



From Bošković's fundamental theory in natural philosophy to generic technical innovations of Tesla

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Abstract

A plethora of scientists gave their invaluable contribution to evolution of knowledge and technology. Among them, Ruđer Bošković and Nikola Tesla are unique and exceptional due to their scientific originality in comprehending basic laws and concepts of nature and a great number of fundamentally original visions in science and technology. Their scientific and technological ideas and innovations used to seem persistently applied for which mankind owes them a debt of gratitude. Ruđer Bošković, a great scientist and philosopher, wrote works and opuscles in philosophy of nature, mathematics, physics and technique areas in his books, which in turn inspired and stirred an intuition of another great scientific innovator – Nikola Tesla. The two gifted, top-notch intellectuals may form a synergy despite the fact that the time distance between them spanned one and a half centuries. A synergy drew over the natural science and technique, inspired a genuine vortices towards a new visions in the mind and spirit of Nikola Tesla whose technical achievements enabled a new civilisation breakthrough. Paper aims to establish for the first time scientific-philosophical-engineering reflections and symbiosis on the work and thinking of Bošković and Tesla, discussing an epistemic foundations of the coupling between two exceptional minds.

The achievements and legacy of Nikola Tesla with a contact to Bošković's Theory

Progress of science and technology is based on theories, models, experiments and inventions (European philosophical or scientific tradition of Plato, Aristotle, Petrić, Galileo, Kepler, Newton, Bošković, ... Faraday, Maxwell, Poincaré, Einstein, ... Tesla) till the present days of the LHC and Tevatron. A basic research today is mostly seeking for fundamental symmetries and laws of motion of the matter at high energies or at the very early phases of evolution of the universe (1). In the given series of great names of science and technology, Nikola Tesla (1856–1943) is included due to his great contributions to both fields. From the epistemological point of view, Tesla was deeply aiming to invent a simple engineering solution as well as to an experimental observation of great discovery: e.g. *stationary waves*, beside the *Hertzian in free space*, by using his *scalar electronics (Tesla's apparatus)* (2–4). Nikola Tesla's achievement and his great intuition in the history of science and technology used to assess critically in this paper, along the new road for future technologies within the framework of Tesla's legacy and influence of his fundamental ideas. Ruđer Josip Bošković (1711–1787)

was included into the same series as the Croatian philosopher and physicist who comprehended – on the shoulders of Newton, Leibniz and Descartes, and also of Plato and Aristotle of the ancient time – the *single universal law of forces* that exists in nature in the middle of 18th century by his method of thought, as the draft for *theory of everything* which is important for physics in 20th as well as in 21st century. Bošković is the father of the original picture of the *points-atoms* as ultimate building-blocks of matter, important both for the modern concept of subatomic particles (from electrons, protons and neutrons to quarks) of the 20th century, and the predicted and expected new *particles* of the 21st century. The Bošković's legacy based on his epoch-making work *A Theory of Natural Philosophy* (Vienna 1758, and Venice 1763) (5) is particularly important due to the current epistemic challenges of 'new physics' acquainted with new *objects* and/or *particles* at high energies, as well as for the global interferences between contemporary science, technology and culture. Within such framework, a *thought contact* between *Bošković's method of thinking* and *Tesla's intuition* seems natural and of epistemic relevance, that might be crucial for modern scientific thinking and research in new technologies of the 21st century. On the occasion of the 70th anniversary of the Tesla's death in 2013, science of electromagnetism and ethical reflections arising from Tesla's work and ideas have to be epistemologically reconciled. That might be understood as the first *synthetic* approach (*beyond* the anniversaries) for new general study of Tesla's life and his important physics-technical concepts important for contemporary science and ethics, under the current constraining conditions of energy and ecology at the global scale. Analysis in the paper is undertaken on the light cluster of several contributions focussed on Tesla's work and life that have been recently produced since 2006 (6–8). A great progress results from Tesla's inventions in the electromagnetism: Tesla's coil and air-core resonant Tesla's transformer to produce a high voltage at a high frequency. That was a revolutionary step in science and technology, especially with respect to H. Hertz's discovery of electromagnetic waves and O. J. Lodge's famous experiments on resonant electromagnetic circuits. However, trivial aberrations of the Tesla's CV data can be found in the historical books, such as in the Lodge's *Autobiography*, where one can find an exotic formulation: "but a *foreigner* from *Czechoslovakia*, Mr. Nikola Tesla, carried it out further" (9). A non-trivial controversies in scientific and historical evaluations of the Tesla's legacy are much more dangerous, particularly suppressions of his name or inventions in the recent editions of Encyclopaedias, as published in 1987, 1996 and 1997 (10). By the very early 20th century Tesla devoted much effort toward design and construction of the grand power to transport electrical power over long distances. Tesla was – primarily – interested for wireless power/energy transfer (*technical dream*) to help a sustainable development of the humankind. It becomes popular today in science and technology as the efficient wireless power or energy transfer. The transmission system was witnessed for the period 1900–1914 by the U. S. Patent Office via the

