis, Differential and integral calculus, High algebra, Analytical geometry, and Analytical mechanics) on the end of the period (1950).

Analytical mechanics is the first theoretical course in physics (1891). Mikhail Momchilow, Dr. Spiridon Ganew, and Ivan Tzenoff were heads of the department of analytical mechanics. M. Momchilow introduced the first course in Analytical Mechanics and read lectures in two university terms (1891 – 1892). After that Dr. Spiridon Ganew (12.04.1869 – 01.11.1961) was lecturer (1893), and associate professor (01.09.1897). He started courses: Mathematical theory of heat (1897/8), Mechanics of the systems (1901/2), Thermodynamics (1904/5), Dynamical equations, theory of gravitation (1906/7) and Theory of Newton potential (1908/9). He had no scientific interests and left the University (01.03.1911). Head of the department and the first Professor of analytical mechanics became Ivan Tzenoff (1914 – 1958) [7].

Theoretical physics was of great importance to university education on physics in Bulgaria. Common specialty "Mathematics and physics" was established in the beginning. During the next 30 years, physicists and mathematicians had one syllabus. Department of "mathematical physics and analytical mechanics" have been written in the law of the University in 1904 for the first time. Independent department of mathematical physics has been written down in the law five years later (1909). Separation between physics and mathematics is started with lectures on mathematical physics and syllabus for physicists (1921), and finished with scientific council on physics for Ph.D. educations (1932 – 1933) [8].

Georgi Maneff created the department of theoretical physics [9-10]. He was assistant (01.09.1919), associate (21.04.1921), extraordinary (27.04.1925), and full Professor (13.07.1935). As soon as the name of the department has been changed from "mathematical physics" to "theoretical physics" (1924) dramatic elections for the head of the department were conducted three times (1929, 1932, 1935) [11]. Georgi Maneff introduced many courses: "Theoretical physics (mechanics, thermodynamics, optics, electricity and magnetism)" (02.02.1922 – 1943/4), "Vector cal-

culus" (1923/4 – 1934/5; 1938/9 – 1943/4), "Vector and tensor calculus" (1935/6 – 1937/8), "Theory of relativity" (1922 – 1923), "Kinetic theory" (1929 – 1930), "Quantum theory" (1931/2 – 1941/2), "Statistical mechanics" (1935 – 1936), "Electron theory" (1936/7 – 1942/3), "Heat radiation and atomistics" (1939 – 1940), and "Theory of heat, kinetics theory of gases" (1939/40 – 1941/2). He initiated seminar on the theoretical physics (1927 – 1928). Raschco Zaycoff, Emil Djakow, Dr. Nikolay Karabacheff and Dr. Assen Datzeff were his assistants. Georgi Maneff had been dean of the Faculty (1926 – 1927 and 1930 – 1931), rector of the University (1936 – 1937) and minister of the education (January 24, 1938 – November 14, 1938). Victimized after the World War II (28.11.1944) he did not return in the University up to the end of his life [12].

Scientific results of Georgi Maneff have been forgotten in Bulgaria during the second half of 20 centiry [13]. We find the principle of Maneff in the textbook on celestial mechanics, written by Hagihara (v. 2, part I, 1975) [14]. The model of Maneff has been used in the 90 years of the twentieth century [15] to calculate orbits of satellites [16]. Conference, dedicated to field of Maneff, was organized in Bulgaria after that [17].

Some theoretical publications, archive funds of the University and the syllabus are the sources for present investigation. The goal of this work is to show some theoretical results in the field of physics, obtained in Bulgaria during the first half of 20 century, and especially the Maneff's ideas for gravitation force.

22.2 Theoretical Specialization

Bulgarian physicists and mathematicians from the Sofia University made research in physics theoretically after specialization abroad. They studied postgraduate (6), Ph.D. (13) and postdoctoral (4) programs in the field of theoretical physics (5), astronomy (5), analytical mechanics (5), physical chemistry (3) and meteorology (2) in Bulgaria and abroad. The ciphers in the brackets show number of Bulgarian students (Table 1). Yordan Kovachev, Nicola Stoyanow, Ivan Tzenoff, Georgi Maneff, Raschco Zaycoff,

and Christo Y. Christov specialized physics theoretically without scientific degree.

