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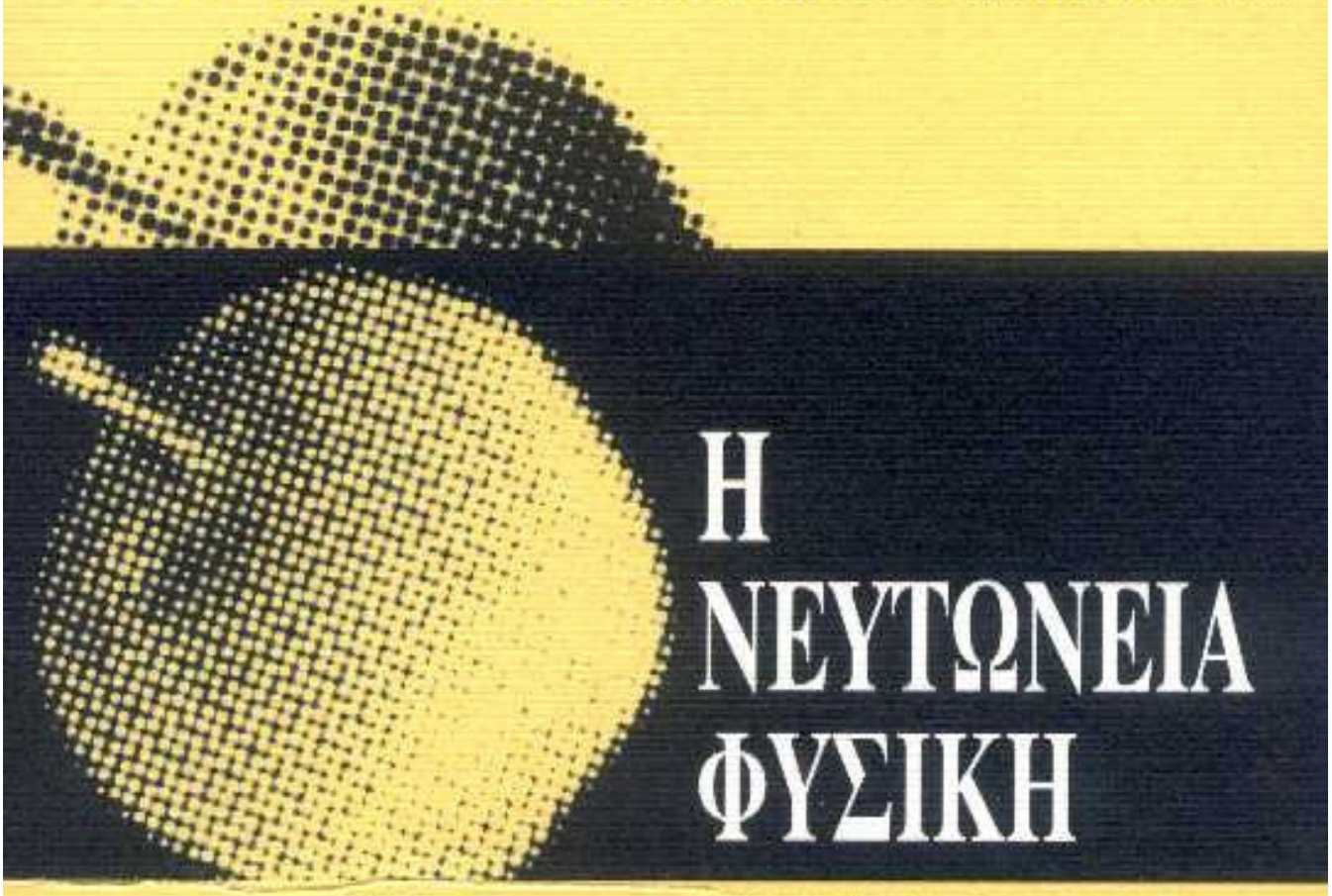

Η ΝΕΥΤΩΝΕΙΑ ΦΥΣΙΚΗ

ΚΑΙ Η ΔΙΑΔΟΣΗ ΤΗΣ ΣΤΟΝ ΕΥΡΥΤΕΡΟ ΒΑΛΚΑΝΙΚΟ ΧΩΡΟ

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Alexander Vavrek - Ganka Kamisheva
Milko Borissov

Professor, Institute of Solid State Physics, Bulgarian Academy of Sciences

DISSEMINATION OF NEWTON'S MECHANICS ON BULGARIAN SOIL DURING THE BULGARIAN NATIONAL REVIVAL*

1. Introduction

For the first time the term «fizicheski nauki» («physical sciences») appeared written down by a Bulgarian in about 1800. It was Sofronii Vrachanski (1739-1813), the famous Bulgarian man-of-letters and cleric, who wrote this term on the margin of one of his manuscripts together with an explanation (or translation?)- «natural sciences»[1]. However, the acquaintance of the Bulgarians with the physical sciences started in the middle of 1820s, when the subject physics was introduced in some Bulgarian schools. The dissemination of physical knowledge and physical sciences on Bulgarian soil was a prolonged and complicated process, which was initiated under the influence of the Greek Enlightenment.