Tesla's patents (11). Historians of science and technology still claim today that Tesla's system was not explained experimentally in details. However, it is evaluated and justified recently in the paper for the simple physics picture of Tesla's monopole antenna and ground circuits (6). Moral concepts on the wireless energy transport, Tesla published in his fundamental philosophical-engineering paper in "Electrical World and Engineering" (January 7, 1905) (12). A notion of the "Universal Peace", connected with a proposal of transmitting of electrical energy by means of the terrestrial stationary waves, rather stands closer to the Russell's logical view on the "world of universals" than to the Kantian idea of the "eternal peace" (1795). Tesla proclaimed a postulate, as the philosophical-political prolegomenon, for the universal peaceful relations through the three aspects as "dissemination of intelligence, transportation, and transmission of power" (12). Against to Einstein who dedicated himself to be "convinced" rather than an "absolute" pacifist, Tesla stands as the "moral universalist" because he did not change his ethical orientation during his entire life. Tesla was granted 116 original patents (109 are U.S. and 7 British patents), by protecting 125 of Tesla's inventions. Due to 164 analogues of these patents, Tesla's opus counts totally 280 patents in 26 countries of the world (13), where his achievements are arranged not only to area of electrical engineering but spanned to numerous modern technologies (high frequency illumination, X-ray technique, cosmic rays, television, till to the *JCT* and the cell phone today). Due to renaissance of his *energy-moral paradigm* today, his *ethos* and *cosmopolitanism* owing to his fruitful and moral passion to help mankind through science and technology, Tesla remains an outstanding figure in the history of world science and culture. His fundamental discoveries and ideas are inspiring and mentoring scholars as the characteristic *teslology at work* much more than expected.

When the news of Nikola Tesla's death swept through Europe, which was in the throes of war at the time, telegrams of condolence from European scientists, politicians and governments began pouring in to New York and Washington. In the United States, three Nobel Prize laureates for physics, namely Robert Andrews Millikan, Arthur Holly Compton, and James Frank, together wrote a eulogy in honour of the inventor as "one of the outstanding intellects of the world who paved the way for many of the technological developments of modern time". Eight months after Tesla's death, the U.S. Supreme Court ruled that Tesla and not Marconi was the true inventor of radio. This was a tremendous acclaim of Tesla's contribution to communication on the global level. Apart from numerous awards and honorary academic titles, acknowledgment of his contribution is also reflected in a launching ceremony of a ship named after Nikola Tesla in the year of his death. Tesla received a lasting recognition on the occasion of his introduction into the Hall of Fame together with other inventors from around the world. The fact that the unit of magnetic induction was named after Tesla in 1960 shows the extent of the acknowledgement and honour he was given for his contribution to science.



Picture 1. Nikola Tesla with Ruđer Bošković's book "Theoria Philosophiae Naturalis", in front of the Spiral Coil of his HF transformer at East Houston St. 46, New York (1896).

Thus he became one of the few scientists who were given a unit in the SI of weights and measures.

Within the context of history of science and technology, Tesla's legacy has been thoroughly studied by the prominent professors at the University of Zagreb (6–8) as well as many other engineers or physicists, historians and scholars in Croatia of the present days.

On many personal photographs Tesla is sitting in the chair holding the book of Ruđer Bošković on the knee. It is clear that Tesla was familiar with Bošković's Theory of Natural Philosophy. Tesla's intuition together with Bošković's method of thinking in natural philosophy were recognized to be an unique fundamental path for future development of science & technology by the Ruđer Bošković Institute. The new road is technically called as the *SYNERGY BOŠKOVIĆ&TESLA* and similar title was used for the scientific–technology–cultural manifestation that held at the Institute (December 13, 2012 – January 7, 2013) on the occasion of 70th anniversary of Tesla's death. According to the world known photograph (Picture 1) where Tesla reads (thinks) Bošković's *Theory*, we are philosophically asking: What for?