	All / Ph.D.	Germany All / Ph.D.	France All / Ph.D.	Sofia All / Ph.D.
Teoretical Physics	5 / 1	1 / 0	4 / 1	-
Astronomy	5 / 4	2 / 2	2 / 1	1 / 1
Analytical Mechanics	4 / 3	2 / 1	2 / 1	0 / 1
Physical Chemistry	3 / 3	2 / 2	-	1 / 1
Meteorology	2 / 2	2 / 2	-	-

Table 1: Sofia University assistant Professors with theoretical specializations

Bulgarian Government granted assistant Professors from the Sofia University to specialize abroad. In addition, three scholarships gave Rockefeller and Humboldt foundations (Dr. Ivan N. Stranski, Dr. R. Kaischew, and Raschco Zaycoff). Thirty-six Ph.D. diplomas on physics were legalized in Bulgaria up to 1950. Thirteen dissertations were theoretical research. Sofia University assistant Professors specialized physics theoretically in Germany (7), France (3), and Sofia (3).

German universities educated theoretically nine students on physics from Bulgaria. Seven of them graduated Ph.D. on physics. French universities trained theoretically eight Bulgarian physicists. Three of them graduated doctoral degree on physics.

Sofia University educated ten Ph.D. students on physics, and awarded four diplomas. Two dissertations were theoretically made (Dr. L. Krastanow, and Dr. M. Malcheva). Number and effectiveness of Ph.D. education on physics in Bulgaria were law [18]. Ph.D. students worked 11 semester physics, 7 – chemistry and geology, and 5 – mathematics (Fig. 1).

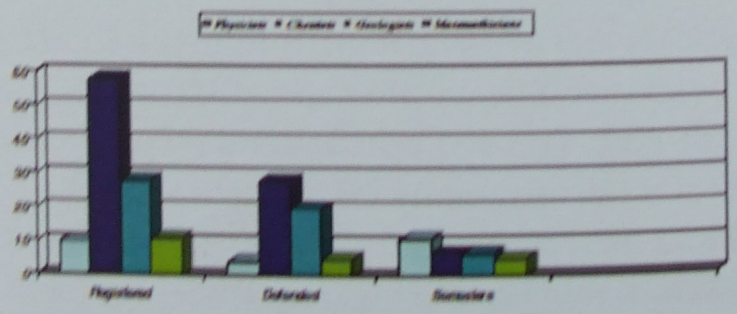


Fig. 1: Sofia University Ph.D. students (1928 – 1950)

Sofia University sent five Bulgarian physicists to specialize theoretical physics abroad. One of them graduated Ph.D. on physics (Assen Datzeff). The first Bulgarian students in theoretical physics (Nicola Stoyanow and Georgi Maneff) admitted to study at the University of Toulouse before the World War First. The next Bulgarian students (Dr. Assen Datzeff and Christo Y. Christov) chose to study theoretical physics in Paris during the 30th years of 20 century. German theoretical physics centers in Göttingen and Berlin educated one person (Raschco Zaycoff) in 20th years of 20 century.

Analytical mechanics studied four assistant Professors from the Sofia University in the Universities of Liege (Dr. Spiridon Ganew), Paris (Ivan Tzenoff), Munich (Dr. G. Bradistilov) and Göttingen (Dr. B. Dolapchieff). Three of them graduated Ph.D. Astronomy studied abroad four assistant Professors from the Sofia University in Paris (Y. Kovachev, Dr. Kyrill Popoff), Potsdam (Y. Kovachev), Leipzig (Dr. V. Hristow), Munich, Göttingen, and Berlin (Dr. Nicola Boneff). Three of them graduated Ph.D. Physical chemistry graduated on the German universities in Berlin, and Breslau (Wroclaw now) two students from Bulgaria (Dr. Ivan N. Stranski and Dr. R. Kaischew). Dr. Stayco Staycow and Dr. L. Krastanow specialized meteorology in Berlin.

Four theoretical scientists from the Sofia University (Dr. Kyrill Popoff, Dr. Ivan N. Stranski, Dr. R. Kaischew, and Dr. L. Krastanow) changed their research fields in postdoctoral specialization on physics.