The general picture of the history of spreading physics in Bulgaria is already fairly clear[2]. Some of the most interesting problems in this history are already comprehesively studied, for example-the life and activities of the first Bulgarian scholar in the field of natural philosophy Doctor Peter Beron[3], and the first

* This paper is partially sponsored by the Bulgarian National Sciences Foundation under Grant No. F-251.

1. V. Mutaficheva, *Kniga 2a Sofronii,* Varna 1983, p. 71.

2. M. Borisov, A. Vavrek, G. Kamisheva, *Predshestvenici na razprostranenieto i razvietieto na fizicheskite nauki v Bălgaria,* Sofia, 1989.

3. N. Băchvarova, M. Băchvarov, O.R. Petăr Beron-zivot, *dejnost naturfilo-*

Bulgarian PhD thesis in physics, defended by Dimiter Moutev at the Berlin University in 1842[4].

In this paper an attempt is made to present the process of dissemination of the Newton's physics on the Bulgarian soil during the National Revival, We have confined ourselves to the Newton's mechanics for two reasons: the first reason is the obvious fact, that when we are saying «Newton's physics", we mean Newton's «Principia» and Newton's laws of mechanics and gravitation (don't we?), and the second reason is our conclusion that it is Newton's mechanics, and especially its law of universal gravitation, that had made Newton's name a symbol of the Enlightenment and the social progress for the Bulgarian intellectuals before the Liberation of Bulgaria.

Only Bulgarian books and other materials of Bulgarian origin are investigated in the paper.

2. The role at the neohellenic schools for disseminating the Newton's physics among the Bulgarians.

At the end of 18th and in the beginning of 19th century, for the first time on the Balkans, physics was introduced as a school subject in the new Hellenic schools in Kydonia, on the Chios Island, in Smirna, Bucharest and Jassy. Many young Bulgarians went to these schools and got acquainted with Newton's physics there. A number of them became later popularizers of physics on Bulgarian soil. Three names are to be mentioned in the first place - Ivan Seliminski, Emmanuil Vaskidovich, and Konstantin Fotinov[5].

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sofija, Sofia, 1975; N. Bǎchvarova, *Prirodonachni te Znania i kniznina prez Bǎlgarskoto Văzrazdane,* Sofia 1982; M. Bǎchvarov, N. Bǎchvarova, Dr. Petǎr Beron, i istorijata na Bǎlgarskata nauka, *Spis. BAN,* year. 37, 1991, vol. 4, p. 75.

4. N. Bǎchvarova, Dimitǎr Muter i negovata disertsacija. izv. na Dǎrz. arhivi (GUA v Bǎlgaria), vol. 44, p. 141, 1982; see also (2) «Predshestvenici...», p. 168-188, see also (3) «Prirodonauchnite...», p. 123.

5. A. Alexieva, Grǎtchkata prosveta i fromionneto na Bǎlgarskata văzrozdenska inteligencija, *Studia Balcanica,* vol. 14, Problemi na Balkanskata istorija i kultura, Sofia, 1979, p. 156-180; A. Vavrek, G. Kamisheva, M. Borisov, Prinosǎt na grǎtchskite i elino-bǎlgarkite uchilishta za prepodavane i populjarizirane na fizikata sred bǎlgarite. To be published in: *Spis. na BAN.*

Ivan Seliminski (Yordan Georgiev Christov, 1799-1867) is born in Sliven[6]. In 1815 he finished an elementary monastery school there and left for Jerusalem. From 1817 till 1821 Seliminski learned in the famous neohellenic school in Kydonia, and obrained good knowledge in the fields of natural sciences and physics under Theophilos Kairis. In 1825 Seliminski returned to Sliven and opened a new school there. In this school he began to teach physics. Evidences exist that demonstrations were made by him during the lessons. In 1831 Seliminski went to Bucharest and opened another school there. An announcement is found in a Romanian newspaper of that time, in which all the subjects in this new school are listed, including physics under # 12. In 1840 Seliminski left for Athens and began his studies in medicine there.