Interaction and Symbiosis between two scientists: historico-epistemic reflections

Ruđer Josip Bošković and Nikola Tesla as the two gifted, keen-sighted explorers can be naturally encompassed by a synergy despite the fact that the time distance

between spanned one and a half centuries. A synergy drew over the natural science and technique, inspired a genuine vortices towards a new visions in the mind of Nikola Tesla whose technical achievements enabled a new civilisation breakthrough.

Tesla in *Theory* was looking for the concept of *force* and its *character* in nature! He was looking for a deep link between Bošković and Einstein's theory of relativity (*gravitation* and *electromagnetic radiation*). Bošković dealt with relativity, including the so-called Einsteinian space-time continuum of the physical world. Tesla has critically assessed Einstein's theory of relativity by arguing that already Bošković two hundred years ago had formulated space time relativity.

Tesla wanted, perhaps, to understand of *annihilation of distance*: for Bošković's *compenetration of points* in *Theory*? He was occupied with space and time and real-local and temporal modes of existence in Bošković's ontology? Tesla wanted to figure out a relationship between point of matter and its related imaginary space, then concept of *virtual compenetration* for case of the very high particle speed in mechanics or optics? Tesla was aiming, finally, for the background for future scenarios of energy resources on the Earth? All enumerated questions with the 'ad hoc' preliminary answers might be interesting topics for young or experienced researchers everywhere in the World, especially at the global centres of excellence in science and technology. A real example towards a such thought orientation is the lecture on the achievement of Bošković for modern particle physics picture of nature, that has been recently given under the brand of the well-known scienceweb *GCOE* programs of the Tohoku University, Sendai, Japan (14).

The intuitive and spiritual aspects of Tesla's creativity

There is no doubt that Tesla was a genius inventor. His mind was very different from other peoples. Due to his *intuition* followed productionally up by *invention* Tesla had the gift of *Cartesian intuitions* according to *Regulae ad directionem ingenii* by R. Descartes (1628) (15). Lat. 'intueri' corresponds literally 'to look at', 'gaze at', but used as a technical term for prompt 'intellectual apprehension' by Descartes. 'Clearly and evidently intuit' (*Rule three* of the Descartes' twenty-one rules) can be attained by *ratione luce* (*light of reason*, respectively), or by *lumière innée* or *lumière naturelle* according to his *Optics*. The best examples of the Tesla's intuitions are very well-known: e.g. the three-phase AC-system and the rotating magnetic field, RF transformer, radio transmission and wireless communication. Tesla was able to solve technical problems fully mentally, starting from an abstract idea to the final realization without making errors. During all his life, Tesla was very much attached to his mother Đuka, an intelligent and simple woman with clairvoyant abilities, which Tesla had also inherited. In his childhood, Tesla has exercise how to form very clear mental pictures, which later on helped him to develop abstract thinking and strong visual intuition.

Earlier description of the physical Universe

His educational and cultural background was based on the European tradition, at that time dominated by Christianity. This common point of view Tesla radically changed after he went to live in America (1884).

By the year 1891, Tesla had invented many very useful devices. However, in 1891, Tesla patented a key device, now known as the Tesla Coil Transformer, for the wireless transmission of electrical power. Tesla was so fascinated by this discovery that he said:

"Ere many generations pass, our machinery will be driven by a power obtainable at any point in the universe.....Throughout space there is kinetic energy..... Is this energy static or kinetic? If static it is a mere question of time when men will succeed in attaching their machinery to the very wheelwork of nature."

That is a part of his speech given before the American Institute of Electrical Engineers.

This description of the physical universe was given before Tesla became familiar with the *Vedic science* of the eastern Nations of India, Tibet, and Nepal. Tesla believed that the Universe was filled with dynamical energy which future generations could use at any point in space and time.

A meeting of Tesla with the spiritual Indian teacher

A big change in Tesla's world view took place after he met *Swami Vivekananda*, a high ranking Indian spiritual teacher, during the Congress of all world religions in Chicago 1893. Tesla became a true follower of the Vedic philosophy including Hinduism, Taoism and Buddhism and their picture of the nature of Universe. Tesla built the Vedic philosophy in his everyday life habits by practising yoga and becoming a vegetarian. For Tesla the Vedic teaching was basis for understanding of modern science and the universe.