22.3 Theoretical Results

Sofia University physicists and mathematicians obtained new scientific results in the fields of mathematical and theoretical physics (ballistics, geodesy, analytical mechanics, astronomy, physical chemistry, meteorology, and classical dynamics).

Two Bulgarian scientists worked theoretically in the field of physics abroad. Dr. Ivan N. Stranski had leader's positions as a scientist in Russia (1934 – 1935), Breslau (1941 – 1944), and Berlin (1944 – 1963). Raschco Zaycoff worked theory of nuclear particles in the Factories Faw in Berlin (1942 – 1944).

22.3.1 Bulgarian Results in Mathematical Physics

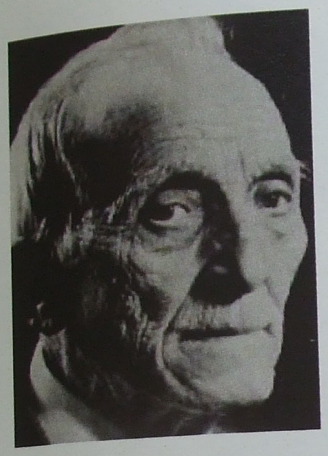
Dr. Kyrill Atanasoff Popoff (03.05.1880 – 01.05.1966) studied celestial mechanic under leadership of Hugo Zelinger (1849 – 1924) in Munich 5 months (1906). In Göttingen Kyrill Popoff studied theory and practice of passage instruments, and Poancare theory of perturbations. He worked in meridian office in Nice (1907) and wrote down Ph.D. study in Sorbonne (1907 – 1910). Under leadership of Andoae, he investigated "Movement of 108 Hekuba One particular case in the problem of three bodies" (1912). Dr. Kyrill Popoff became associate (01.10.1914), extraordinary (01.08.1920), full Professor (01.04.1922) and head of the department of differential and integral calculus at the Sofia University. Latter on, he worked in Berlin in the field of ballistics with R. von Mizes (1920), and lectured courses on external ballistics in the Universities of Paris and Berlin (1925). Dr. Kyrill Popoff used mathematical methods to solve physical problems up to the end of his life. In the aria of internal and external ballistics, he investigated gunfire during the World War First. Took attention to magnetism on the ground and resistance of the air he improved precision of shooting vastly. French Academy of Sciences awarded Dr. Kyrill Popoff for results in ballistics with premium "Montion" (1926). Dr. Kyrill Popoff investigated planetary orbits (1920) too. The last field of his investigations was non-reversible thermodynamics [19, p. 573-578].

Yordan Kovachev (26.10.1875 – 05.07.1934) studied high geodesy in Paris (1906 – 1908) and specialized in Potsdam Institute of Geodesy six months (1909). He became head of mathematical geography department at the Sofia University (1917 – 1934). Y. Kovachev investigated motion of Earth poles (1903), disturbances of atmosphere caused by Earth rotation (1906), reasons of magnetic perturbations (1906), accuracy of Russian geodetic measurements in Bulgaria 1877 – 1878 (1909), the Earth crust structure, and variations of the force of Earth attraction [20].

Dr. Vladimir Kirilow Hristow (05.12.1902 – 28.02.1979) studied astronomy in Leipzig. He investigated orbits of comets 1896 in his Ph.D. thesis

(1925). He headed astronomical division of Military Geographical Institute (1925 – 1948). Studying the theory of coordinates in Geodesy he defined the reference ellipsoid [19, p. 755-762].

22.3.2 Bulgarian Results in Analytical Mechanics



Ivan Tzenoff (02.01.1883 – 19.09.1967) specialised analytical mechanics in Paris (1911 – 1913). Returning to Bulgaria he wrote habilitation research paper "Movement of rotating solid, heavy, homogenous body in case of Lagrange" and took the department of analytical mechanics (01.10.1914). Ivan Tzenoff decided equation for solids with a moving point called holonomic systems using Lagrange equations. He solved successfully problem of non-holonomic systems (motion around moving center). The equations for non-holonomic systems are called first Tzenov's equations now. He received three new equations later, called second Tzenoff's equations. Ivan Tzenoff was elected to member of the Bulgarian Academy of Sciences (1929) [19, p. 789-792].