The language which was used by Seliminski in his schools was Greek. By the end of his life he had not learned the written Bulgarian. All his papers and letters are written in Greek. (This fact was a personal tragedy for him). Many of his works have been translated into Bulgarian and included in the 14 volumes at «The Library of Doctor Ivan Seliminski» published after the Bulgarian Liberation[7].

Emmanuil Vaskidovich (1795?-1875) is born in Melnik, where he has obtained his primary education in the Greek school. Afterwards he has learned in the new Greek schools on the Chioss Island and in the Bucharest Bey-Academy. His teachers in physics were Neophitos Vamvas in Chios and Konstantinos Vardalahos in Bucharest. In 1815 Vaskidovich, who had already finished his schools, decided to join Vardalahos as a teacher. On his way to Bucharest he was invited to open a new school in Svishtov and settled there.

The Vaskidovich's school in Svishtov had two stages-lower and higher. Starting from 1824 or 1825, physics was included in the

6. M. Arnaudov, *Seliminski, Zivot, delo, idei,* Sofia 1938; C. Kpuistanov, S. Moslev, I. Penakov, *Dr. Ivan Seliminski kato uchitel, lekar i obshtestvenik,* Sofia 1962.

7. *Biblioteka Dr Ivan Seliminski,* vol. 1-6, Sofia 1904-1907, vol. 7-14, Sofia 1928-1931.

program for the higher stage[8]. It is established that in 1817 Vaskidovich received from Vardalahos his textbook in physics and chemistry, published in 1812. In the course of 20 years Vaskidovich taught physics in Svishtov in Greek language. In 1846 however, an announcement appeared in his book «Preskorbnoe oprawdanie» («An unhappy excuse»), that he was planning to publish several new textbooks in Bulgarian, including a textbook in physics. This means that the manuscript of such a textbook had been almost prepared by that time. It is assumed that Vaskidovich began to teach physics in Bulgarian in 1843 or 1844. His «Physics» has never appeared. In 1847 he left Svishtov for Pleven and returned back 4 years later. Meanwhile, in 1849 the first Bulgarian textbook in physics was published.

No direct documentary evidences for the teaching activities of Seliminski and Vaskidovich in physics are discovered in archives by now. As far as Seliminski is concerned, even the textbooks used by him are not known, because his library, which he had left by testament to his town of birth Sliven, was burned out during the Liberation War in 1877. Nevertheless, we should consider these two eminent Bulgarian teachers and intellectuals to be pioneers in introducing Newton's physics in the Bulgarian schools during the National Revival[9].

We obtain the three Newton's laws of dynamics written down by the hand of a Bulgarian in a manuscript of 1824, which is being preserved in the National Library in Sofia. It is a copy of the manuscript-textbook «Metaphysics» of A. Psalidas, made by Konstantin Fotinov in Greek**.

Konstantin Fotinov (1785?-1858) is born in Samokov. He has obtained his education in the elementary monastery school in

8. P. Hartomaciclis, Emanuil Vaskidovich- dejnost i vazgledi na obrazovanieto. *IZV na NIIO «T. Samodumov»*, vol. 27, 1973, p. 53-88.

9. G. Kamisheva, Fizikata v Svishtovskoto uchilishte na Emanuil Vaskidovich. To appear in: *Svetăt na fizikata*, vol. 2., 1993.

** Acknowledgements are due to Nadja Danova from the Institute for Balkans Studies at the Bulgarian Academy of Sciences in Sofia for this valuable information and for the fruitful discussions.

Samokov, and then - in the Hellenic schools in Plovdiv and probably - Smirna. About 1825 he opened a Hellenic-Bulgarian school in Smirna (In 1840s he became an interpreter in the French Consulate here and a teacher in Greek for the diplomats there). In 1850s he joined the team of translators of the Bible into spoken Bulgarian, working in Tzarigrad.

Most probably, Fotinov got acquainted with some ideas of the Newton's physics in the Hellenic school in Plovdiv. A catalogue of the school's library (which is dated about 1800) was recently obtained in the Bulgarian archives[10]. Several textbooks in physics and cosmography are listed in this catalogue, translated from European texbooks into Greek. In Smirna Fotinov's interest in physical sciences had grown up.