Although Tesla before 1894 was describing the universe as a kinetic system filled with energy which could be used at any location in space, his concepts during the following years were greatly influenced by the teachings of Swami Vivekananda who was the first of a succession of eastern yogi's who brought the Vedic philosophy and religion to the West. After meeting the Swami Tesla continued to study the Eastern view of the mechanisms driving the material world, Tesla also began to use the Sanskrit words *Akasha*, *Prana*, and the concept of luminiferous ether to describe the source, existence, and construction of the physical universe.

Tesla and new communication and particle accelerator technology

Nikola Tesla discovered and introduced the practical application of a number of long-lived principles and technical solutions in numerous inventions, of which many are permanently used in everyday life throughout the world. He made the high frequency transformer a reality

thus introducing alternating current into diverse technical solutions. He extended that application also into medical applications, discovered how *diathermia* properties of high frequency current affect the human body.

Tesla developed and applied the communication properties and technical solutions of modern radio. He developed wireless remote control of radio waves and was the first to apply digital logic while demonstrating ship remote control.

His most significant discoveries include polyphase systems based on which rotary magnetic fields are created. Thus he devised asynchronous and synchronous motor. He developed a concept of remote AC power transmission by using three phase electricity. In this context, he established distributed systems, namely the Analogue Grid.

Tesla stands out as a unique scientist with permanently applied technological innovations in the field of electric energy (AC polyphase system and rotary EMW based engine) and radio communications (transfer of information by resonant frequency circuits). These two areas are the foundation of generic electrical engineering and communication of contemporary life and work within the framework of civilization today. Also, Tesla was the mastermind behind the distributed systems and the creator of the analogue Grid (power-grid networks) whose principle combined with the advanced technology base enabled the establishing of what we know today as the Digital Grid. Tesla foresaw it saying: "This will turn the whole Earth into one huge brain that is able to send a reply to each of its parts" – this idea is the basis for the development of *Internet* and *Cloud* services as highly developed distributed systems.

A modern accelerator technology was endorsed by the Tesla's radio frequency (RF) transformer where during a half-period of voltage oscillation of the Tesla's transformer, the very high voltage (RF field) is used for accelerating the pulses of the particles (beam) in the accelerator channel. A new development is occurring in branch of the Superconducting Radio Frequency (SRF) accelerator technology at JLab, Cornell or CERN achieving the maximum possible gradient (in MV/m, megavolts per meter) for accelerating subatomic particles (electron, proton), or ions, through the accelerator resonant cavities which brings a name of *Tesla cavity*. In the last few decades at the Jefferson Lab a superconducting *niobium* ($_{41}\text{Nb}$) was used as the building material for the type of Tesla's cavity at 2 K, reaching the theoretical limits of optimising the accelerating gradients and high quality Q-factor with respect to residual RF-losses. By the upgrading from 6 GeV to the 12 GeV for *nuclear & particle physics* research, the JLab becomes a world leader in SRF *science & technology* in the near future (16).

A permanent aesthetic tribute to the Symbiosis between Bošković and Tesla in the Ruđer Bošković Institute park

The historically based synergy and symbiosis between Bošković and Tesla was immortalized by a famous sculp-



Picture 2. The famous sculptor Ivan Meštrović created and donate to Ruđer Bošković Institute a pair of sculptures, representing the real Bošković-Tesla symbiosis.

tor Ivan Meštrović, who created a pair of sculptures representing Bošković-Tesla symbiosis. The sculptures are intentionally mutually linked in their dimensions, the outlook and the vision of minds immersed in deep thought.

These monuments are also linked in concept as they depict a figure seated on a pedestal. While creating Tesla, Meštrović decided in favour of his earlier version of Ruđer Bošković statue, which goes to show that he had created these monuments "in pair" having in mind the place where they were to be displayed, namely Ruđer Bošković Institute park. He thought that it was the logical link between the two monuments. The paired monuments portray both the respect that Tesla had for Bošković and the friendship between Tesla and Meštrović. They were the result of desire and inspiration as well as the determination that these monuments have to be placed and kept at the Ruđer Bošković Institute as requested by author, and no replicas are allowed.