Dr. Georgi Bradistilov studied analytical mechanics in Munich and received his doctorate in 1938. He described the external shape of crystals by non-linear theory of vibrations [19, p. 84-87]. Dr. Blagovest Dolapchieff specialized hydro and aero dynamics in Göttingen (1935 – 1937), and Budapest (1942 – 1943). Returning to Bulgaria he defended Ph.D. thesis "Contribution to the stabilization of Kármán vortex streets" and became Doctor of Mathematics (1937) [19, p. 211-214].

22.3.3 Bulgarian Results in Astronomy

Dr. Nicola Boneff Ivanoff (11.07.1898 – 18.06.1979) studied astronomy at the Sorbonne in Paris two years (1924 – 1926). He specialized in the Institute of Geodesy in Potsdam (1926 – 1928) and received his doctorate from

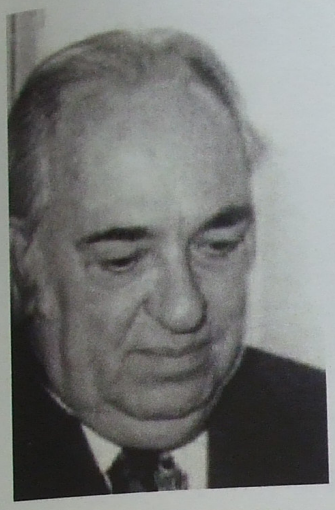
the University of Berlin (1927). The topic of his dissertation was "Potential of Neumann and retrograde satellites of Jupiter and Saturn". He became chairman of the department of astronomy at the Sofia University (1928 – 1966). Dr. Nicola Boneff examined gravitational law in relative theory and problem of Bertrand (1934), as well as one Euclid extension universe (1935) and some considerations about Heisenberg's principles of causality and undefiniteness. He modified Laplace hypothesis for Solar system creation. Using Neumann potential, he analyzed problem of eccentricity, structure and evolution the rings of Saturn. Dr. Nicola Boneff examined the number and distribution of the craters on the Moon and he determined that the big craters had volcanic origin [19, p. 66-69].

Dr. M. Malcheva wrote Ph.D. thesis under leadership of Professor Nicola Boneff (1946 – 1949). In celestial mechanics, she investigated determination of meridian direction and some related problems.

22.3.4 Bulgarian Results in Physical Chemistry

Dr. Ivan Nikoloff Stranski (21.12.1896 – 18.06.1979) studied medicine in the University of Vienna (1917 – 1918) and chemistry in Sofia (1918 – 1922). He was Ph.D. students on physics in Berlin under leadership of Pawl Gunter. Dissertation theme was Roentgen spectral analysis (1925). Dr. Ivan N. Stranski created the department of physical chemistry at the Sofia University (1925 – 1941). He became associate (1925), extraordinary (1929), and full Professor (1937). Rockefeller's foundation granted him to have postdoctoral specialization in the Institute of Physical Chemistry at the High Technical School in Berlin under leadership of Professor Maks Fol-

mer (1930). Dr. Ivan N. Stranski created molecular kinetic theory of crystal growth. He explained crystallization processes, and together with Dr. L. Krastanow examined eppitaxial growth of ionic crystals. Model, called Krastanow-Stranski, describe precipitation of univalent ionic crystals on bivalent ionic crystal pad. He defined velocity of the growth from satiation [21].



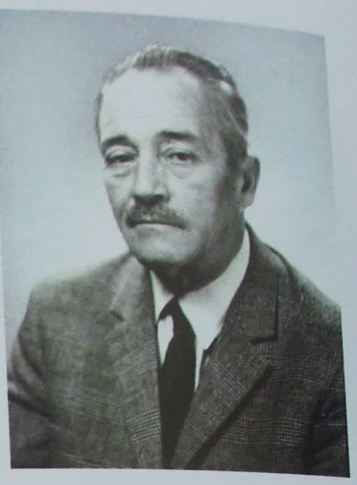
Dr. Rostislaw Kaischew (29.02.1908 – 18.11.2002) studied physics in Breslau with Rockefeller's scholarship (1930). Director of his Ph.D. study on physics was Professor Fransis Sayman. His dissertation thesis examined thermal properties of fluid and solid helium (1932). Dr. R. Kaischew had specialization on physical chemistry under leadership of Dr. Ivan N. Stranski and became head of the department of physical chemistry at the Sofia University (1941 – 1962). Dr. R. Kaischew found connection between sharp, structure and molecular forces; built Kaischew – Stranski model for layer crystal growth; and gave connection between two dimensional crystal formation and spiral growth of the crystals. Dr. R. Kaischew generalized Wolf theorem about equilibrium state of crystals, growth on alien base
(rule of Wolf-Kaischew), and developed thermodynamics and kinetics of electro-crystallization and electrolyte crystal formation [19, p. 298-302].