In Fotinov's manuscript of 1824 «the laws of motion, discovered by the Englishman Newton, the most thoughtful among the physicists» are formulated in the following manner[11]:

«1. Every body remains in its state of rest or of motion with the same direction and velocity, unless an external force make it change its state.

2. The change of motion of a body is proportional to the force acting upon it, and is always taking place along a straight line.

3. The opposing force is equal to the force, to which it is opposed; and thus, the actions of the two bodies are mutual and directed to opposite places».***

All this is quite sufficient in order to put the name of Fotinov

10. N. Danova, Oshte za grătchkija kanal na obshtuvane na bălgarite s euvpg'skata kultura. Sluchajat Fotinov. To be published in: *Literaturna misăl*, 1994.

11. Narodna Biblioteka. «Sv. Sv. Kiril i Metodij, Odel za răkopisi, Gr. 117, ff. 104-105.

*** Here is the contemporary formulation of these laws in English:

a. Every body continues in its state of rest or of motion in a straight line unless it is compelled to change that state by force impressed on it;

b. The change of mtions is proportional to the motive force impressed and is made in the direction of the straight line in which that force is impressed;

c. To every action there is always opposed an equal reaction; or, the mutual actions at two bodies upon each other are always equal.

between the names of pioneers in physics in Bulgaria. However, we should mention one more contribution of him to the dissemination of physics in our country. This is the announcement of the discovery of Neptune, published in December 1846 in his journal «Lyuboslovie» (It is the first Bulgarian journal)[12]. As is well known, Neptune is discovered in September 1846. Probably, this short notice is translated by Fotinov from a Greek publication. Only Le Verrier and Johan Galle are mentioned as discoverers.

Tens of young Bulgarians have obtained their quite modern for the time education in the new Greek schools during the Greek Renaissance. They have transfered the ideas of the European Enlightenent and the new scientific knowledge to the Bulgarian soil. I. Seliminski, E. Vaskidovich and K. Fotinov, who learned physics in the some of the best Greek schools in 1820s, are the first who have introduced Newton's physical ideas in their Hellenic-Bulgarian schools. The role however of the new Greek schools in the history of Bulgarian physics and education is of particular significance till the foundation of independent Greek Kingdom. Afterwards, Russian, French, and German influences on the Bulgarian school began to grow up.

3. The Newton's law of universal gravitation in the Bulgarian textbooks during the National Revival

It was the Newton's law of universal gravitation, which first of the Newton's laws appeared in the Bulgarian textbooks during the Revival. This happened in the first Bulgarian textbook in mathematical geography published by Ivan Bogorov in Odessa in 1842.

Ivan Bogorov (Ivan Andreov Bogoev, 1820?-1892) is born in Karlovo, where he has learned under the famous Bulgarian teacher Rayno Popovich. After finishing his primary education, Bogorov went to «The Great Public School» in Tsarigrad. In 1840 he left Tsarigrad for Odessa and continued his studies in the Richelev's liceum.

The «Mathematical Geography» by Bogorov was a translation

12. V. Fotinov, *Nova planeta Ljuboslovie,* v. 2, part 24, 1846, p. 177.

from Russian into Bulgarian of a textbook by V. Bardovskii[13]. The Newton's law of universal gravitation is included in the part «About the whole world» of the book. One of the sections in this part is named «Attractive and pushing-off forces». We meet a formulation of the law of universal gravitation in this section, but the name of Newton is not mentioned. It is explained, that the celestial bodies«are held in the celestial space and are moving along their ways which God has determined by the help of the attractive and pushing-off forces. The attractive force is the force of attraction of one body to another body. By the action of this force, when one body is twice as big as another body, it attracts twice as stronger, and when the distance of the body to the other body is three times greater, the attraction is nine times smaller. The attraction of a body to the centre of another body is called gravitation». (Then the «pushing-off force» is defined as the force which is «pushing-off a body, turning around another body» (i.e. the centrifugal force is ment).

As we see, the Newton's law at universal gravitation is formulated precisely. Nevertheless, a very important feature is missing - the idea that the attraction is a mutual attraction. This idea was correctly elucidated in the Bulgarian textbooks much later.

Here, we do not intend to analyze the content of Bogorov's textbook in details, but we would like to cite one more sentence from the chapter «Immobile Stars». It says: «The immobile stars, because of their big size, and their shining and sparking light, are thought to be suns, which are centres of planetary systems, unvisible for us».