Based on the existing documentation, Meštrović's explicit wish is well-known. "As for the Tesla's original plaster cast, I think it should be destroyed because it is enough to have one bronze cast displayed in a public place in Zagreb. This will save me from the onslaught of demands for other replicas to be displayed in other places in the future, which is something I do not want." (Letter from Ivan Meštrović to Milan Ćurčin, 25/5/1958). These are historical grounds for the pair of monuments Bošković-Tesla to be returned to the RBI Park. There are coherent artistic, scientific, cultural and historical links between the sculptures and the RBI science park. Their symbiosis was clearly expressed and discussed by art historians Ivo Šimat Banov (17) and Irena Kraševac (18).

Since Meštrović intentionally created the sculptures as a pair he had relinquished his baroque sculpting abi-

lity as well as his rhetorical, dynamic solutions which were characteristically passionate. He wanted to avoid the conventional symbolism of a figure holding a sphere, a light bulb, a coil or lightning in hand as is the case with many other sculptures by different authors (e.g. Mačkutin's Tesla from 1951). This sculpture pair underlines that Bošković and Tesla were deeply focused, wise and composed persons and this is what Meštrović wanted to depict in form and style in content and theme thereby giving permanent form to their symbiosis.

Bošković and Tesla sculptures are self-possessed and oriented inwardly, and they are intentionally more closed than open in their plasticity. They are mutually linked in pose and turn of the head with moderate dynamics and typical Meštrović's expression of gesture. Thus they establish a relationship of communication, symbiosis and synergy. This leads us to conclude that they need to be placed together, looking at each other thereby creating an impression of minds deeply immersed in thought in the field of natural and technical science. Therefore, Meštrović intentionally designed them in both content and form for the space of the RB Institute park and specifically demanded the place and manner of their display. The idea was for the sculptures to be displayed in a place where they are dignified without gestures, composed, concentrated, closed and focused inward (17).

Subsequently, it can be concluded that in their essence the sculptures form a pair and in their content they are morphologically sublime, more intimate than public. In their role of a scientist, they are introverted and have no expressed public communicativeness. They can be a whole only as a pair deeply immersed in thought intended for display only inside the RB Institute park.

CONCLUSION

Nikola Tesla's work and achievement are profound and humane, containing deeply creative and innovative motifs and messages for future. Tesla's inventions revolutionised the work production relations, the environment and the way of life and sustainable development on the Earth. He made many of his technical solutions and inventions available to the industry and development of culture. The greatest acknowledgement to him comes out of the fact that billions of people on the planet were benefiting from his results and work. Bošković, who stands in the synergetic pair with Tesla, was gained scientifically on the occasion of 300th anniversary of his birth (2011) because his epoch-making work *A Theory of Natural Philosophy* became important again due to the current epistemic challenges of 'new physics' at high energies (19). The fact that Tesla is so unique and exceptional for the fields of modern science, technology, and innovations, gives a justification to the initiative that his birthday every year will be proclaimed to be the *International Day of Science, Technology and Innovation*.