22.3.5 Bulgarian Results in Meteorology

Dr. Stayco Staycow (23.10.1882 – 03.11.1915) was student in Berlin (1908 – 1912) where he is prepared Ph.D. thesis "Contribution to Bulgarian climatology – temperature distribution" (1914). Rejecting the invitation to work in the Meteorological Institute of Potsdam, Dr. Stayco Staycow returned to Bulgaria and published 25 scientific articles during his short life. Climatology has been the main field of his research. He investigated vertical temperature gradient, atmospheric perturbations, and optical phenomena in high atmosphere at the time of twilight. He is wrote book

"Building material for Bulgarian seismography" about earthquakes on our lands from 282 B.C. up to 1884. The model for meteorological cell, proposed by him, is in use up to now.

Dr. Lubomir Krastanow (15.11.1908 – 08.05.1977) obtained first Ph.D. in physics at the Sofia University (1938). Professor Ivan N. Stranski was scientific head of the theme of dissertation "Growth of ionic crystals one on top of other". After that, Dr. L. Krastanow has been sent to specialise meteorology in the Geophysical Institute of Leipzig and in the Geophysical Observatory of Wilsdruff near Dresden (1940). Dr. L. Krastanow held posts: an associate professor (1946), a professor of meteorology (1951), and the President of the Bulgarian Academy of Sciences (1962 – 1968). In the field of physics of the clouds he investigated condensation centers, water phase transitions, and atmospheric turbulence. In a micro physics of the clouds, he has established quantitative law for the liquefaction and crystal growth of the ice [19, p. 352-355].

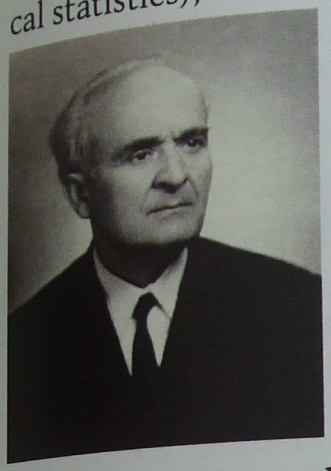


22.3.6 Bulgarian Results in Theoretical Physics

Nicola Stoyanow studied a bachelor degree in the Higher School of Sofia (1892 – 1895) and a Master's degree in the University of Toulouse (1899 – 1901). He received scholarship to study theoretical physics in Toulouse 2 years (03.01.1904 – 16.01.1906), but prefer to see astronomy [22].

Raschco Zaycoff (10.12.1901 – 25.11.1982) started to learn in the Military College in Austria (1914). Latter on, he chosed civil education on mathematics and physics, and studied courses of David Hilbert, Emy Nöter, Max Born in the University of Göttingen (1922 – 1923), and courses, lectured by Max von Laue (09.10.1879 – 24.04.1960), and Albert Einstein (14.03.1879 – 18.04.1955) at the University of Berlin (1923 – 1924). Raschco

Zaycoff became first Bulgarian scholarship student of Humboldt's foundation (1925 – 1928). He assisted to Professor Grotrian in the Astrophysical Observatory Second in Nöesbabelsberg (1927). Raschco Zaycoff investigated five dimensional general relativity, unified field theory, and quantum mechanics (1928 – 1935). He worked on applied mathematics (mathematical statistics), and on natural philosophy [23].



Dr. Assen Datzeff (14.02.1911 – 12.02.1994) studied under Loui de Broil's leadership in Sorbone, Paris (1934 – 1938), where he obtained Ph.D. in physics (1938). In Bulgaria, he solved many theoretical problems in the field of quantum theory, potential barriers, theory of solid bodies, classical heat conductivity, and problem of Stephan [19, p. 187-190].