In 1850 a similar picture of the Universe is introduced in the encyclopaedic «Textbook for Children», a translation of the textbook of Konstantinos Vardalahos into Bulgarian, made by Antonii Nikopit[14]. The book is organised in «lessons» each

13. *Matematicheska geografija. Prevedena ot ruskijt na novo-bălgarskijt ezik Chast părva.* Odessa, vo Braunovata tipografija, 1842. Translated by Ivan Andreov Bogoev (72 pages).

14. *Uchelnija za detchata. Sochineni pervo po Grecheski ot Konstantina Vardalaha, prevod po Bolgarski Antonij Nikopit.* Period pervij. Tipogafija na Tcharigradski Vestnia 1850 (355 p.).

containing several subjects. For example, the subject «Physics» appears in many places in the book. On page 60, under the title "Physics" we read: «The immobile stars are said to be shining spheres as our Sun is, and they are shining on some spheres, or planets, which are very far from us and our eyes can not see them». Several lines below we find the explanation: «The planets are going around the Sun and they do not shine by their own». The law of universal gravitation is not included in this textbook. This fact, however, should not be regarded as its important disadvantage. On the cover of the book is printed «first period», that is, it was intended for the year of education in a higher level school (most probably - for the new Bulgarian middle schools - the so called «class-schools»), and textbooks for the second and third periods were to be published.

Thus, in 1842 it was already written down in some Bulgarian textbooks that many planetary systems exist in the Universe, which are like the Solar System, and all these systems obey to the law of universal gravitation. We should admit, that such a «large scale» approach to the world's system was beyond the needs and even possibilities of the Bulgarian pupils in the middle of the 19th century. The simple explanations, presented in the smaller textbooks on «Earth-Description» («Zemleopisanie»), published by the 1860s were obviously more appropriate for them[15]. These explanations aimed mainly to spread the heliocentric view on the Solar system throughout the Bulgarian people.

The second formulation of the law of universal gravitation in Bulgarian textbooks appeared in 1861 in Joakim Grouev's «Lessons in Earth-Description»[16]. The third part of this book is

15. *Obshtoe zemleopisanie varatce za sichkata zanlja. Prevedeno ot Grecheskij na Slaveno-Bolgarskij jazik, umnozenno c rasprostraneniem i pribavleniem mnogotaznih potrebnih oblastej, i sega pervo na svjat izdano trudom Konstantina G. Fotinova S.*, Smyrna, V. Tipografii A. Damianova, 1843 (236p.); Kratko zemleopisanile. *Estestvenno matimatichesko i grazdensko ot Georgija Ekonomova,* Dupuijamina. Bucurest, v knogopechatnjata kopajnigova, 1856 (134 p.): Prvi znanija za detca. Narjadil Iokim Gruev, Belgrad, v Knjazesko-Srbska migopechafnja, 1857 (97 p).

16. *Kroci po zemleopisanije ot J. Grueva.* 1861. Izdeva sija ot Sădruz. na Blăg. knigoprodavnica v Provdiv. Văv Viena, u Knigopechatu. 1. Somera (299p.).

named «Calculative Earth-Description or Cosmography.» In Lesson 3 of this part the following explanation is proposed: «The movable stars are suspended in the space and they are moving around the Sun with the help of forces, named attractive and pushing-off [forces]». The definition of the attractive force is more precise than in Bogorov's textbook: «The attractive force attracts bodies proportionally to their heap (i.e. mass) and reversely proportionally to the square of the distance; i.e. when a body is three times bigger it [the attractive force] is three times stronger, and when a body is three times more distant, it is nine times weaker».

The explanation however of the pushing-off force, proposed by Grouev, is not correct. «The pushing-off force pushes the bodies along a straight line, and the attractive force causes this line to bend and to form elongated circles (ellipses), which are drawn by the celestial bodies during their turning around [the Sun]».

It should be mentioned, that in Grouev's textbook Neptune is included in the list of the planets in the Solar system for the first time in the Bulgarian astronomical literature. Newton is not mentioned in the book.

During the Revival, the idea, that the universal gravitation is due to mutual attractive forces between bodies was very difficult to acquire. An example from 1865 clearly demonstrates the situation. In this year the «Mathematical Geography» of Spiridon Petrov was published in Russian[17]. It is correctly explained in the book, that the force of the Earth attraction, which causes a stone to fall to the Earth surface, is the same force as the universal gravitation, which attracts the Moon to the Earth and the Earth to the Sun. It is mentioned that Newton (!) has proved that this force is reversely proportional to the square of the distance. After that, a totally incorrect statement follows: «The Earth attracts the Moon, and also the Moon attracts the Earth, but with a much weaker force, because its mass is much smaller than Earth's mass, and the attractive force

17. *Pălna matematicheska i fizicheska geografija ot Spiridona Petrova. Za upotreblenie na narodnite uchilishta. Chjast I. Matematicheska geografija, izdanie părvo.* Russe, v pechjatnichata na Dunavskata provincija, 1865 (144 p.).

of the bodies is proportional to their masses». Several pages below the same reasoning is used as a «proof» of the heliocentric structure of the Solar system - it would be impossible for the earth, according to this «proof», to hold the Sun on its orbit, because of the Earth's small attractive force, compared to the Sun's attraction.

