Mihailo Petrović
ALAS
Life Work Times

Serbian Academy of Sciences and Arts

MIHAILO PETROVIĆ ALAS 150th birth anniversary

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SERBIAN ACADEMY OF SCIENCES AND ARTS

MIHAILO PETROVIĆ ALAS: LIFE, WORK, TIMES
ON THE OCCASION OF THE 150th ANNIVERSARY OF HIS BIRTH

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Exclusive editions, such as this monograph, call for the engagement, enthusiasm and cooperation of a number of individuals and institutions. We would like to use this opportunity and extend our gratitude to everyone who has taken part or in any way contributed to, or supported the creation and publication of this monograph.

First of all, we would like to express our gratitude to the authors of papers for their effort taken to provide expert and high level insights into some main points of Mihailo Petrović Alas' life and work, at the same time preserving an important aspect of being easy to read and appealing to a broader readership. In addition, we would like to thank to Ms. Snežana Krstić-Bukarica and Ms. Nevena Đurđević from SASA Publishing Section for performing a thorough proofread of the papers, thus making the writing even more articulate.

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S. Pilipović, G. Milovanović, Ž. Mijajlović

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As soon as one first encounters the work of Mihailo Petrović, it becomes evident that he was a person that according to its numerous traits was a polymath. Above all, the academician Petrović was a gifted mathematician and a renowned professor at the University of Belgrade, but also a fisherman, writer, philosopher, musician, world traveler and a travel writer. He earned a degree in mathematics at the Belgrade Grand School and a licentiate degree in mathematics, physics and chemistry at the Sorbonne. At the age of 26, only a year after he had completed his studies, he defended his PhD degree in mathematics at the same university, as a student of the famous French mathematicians Henri Poincaré, Charles Hermite and Charles Émile Picard. In the same year (1894) he was elected to the position of professor at the Grand School to which he brought the spirit of the French mathematical school. It was at that point that his long and prolific journey through science began, whereas, owing to him, Belgrade achieved parity with other major European centers in mathematical sciences. He became an initiator and a leader of the Serbian mathematics and strongly contributed to the spirit of the modern European science in Serbia.

Petrović's expertize spanned several mathematical areas in which he achieved scientific results of world-class relevance: differential equations, numerical analysis, theory of functions of a complex variable and geometry of polynomials. He was also interested in natural sciences, chemistry, physics and biology, and he published scientific papers in these fields, too. In his scientific endeavor he managed to meet the most rigorous standards of the most developed European countries. In a brilliant rise, in a few years' time, up to the early 20th century, he wrote around thirty papers that he published in the leading European mathematical journals. It was due to this fact that he was elected a member of the Serbian Royal Academy as early as at the age of 30, and soon after he became a member of a number of foreign academies and prominent expert societies. He won the greatest respect of the global mathematical community: he was among few mathematicians (13) who delivered at least five plenary lectures or lectures as a visiting lecturer at the International Congress of Mathematicians (ICM). He delivered five such lectures (1908, 1912, 1924, 1928 and 1932). One such invitation has been considered by the mathematical community as an equivalent of an induction to a hall of fame. In addition, it has been considered that Petrović was a founder of new scientific disciplines, namely mathematical phenomenology and spectral theory. He invented several analogue computing machines, possessed technical patents and was the main cryptographer of the Serbian and Yugoslav Army.

Up to the Second World War he was the mentor of all doctoral thesis in mathematics defended at the University of Belgrade. Aforementioned is related to one of professor Petrović's greatest and most important achievements – he was a founder of the Serbian mathematical school that has produced a great number of renowned and successful mathematicians not only in Serbia but also around the world.

In 2018, the Serbian Academy of Sciences and Arts and mathematicians in Serbia celebrate the 150th anniversary of the birth of Mihailo Petrović Alas. Throughout this year, the Academy has organized a large exhibition dedicated to Petrović, alongside a solemn gathering and a conference. This monograph commemorates this important jubilee of the Serbian mathematics. Given the fact that a lot of articles on Petrović have already been written, and that his collected works were published at the end of the last century, the editors and authors of the papers in this monograph were faced with a daunting task of finding some new details from professor Petrović's life and career. Even more so given that his body of work is immense, spanning different scientific areas and encompassing topics that at first glance one finds difficult to combine. As Dragan Trifunović, Petrović's biographer and a man who most thoroughly studied his life and work, noted on one occasion that almost an institute was necessary that would encompass professor's entire body of work. Therefore, we set a relatively modest goal to ourselves to shed light upon some main points of Petrović's life and work, times and circumstances he lived in, as well as to elaborate on the present developments in relation to the Serbian mathematical school, through a selection of papers. The authors of the papers steered clear of technical details and excessive use of mathematical language. Hence, the monograph is intended for a broader readership, in particular to those readers who are interested in the history of Serbian science and its evolvement at the turn of the 20th century, but also to those who want to gain a deeper insight into the life of a brilliant mathematician and a polymath, and, we can quite freely say, an unusual personality.