BIBLIOGRAPHY AND NOTES

- PETKOVIĆ T 2011 *Experimental physics and theory of knowledge*, includes acronym and glossary interpretation, summary of the book in Croatian and English language and index; *Postscriptum* to the 3rd edition: A lecture on the precision experiments of the Standard Model and new expected physics at the LHC at CERN, *Školska knjiga*, 3rd improved edition (in Croatian), Zagreb.
- TESLA N, *Moji pronalasci/My Inventions*, translated into Croatian by T. Bosanac and V. Aljinović, foreword: T. Bosanac, ed. B. Valić, Školska knjiga, Zagreb, 1984. Bilingual Croatian-English edition on the occasion of the 120th anniversary of the birth of Nikola Tesla, in cooperation with the Celebration Committee of the Yugoslav Academy of Arts and Sciences, Nikola Tesla Museum in Belgrade and published by Školska knjiga in Zagreb, under the patronage of the president of the Socialist Federal Republic of Yugoslavia, Josip Broz Tito.
- TESLA N, *Colorado Springs – Notes*, Nolit, Belgrade, 1978.
- SOMMERFELD A "Über die Ausbreitung der Wellen in der drahtlosen Telegraphie," *Annalen der Physik*, Bd. 28 (1909), S. 665–736.
- BOŠKOVIĆ R J, *A Theory of Natural Philosophy*, editing and afterword by V. Filipović, translated from Latin by J. Stipišić, expert editor Ž. Dadić, edited at the *Institute of Philosophy* of the University of Zagreb, Latin edition reprint made according to the resources from the National and University Library (sign. 20 020 – A and B), bilingual Latin-Croatian edition, Sveučilišna naklada Liber, Zagreb, 1974.
- PETKOVIĆ T 2006 "Teslini izumi u fizici i njegov inženjerski duh"/"Tesla's Inventions in Physics and His Engineering Spirit", *Energija*, god. 55 (2006), br. 3, str. 262–291. *Journal of Energy* 55(3): 262–291
- PETKOVIĆ T 2006 "Implications of Tesla's Inventions and His Moral Character on the Development of Contemporary Science and Technology". Proc. Symp. "Tesla in Croatia", September 13th, 2006, UNESCO, Paris, Croatian Academy of Engineering; printed also in *Annual 2006 of the Croat. Acad. of Engineering*, Zagreb, p 307–334
- PETKOVIĆ T 2009 "Critical assessment of Nikola Tesla's legacy for contemporary science and society", XXIII International Congress of History of Science and Technology: Ideas and Instruments in Social Context, Budapest 28 July – 2 August 2009, Book of Abstracts & List of Participants, T16 Science and Society, ICHST 2009, Omigra Ltd., p 595 – 596
- PAST YEARS. *An Autobiography by Sir Oliver Lodge*, Charles Scribner's Sons, New York, 1932. A strange statement on Tesla's Czechoslovakian origin is connected with Tesla's experiments on the discharge currents and other luminous effects, on p 188 – 9
- Encyclopedia of Physical Science and Technology* (in 15 vol.) 1987 Acad. Press, Inc.; *Encyclopedia of applied physics* (in 20 vol.), Wiley-VCH Verlag GmbH, 1996; McGraw-Hill encyclopedia of science & technology (in 20 vol.), 1997. In these editions, Tesla coil or RF transformer were not included as well as no entries on Tesla.
- TESLA N U.S. patent 645,576 "System of Transmission of Electrical Energy", Patented Mar. 20, 1900 (Application filed Sept. 2, 1897); U.S. patent 649,621 "Apparatus for Transmission of Electrical Energy", Patented May. 15, 1900 (Application filed Feb. 19, 1900); U.S. patent 1,119,732 "Apparatus for Transmitting Electrical Energy", Patented Dec. 1, 1914 (Application filed Jan. 18, 1902 Renewed May 4, 1907).
- TESLA N 1905 "The Transmission of Electrical Energy Without Wires as a Means for Furthering Peace", *Electrical World and Engineering*, January 7. Reprinted in: Nikola Tesla, *Miscellaneous Writings*, Wildside Press, 2006, p 43 – 58
- TESLA N Museum / Muzej Nikole Tesle, www.tesla-museum.org, Beograd, Srbija.
- PETKOVIĆ T "The Achievement of R. J. Bošković for the Development of Modern Particle Physics Picture of Nature", seminar/lecture at the Department of Physics, Tohoku University, Sendai, Japan, 21 February 2012. A seminar is documented in the *GCOE* programme: *Weaving Science Web beyond Particle-Matter Hierarchy* (<http://www.scienceweb.tohoku.ac.jp/public/?p=2408>).
- DESCARTES R, *DESCARTES: Selected Philosophical Writings*, translated by J. Cottingham, R. Stoothoff and D. Murdoch. Cambridge University Press, 1988. Cf. the chapter: "Rules for the Direction of our Native Intelligence," p 1-19
- www.jlab.org/srf-institute/
- BANOV Š I 2012 Simpozij o sinergiji Bošković - Tesla, IRB, 17. prosinca 2012., Zagreb.
- KRAŠEVAC I, Tribina »Kako je Meštar rekao«, IRB, 9. ožujka 2012., Zagreb.
- PETKOVIĆ T, PETKOVIĆ T ml., "R. J. Bošković's Achievement in Natural Philosophy for the Development of Modern Particle Physics; On the Occasion of the 300th Anniversary of the Bošković's Birth", *Filozofska istraživanja* 126, God. 32 (2012) Sv. 2 (343 – 360). (In Croatian)