It is strange enough to find such a misunderstanding of the Newton's law of universal gravitation in 1865, because 16 years before the mutual character of the gravitational force was very clearly pointed out in the first Bulgarian textbook in physics - the Nayden Guerov's «Survey of Physics», published in Belgrad[18]. What we read in this book is: «Universal attraction is the force, responsible for the mutual attraction of all parts of the matter, which drives them to draw closer to each other. This force demonstrates itself in different phenomena and is being called correspondingly gravitation, Earth attraction, and particle's attraction. Gravitation is that action of the universal attraction, which is responcible for the perpetual and unchanging motion of the celestial bodies. Due to the Earth's attraction all the Earth bodies are being pulled to the centre of the Earth».

In 1869 the second Bulgarian textbook in physics is published in Plovdiv by J. Grouev. It was a translation from French of the well known «Experimental Physics» by A. Ganot[19]. In this book the law of universal gravitation is formulated fully and precisely: «The famous English physicist Newton... has discovered the important laws of universal attraction, which govern the motion of Earth and celestial bodies... We can formulate the Newton's theory of universal gravitation like this:

1) Mutual attraction exists between all the bodies in the world, which is present at any distance and drives the bodies to draw closer to each other;

18. *Izvod ot fizika, napisan ot Naiden Gerov, chast prăva.* Belgrad. Pechatano v pravitelstvena pechatnju 1849.

19. *Opitna fizika s 368 hubavi chertezi, săstavena na franchuzskij jazik ot A. Gano, prevedeni ot J. Gruev.* knizarnica Xr. G. Danov i Siev Plovdiv, Ruschjuk, Veles, 1869. Vienna, y knigopecatu. A. Somerova.

2) the attraction of any body at a given distance is growing up with its mass, or, in other words, the attraction is proportional to the mass of the body;

3) The attraction at given masses is decreasing as the square of the distance is increasing; or, all the same, the attraction is reversely proportional to the square of the distance».

On the next page we can find some additional explanations: «The special attraction between the celestial bodies is called gravitation... The Earth's attraction is the force, which causes all the free bodies to fall, that is to move towards the centre of the Earth. This force is a particular case of the universal attraction. It is caused by the mutual attraction between Earth and the bodies on its surface».

In 1873 a comprehensive consideration of the problem of the universal gravitation in Bulgarian appeared in the textbook «Cosmography» by A. Malinin and K. Burenin, translated from the 3rd Russian edition by D. Enchev[20]. In this book, for the first time in Bulgarian, are formulated (very correctly) the three Kepler's Law. These laws are used in Part 17 of the book, which is devoted to the universal gravitation. A simple consideration is proposed in order to show, that the reverse proportionallity of the gravitational force on the square of the distance is a consequence of Kepler's laws. Some arguments are also put forward, which demonstrate that this force should be proportional to the mass. Then a full and precise formulation of the law is given:

«Thus, the Earth's attraction is only a particular case of those mutual attraction which the Sun exerts over the planets, the planets exert over the Sun and one over each other, and all these phenomena are particular cases of one and the same natural law, called law of the universal attraction, and which says that every two particles of matter attract each other with a force, which is proportional to the product of their masses and reversely

20. *Kosmografija (Răkovodstvo za uchilishtata). Săstavili A. Malinin i K. Burenin, prepodavateli v 4ta Moskovska gimnazija Ot tretoto isdadeno i dopălneno izdanie prevod D. Enchev.* S. 101. figuri Knigoprodavnitcha Monchilovi i Sie i Tămovo; Viena u knigopechatnitchata 1. Somer i Sie, 1873.

proportional to the square of the distance between them. This law is discovered by Newton».

Then, the well known formula for the gravitational force is presented and an interesting description of the Cavendish's experiment is given. It is especially stressed that this experiment is a direct proof of the Newton's law.