Ž. Mijajlović, S. Pilipović, G. Milovanović

MIHAILO PETROVIĆ ALAS: LIFE AND WORK

MIHAILO PETROVIĆ'S FISHING – ONE VIEW

Nenad TEOFANOV
University of Novi Sad,
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I

Mathematical phenomenology is an original theory by Mihailo Petrović, which, as a mathematical theory of the activity of causes, was briefly presented to the public in his accession academic speech when he became a full member of the Serbian Royal Academy. In less than 10 years, Mihailo Petrović grew from a graduate of the Belgrade Faculty of Philosophy into a world-class mathematician and became a full member of the Serbian Royal Academy. After completing his studies at the Belgrade Faculty of Philosophy's Department of Natural and Mathematical Sciences, Mihailo Petrović moved to Paris for further education. The year was 1889, late September, and the World Exhibition (Exposition Universelle) was on, an ambitiously organized event marking the centenary of the French revolution. The Eiffel tower dominated the exhibition, which was built for this occasion. In this period, later named the Belle Epoque[136], Paris was the center of significant social changes. In addition to scientific, technological and cultural innovations, the emergence of entertainment industry and consumer society took place. Educational, scientific and medical institutions, alongside casinos, cabarets and restaurants in Paris were the leading ones in Europe at the time.

Studying at the prestigious l'École normale supérieure enabled Mihailo Petrović to form himself as a scientist under the influence of the top-notch professors among whom the most important one was probably

Henri Poincaré, who, together with the other committee members, approved the subject of Petrović's future doctoral dissertation. The committee before which Petrović defended his doctoral dissertation at Sorbonne in 1894 consisted of equally famous mathematicians Hermite, Picard and Painlevé.[137]

The Serbian Royal Academy in Belgrade recognized the quality of Petrović's scientific discussions from that period and consequently he became a corresponding member in 1897. That same year, the first International Congress of Mathematicians was held in Zurich, and Poincaré was invited to participate as one of the four plenary lecturers.[138] At the opening ceremony, Adolf Hurwitz highlighted the importance of aligning mutual cooperation and individual act of mathematical research: "No science, unless perhaps philosophy, has such a brooding and solitary character as mathematics. Nevertheless, in the breast of a mathematician subsists the need for communication and understanding with colleagues."[139]

The subsequent world congress of mathematicians, held in Paris in 1900, was marked by the rivalry between the two approaches to nature and the essence of mathematical research, a formalistic one and an intuitionistic one, as they were termed later. Poincaré was classified into the intuitionistic group, whereas David Hilbert was the main proponent of formalism, who delivered his famous lecture on mathematical challenges heading into the 20th century.[140]

Mihailo Petrović took part in the congress and it is very likely that he attended Hilbert's lecture.[141] Henri Poincaré, Petrović's professor and one of the four plenary lecturers in Paris, was also in the audience. One of Hilbert's problems, the so-called Poincaré Conjecture, was included in the Clay Mathematic Institute's Millennium Problems list, which was published in 2000. The list contained seven mathematical problems for the solving of which an attractive reward of one million dollars per problem was offered. The Poincaré Conjecture has been the only solved problem from the list up to now.[142]

A few months prior to Hilbert's lecture, on January 9, 1900, Mihailo Petrović delivered his accession speech titled *On Mathematical Theory of Activity* at the ceremony held on the occasion of his appointment as a full member of the Serbian Royal Academy. Petrović's theory, later termed mathematical phenomenology[143], has been original, ambitious and promising, in accord with the spirit of the most important mathematical achievements of that time.

II

Mihailo Petrović delivered his accession speech at the Serbian Royal Academy almost one year after he was elected its full member on February 4, 1898. In his speech he expounded the "first draft of a theory" and announced the direction of his future research. The theory was about *the causes of phenomena*, with an emphasis on disparate, different phenomena and *about possibility of discerning analogies among those phenomena*. For this purpose, the term *activity of causes* was introduced, representing the dynamic side of the cause, embodied in the *aspiration* of the cause, which is defined by its meaning and intensity. The discussion aims to show the following:

Mihailo Petrović's memory from fishing (SASA Archive, 14197/II-23)

"That it is possible to introduce the term of activity as a pure, general, precise term, which possesses all characteristics of terms in mathematical analysis;

That it is possible to develop a general, purely mathematical theory the subject of which would be the following: researching various activities in terms of their dynamic nature, looking into their various combinations and determining the effects that result from the impacts of those activities on a certain phenomenon;

That the theory developed in such a way can be applied to seeking quantitative laws of all phenomena for which the activities of the cause are known, regardless of their nature."[144]

In order to clarify this abstractly formulated goal, Petrović states a more specific idea: "Instead of gravitational, electrical, magnetic, chemical, etc. forces, we would deal with a general term of *causes* and their *activities*; instead of a mechanical, physical, chemical, etc. phenomenon which is being observed, we would have an abstract concept of *effects*; instead of special laws based on which the mentioned specific causes act, we would deal with the laws applicable to the aspirations of causes according to which they attempt to affect the phenomena. Knowing the way in which a cause or a group of causes aspires to strengthen or weaken a phenomenon, we can calculate their effect and determine the law based on which the phenomenon will change when the strength of the cause with such aspirations changes."