Christo Yankov Christov became postgraduate student in the Sofia University (1938) and had 8 months specialization under Fransis Peren's leadership in Sorbonne, Paris (1938 – 1939). In Bulgaria, he wrote some articles about uniform equations of electro-dynamics and gravity, energy in contemporary physics, and laws of classical physics [19, p.773-775].

22.4 "Reaction" Theory

Georgi Ivanoff Maneff (15.01.1884 – 15.07.1965) obtained grant to study theoretical physics, and worked under leadership of Professor H. Bouasse in Toulouse one year (1913 – 1914). We will give a special attention to theory of Georgi I. Maneff. He accepted imaginary force caused rotation around movable center and applied it to describe electricity, magnetism and gravitation. His theory provided the same good theoretical approximation as general relativity.

Georgi Maneff presents his *"substantial dynamic theory about matter and energy" [24A, 20 (1924) p. 121] in the next words "Reaction theory is the name*

we allow to give. We shall accept extended reaction principle ... action and reaction for matter and energy. Mathematical problem in our theory is the same as in the theory of relativity. Two systems in motion, equivalent kinematically, are not equal dynamically and physically ... We accept spherical symmetry of the universe. Gravitation in our theory is a force and independent gravitation field. Rotation is very important, when we investigated movement of the bodies in gravitation field. We use imaginary force in our extended mechanics [24A, 20 (1924) p. 167]. *Our presentation is different from relative theory in initial principles and terms. Our method is different. Einstein's solution is particular case of our substantial solution"* [24A, 27 (1931) 1, p. 355-397].

Some reviewers evaluated positively Maneff's scientific results, notwithstanding severe remarks (1925 – 1935).

Petar Pentchew (18.01.1873 – 19.03.1956) Extraordinary Professor on Radioactivity and experimental physics wrote that *"Maneff give new and abstract principle about inertial energy. Initiation the problem is a credit"* [25, Sheet 40 Back (1925)].

Dr. Nicola Obreshkoff (06.03.1896 – 11.08.1963), Professor and head of the high algebra department comparing G. Maneff's and A. Einstein's theories wrote: *"Mr Maneff obtain, $v = c\sqrt{2} > c$ that all bodies moved uniformly with one and same velocity ... Mr Maneff ... gets that the mass depends on direction. For radial mass, he writes* $m_r = m_{rr} e^{\frac{2kM}{c^2 r}}$ *[26, Sheet 20-21 Back (1930)]. About Mercury, he approximated relation* $\overline{E}_{\min} = -\frac{1}{2}\overline{E}_{rel}$ *that is correct strictly about circular motion, but not in case of parabola or hyperbole"* [26, Sheet 23-24 (1930)]. **Dr. Nicola Boneff** wrote that Maneff *"reached two very important astronomical effects ... satisfactory interpretation of and special case of expanded universe [26, Sheet 123 (1932)]. About effect of spectral displacement, Maneff writes that can only fixed, not measured it, because experimental evidences are modifying in wide borders"* [27, Sheet 84-88 (1935)]. **Ivan Tzenoff** wrote that Maneff [24A, 20 (1924) 1, p. 167] *"gives parallel between substantial and structural point of view for gravitation* [26, Sheet 88-88 Back (1932)]. *Maneff reach important differential equation about displacement of the perihelion of planets* [26, Sheet 108 Back (1932)]. *Therefore, with equation (29) he solves simultaneously two effects: displacement of perihelion and spectral lines* [26, Sheet 87 (1932)]. *Law of the mass is correct, but in the case when the center of Sun moves and its mass is variable* [26, Sheet 84 Back (1932)]. **Dr. Kyrill Popoff** thought, that Maneff's papers contain

"some value conclusions. Maneff accepts that velocity of light $c_1 = c\epsilon\frac{kM}{c^2 r}$ *is equal to tangential component* [26, Sheet 38 (1925)]. *This same result* [24C, 56 (1929) s. 421] *is a hit on hart of relative theory. Its results will be true only if we accept velocity of light for unit. In other measuring unit for the velocity of light, we will receive different results. Take in account great futurity and importance that my note will play in history of physics, I refrain to accept this result* [26, Sheet 13 Back (1930)]. *Maneff's papers are unskillful built from the mathematical and mechanical point of view. I do not speak about pure physics works here. They have one strong physical character. Many theories in physics as law for conservation of energy, the law of Carnot, electromagnetic theory of light, and pure mathematical theory of Gruna were presented in bad mathematical frame"* [26, Sheet 14-14 Back (1930)].