The last paragraph of the textbook is devoted to the discovery of Neptune, which is «the most brilliant verification of the Newton's law of universal gravitation». We should notice here, that in their book Malinin and Burenin present both independent discoveries of the new planet-that of Galle, who has followed the theoretical predictions of Le Verrier, and the theoretical discovery of the Cambridge astronomer John Adams, whose calculations are now believed to have been completed before the calculations of Le Verrier. (The story of discovery of Neptune is told comprehensively, in the popular astronomic book of O. M. Mitchell «Orbs of Heaven: or the Planetary and Stellar Worlds», translated from English into Bulgarian by D. Vitanov and published in 1875).

In 1872 and 1874 the third and forth Bulgarian textbooks in physics are published.[21, 22] In both of them the universal gravitation is considered very shortly. It was not easy to add something really important to the comprehensive consideration given in the book of Malinin and Burenin. Even in the beginning of 20th century their «Cosmography» was used in the Bulgarian secondary schools.

4. The Newton's laws of dynamics

In 1849, as we have already mentioned before, the first Bulgarian textbook in physics was published. It was the «Survey of Physics» («Izvod ot fizika») of Nayden Guerov. Surprisingly enough, this is not a translation, but a fully original textbook. Its author Nayden

21. *Fizika za glavni narodni uchilishta ot šubert, prevedena ot J. Gruev,* 76 figuri, knijarnica na Mr. G. Danov i Sio v Provdiv, Ruschjuk, Veles, 1872 Viena, knigopechatna. L. Somera i Sie.

22. *Răkovodstvo kăm fizikata. Săstaveno ot I. W. Gjuzelev,* 292 cherteza v tekstăt. Namira sja za prodan y izdatelja na knizarnicata na Mr. G. Danov i Sie v Provdiv, Ruchjuk, Veles. 1874. Praga, knigopechatu Ginek Militki i Novak.

Guerov (1823-1900) was born in Koprivshtitsa. He has learned in his birth town and in the Hellenic school in Plovdiv. In 1839 he went to Odessa and continued his education in the secondary school at the Richelle liceum. In 1842 he entered the Cameral division of the Liceum (where administration, finance and technology were teached). In 1846 he graduated from the Richelle liceum with a thesis on the technology of glass. In 1846 he returned back to Koprivshtitsa and opened a new school there.

The school created by N. Guerov in Koprivshtitsa is known to be the first Bulgarian middle school («class school»), opened as a separate school not being an addition to a primary school. N. Guerov included physics in the program of his school and wrote his «Physics» for the needs of teaching this subject. When writing his textbook, N. Guerov was using some of the best textbooks of that time, in the first place these of E. Chr. Lentz, in Russian, and of K. Pouillet, in French. The interest in the textbook was great - 683 copies had been sold before the book was printed.

In the Guerov's «Physics» we find the first presentation of the foundations of the Newton's laws of mechanics in Bulgarian. The Newton's name however is not mentioned. The First Newton's law is given in the following form:

«A body, being in rest, can not begin to move by itself; or being in motion, can not stop by itself. This property is called "inertia" and it is spoken for the bodies that they are inert».

The first introduction of the notion of force in the book is not precise: «Every cause, which makes a phenomenon, is called force, or action-maker («deystvovatel», those who acts)». Several lines below we read: «The real nature of the forces and action-makers is still hidden from us; only their effects are known, and this fact allows us to devide all the action-makers into two groups: 1)universal, or general, attraction, and 2) some rather thin matters, like heat, light, magnetism, and electricity».

The definition of force is much more precise several pages below: force is being called «every cause which can make a body move». This is already a dynamic definition, although not a full one. The explanations of the notion is going on with introducing

«momentary and infinite (constant) forces», with elucidating the main elements of a force -size, direction, and point of application. The main methods of measuring and summing forces are also explained. Then a more precise form of the Newton's first law of dynamics is proposed: .

«If a body is put in motion by a momentary force, it will keep moving inifinitely and with a constant speed along a straight line; it can not change its direction or speed of moving by itself. Another force should be applied to it in order to stop it, or no change its direction or speed of moving».

Afterwards the following form of the Second Newton's law of dynamics is introduced: «When one and the same force is acting on different bodies, it makes them move with speeds reversely proportional to their heap (mass)». Actually, not just a force, rather than a force impulse (i.e. a «momentary» force) is ment here. Then the momentum (old name «quantity of motion») is defined as a product of the mass and speed, and a new form of the Second law is given:«A force (a «momentary»'force!) gives one and the same quantity of motion to every body». At the end of this section, an idea of the Third Newton's law of dynamics is given using the example of a «kicking» of a gun.

Then, we meet again the second Newton's law, formulated for the case of constant forces: «There is such kind of variable motion, whose speed is increasing or decreasing with a constant rate... This kind of motion is a consequence of a constant force». The free fall near the Earth's surface is analyzed as an example of such a motion.

Thus, in the first Bulgarian textbook in physics the Newton's laws of dynamics are not formulated in a general form. In 1869 and 1872 two new textbooks in physics, translated and published by J. Grouev, appeared . These textbooks however are not better than N. Guerov's «Survey» as far mechanics is concerned. Moreover, they are less precise in some important topics, like the notion of weight and its connection with the Earth's attraction.

The second original Bulgarian textbook in physics is published in 1874. Its author, Ivan Gyuzelev (1844-1916), is born in Gabrovo. He has obtained his elementary education in his birth town. In 1860

he left Gabrovo for Odessa where he entered the Herson seminary. Seven years later, in 1867, Gyuzelev finished the course in the seminary and began his studies at the Faculty of Mathematics and Physics of the Odessa Novorossiiski University. He graduated in 1871 and returned back to Gabrovo. Here he was appointed a teacher in the Gabrovo middle school and became one of the initiators for transformation of this school into a fullprogram secondary school. His «Guide to Physics» was written in order to meet the needs of this new secondary school. (The book is based on Russian and French textbooks).

In Gyuzelev's «Guide» some of the notions of mechanics are defined more precisely than in N. Guerov's «Survey». For example, the notion of force is introduced in this manner: «In mechanics forces are considered only as causes of motions. For that reason, in mechanics every cause which can make a body move or stop moving, is called a force».

Interesting enough, but 25 years after the publication of the textbook of N. Guerov, in the «Physics» of Gyuzelev the First Newton's law of dynamics is introduced in a much the same way: «If a momentary force (in the book «interupted force» is used) make a body move, then, as we know, the body will not stop moving or change its motion by itself. That's why: 1. the direction of moving will remain the same, i.e. the body will move along a straight line; 2. in equal time intervals the body will pass equal spaces».

The Second Newton's law in the case of a constant moving force is introduced in the from: «If the force is constant, the body will get proportionally greater and greater motion» (That is - its speed will be increasing with a constant rate). A more satisfactory formulation of this law appeared in 1895, in the second edition of the textbook[23]. In the second of the additional chapters of this edition «Forces and resistances» we read: «The ratio between the force and acceleration of one and the same body is always a

23. *Răkovodstvo kăm fizikata ot I.N. Gjuzelev. Izdanie tovo, preraboteno i dopalneno v razmer na programata za gornite klassove na srednite uchilishta.* S. 417 figuri v teksta, Sofia, knigopechatnitcha u Litografija na Jakno Kovachev, 1895.

constant. This constant is called the mass of the body».

In 1895's edition, in the fourth additional chapter, «Collision of bodies. The centrifugal force», we meet for the first time in the Bulgarian literature in physics a formulation of the Third Newton's law of dynamics: «When a body is acting on another body, we have to accept that the second body is acting on the first body with a force with the same size,... but in a reverse direction. This is a general rule in dynamics, which is called the equality law of action and reaction».

As we see, in contrast to the Newton's law of universal gravity, the three Newton's laws of dynamics have not been included in their general form in the Bulgarian textbooks in physics by the National Liberation in 1877. Notwithstanding, the main ideas of these laws are well explained in these textbooks, though without mentioning the Newton's name.

CONCLUSIONS

The dissemination of knowledge in the fields of physics and other natural sciences on the Bulgarian soil during the National Revival had gradually built up the faith and hope of the Bulgarian intellectuals in the science, as a basis and prerequisite for economical and social progress of the society. The Newton's name and his Law of universal gravitation had become a symbol of the New Time for the Bulgarians. «The discovery of the astronomical laws by Kepler, of the natural attraction of bodies by Newton, of the chemical composing and decomposing in the reality, the new geological investigations and discoveries have broken the slave chains of the human's spirit in the whole Europe - wrote Ivan Seliminski in 1859[24]. These acquisitions will gradually penetrate in the other four continents of the Earth and the slave chains will completely disappear from the mankind. This is the natural road, drawn by the very Nature, to the good fortune of the human kind, and - consequently -of our people as well».

24. I. Seliminski. Po kakav nachin shte se osvobodi nashijat narod? In: *Izbrani sacinenija*, Sofia 1979, p. 152.