22.5 Conclusions

Ballistic improvements, description of non-holonomic mechanical system, kinetic theory of molecular crystal growth and condensation law are some of Bulgarian theoretical results in physics in the first half of 20 century. Professor Georgi Maneff laid the foundations of theoretical physics in Bulgaria. Extending the third principle of Newton about action and reaction, he described dynamically motion in the universe with rotation around movable center. His articles were published in Bulgarian, French and German scientific magazine in 1924 and 1925 for the first time. Evaluation of Maneff's theory is not complete yet. Its importance in history of physics is forthcoming to be unveiled.

References:

[1] Mutieff, D. De psychrometria, Dissertatio physica, (Berolini: MDCCCX-LI).

[2] Kamisheva, G., World of Physics, 2, 152-159 (2002). (In Bulg.)

[3] Borissov, M., A. Vavrek, G. Kamisheva, Predecessors of Dissemination and Development of Physics in Bulgaria (Sofia: Prosveta Publishing House, 1985). (In Bulg.)

[4] Batchvarova, N., Journal of the State Archives, 44, 141-189 (1982). (In Bulg.)

[5] Borissov, M., A. Vavrek, G. Kamisheva, History of the Bulgarian Literary society 1869 – 1911, 115-133 (Sofia: "Prof. Marin Drinov" Publishing House, 1994). (In Bulg.)

[6] Borissov, M., A. Vavrek, G. Kamisheva, Proceedings of 1st General Conference of the Balkan Physical Union, No 1, 21-23 (1991).

[7] Kamisheva, G., A. Vavrek, Bulgarian Journal of Physics, 27, 4, 59-62 (2000).

[8] Kamisheva, G., A. Vavrek, Bulgarian Journal of Physics, 27, 4, 55-58 (2000).

[9] Sretenova, N., Prof. G. Manev's Legacy, 54-61(Sofia: Heron Press, 2005).

[10] Fiziev, P., Annuaire de l'Université de Sofia "St. Kliment Ohridski", Faculté de Physique, 97, 5-13 (1994). (In Bulg.)

[11] Kamisheva, G., Proceedings of the BPU-5 General Conference of the Balkan Physical Union,Vrnjacka Banja, Serbia and Montenegro, August 25-29, 2003, Eds. S. Jokic at al., 1999- 2002 (2004).

[12] Kamisheva, G., Prof. G. Manev's Legacy, 45-53 (Sofia: Heron Press, 2005).

[13] Zamfirov, M., Annuaire de l'Universite de Sofia "St. Kliment Ohridski", Faculte de Physique, 101, 127-142 (2008). (In Bulg.)

[14] Diacu, F., Encyclopedia of Nonlinear Science (2002).

[15] Mioc, V., M. Stavinschi, Proceedings Balkan Meeting of Young astronomers, 25-29 September 2000, Belogradchik, Bulgaria, 53-61 (2001).

[16] Tsvetkov, M., K. Tsvetkova, V. Mioc, M. Stavinschi, Proceedings BPU-5, 2029-2031 (2003).

[17] Prof. G. Manev's Legacy, Eds V. Gerdjikov, M. Tsvetkov, (Sofia: Heron Press, 2005).

[18] Dissertation, defended abroad from Bulgarians 1878 – 1964, Bibliographic Index, National Library "St. Kiril and Metody", Sofia (1975) p. 68. (In Bulg.)

[19] Le Centenaire de l'Academie Bulgare des Sciences 1869 – 1969, I, Sofia, Editions de l'Academie Bulgare des Sciences, 1969. (In Bulg.)

[20] Kovachev, J., Astronomische Nachrichten, B. 203 (1916) s. 12.

[21] Stranski, I. N. A) Beiträge zur Röntgenspektralanalyse, Berlin (1925); B) Zeitschrift für Physikalische Chemie, 136 (1928) 259-278; (with K. Kuleliew) A, 142 (1929) 453-466, 467-475; (with T. Mutaftschiew), A, 150 (1930) 135-138; Bodenstein-Festband (1931) 230-238; (with D. Totomanow), A, 163 (1933) 399-408; (with R. Kaischew) B, 26 (1934) 100-113, 114-116, 312-316; (with R. Kaischew) B, 26 (1934) 317-326; (with R. Kaischew) A, 170 (1934) 295-299; (with R. Kaischew) 35 (1937) 427-432; C) (with R. Kaischew) Naturwissenschaften 19 (1931) 689-690; (with D. Totomanow) 20 (1932) 905; D) Physikalische Zeitschrift, 36 (1935) 11, 393-403; E) (with L. Krastanow) Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, 74A (1938) 305-317; F) (with L. Krastanow) Sitzungsber. D. Akad. D. Wiss., Wien, Mthn Kl, IIb, 146 (1938) 10, 797-810; G) (L. Krastanow) Zeitschrift für Kristallography, 99 (1938) 444-448.

[22] Stoyanow, N., A) Annales de la Faculté des Sciences de l'Université de Toulouse, 2-e série, 5 (1903) 157-196; B) Bulletin Astronomique, Paris, 22 (1908) 6; 24 (1910) 1, 1-26; C) Physikalische Zeitschrift, 10 (1910) 13, s. 430.

[23] Zaycoff, R., A) Fünfdimensionale Relativitätstheorie, Sofia (1928); B) Zeitschrift für Physik, 53 (1929) 719-728; 54 (1929) 588-589; 590-593; 56 (1929) 717-726; 738-740; 862-864; 58 (1929) 280-290; 61 (1930) 395-

410; 66 (1930) 572-576; 67 (1931) 135-137; 69 (1931) 428-430; 83 (1933) 338-340; 84 (1933) 264-267; C) Zeitschrift für Astrophysik, 6 (1933) 128-137; 193-197; D) Annalen der Physik, 7 (1930) 650-660.

[24] Maneff, G., A) Annuaire de L'Universite de Sofia, Faculte Physico-Mathematique, 20 (1924) p. 121; p. 141; p. 167; 27 (1931) p. 355-397; B) La Gravitation et le Principe de L'Egalite de L'Action et de la Reaction, Comptes Rendus, Paris, 178 (1924) p. 2159; La gravitation et le principe de l'egalite de l'action et de la reaction, 179 (1924) p. 96; Le Principe de la Moindre Action et la Gravitation, 190 (1930) p. 963; L'Energie electromagnetique dans le champ de Gravitation, 190 (1930) p. 1180; La Gravitation et L'Energie au Zero, 190 (1930) p. 1374; Sur le deplacement du perihelie de Mercure, 199 (1934) p. 1376; Sur les effets de la theorie de la relativite, 200 (1935) p. 215; C) Die Gravitation und das Prinzip von Wirkung und Gegenwirkung, Zeitschrift fur Physik, 31 (1925) s. 786; Über die Einwande von A. H. Bucherer und die Bemerkungen von K. Popoff zu meiner Arbeit: Die Gravitation und das Prinzip von Wirkung und Gegenwirkung, 33 (1925) s. 28; Die Gravitation und die speziellen Gravitationsfelder der Relativitatstheory, 48 (1928) s. 141; Über die Schwarzschildsche Gleichung der allgemeinen Relativitatstheorie, 56 (1929) s. 421; D) Die Masse der Feldenergie und die Gravitation, Astronomische Nachrichten, 236 (1929) 5664, s. 401; E) Die Energiemasse und der Elektrizitatshaushalt der Erde, Terrestrial Magnetizm und Atmospherie Electricites, Baltimore (1929) s. 225; Zur Elektrizitatshaushalt der Erde, 35 (1930) s. 50; F) Über das Kosmologische Problem der Relativitatstheorie, Zeitschrift fur Astrophysics, 4 (1932) s. 231; Über die Welt in Ausdehnung, 4 (1932) s. 241.

[25] Central State Archives, Sofia, Fund 994k, Register 13, Archival Units 22.

[26] Central State Archives, Sofia, Fund 994k, Register 13, Archival Units 28.

[27] Central State Archives, Sofia, Fund 994k, Register 13, Archival Units 30.