Finally, various phenomena, observed with the proposed method, could be unified under a more comprehensive theory. According to Petrović, all separate theories obtained in such a way would be then observed from a *higher point*, from which they would look as parts of one and the same whole. Thus, Petrović used his accession speech to expound the program of his future scientific work, shortly stating the idea concerning the way in which his theory of activity will be treated with the help of mathematical analysis, and the general aspect this theory will have once it is fully developed.

Petrović further observes historical phenomena, environmental impact on the development of various biological species, science of language development, etc, in line with the idea of developing a theory which would combine and bring to a common basis a huge number of disparate theories, which otherwise would not share any interdisciplinary ties whatsoever. Undoubtedly, such an approach was inspired by the success of the mathematical description of physical phenomena. As an illustration of analogy among disparate phenomena, we mention examples of proportionality of some physical quantities. That is the simplest possible relation between the two physical quantities in nature, and it is described by a linear function.[145]

The continuous flow of electric charge (direct current, without the change of the velocity of a charge carrier) determines current intensity. Such current intensity, defined by a change in charge quantity which passes through a certain point of the wire in a unit of time, is proportional to the difference of potentials (voltage) at the ends of the wire:

$$I = \frac{dQ}{dt} = -\frac{V_2 - V_1}{R},$$

where R stands for resistance, and V_2 and V_1 stand for potentials. The minus sign shows the direction, i.e. that the flow goes from the point with higher potential towards the point with lower potential. If G denotes conductivity, then we obtain a connection which is also known as the Ohm's law:

$$I = \frac{dQ}{dt} = -G\,(V_2 - V_1).$$

The next example is related to a thermal phenomenon. If a metal bar the length of which is denoted by l is heated at one end, and constant temperature is maintained at the other end, then the quantity of heat passing through the bars' cross section in a unit of time is proportional to the difference in temperatures at the bar's ends:

$$\frac{dH}{dt} = -\frac{kA}{l}(T_2 - T_1),$$

where A denotes an area of the bar's cross section, and k is thermal conductivity of the material. The minus sign says that the heat flows in the direction opposite to the temperature increase. With the notation

$$K = -\frac{\kappa A}{l}$$

for the bar's thermal conductivity, we get the equation

$$\frac{dH}{dt} = -K(T_2 - T_1).$$

We can notice the analogy with the Ohm's law. However, instead of the flow of electric charge, here we are dealing with the flow of heat, caused by the difference in temperatures, not in potentials.

The third example looks into the flow of liquid through a pipe (without turbulence) which occurs due to the difference in pressures at the ends of the pipe. If r is the pipe's radius, l is the pipe's length, and η is its viscosity (measure of its inner friction), then the volume of liquid which passes through the pipe's cross section in a unit of time is shown with

$$\frac{dV}{dt} = -\frac{\pi r^4}{8\eta l}(p_2 - p_1),$$

where p_1 and p_2 are pressures at the ends of the pipe. The minus sign marks the direction of the flow of the liquid from the end with higher pressure towards the end with lower pressure. Such a relation is named Poiseuille equation. With the notation F for flow conductivity through the pipe, we get

$$\frac{dV}{dt} = -F(p_2 - p_1).$$

There is a similar law, for instance, related to diffusion (change in the concentration of a solution) which relates a concentration gradient with the difference in concentrations at the ends (of sump)

$$\frac{dn}{dt} = -C(n_2 - n_1),$$

where C denotes diffusional conductivity (of the sump).

Therefore, the flow phenomenon is characterized by a general relation that is evident in the following table:

Current intensity	$\frac{dQ}{dt} = -G(V_2 - V_1)$
Heat	$\frac{dH}{dt} = -K(T_2 - T_1)$
Flux	$\frac{dV}{dt} = -F(p_2 - p_1)$
Diffusion	$\frac{dn}{dt} = -C(n_2 - n_1)$

Mihailo Petrović wanted to generalize the analogies of this type of phenomena in sociology, economy, linguistics, and to describe them with mathematical formulas, by expanding the existing terminology. Petrović dealt with mathematical phenomenology for the rest of his life,

Mihailo Petrović – Mika Alas on the Danube, Belgrade 1911 (*Collected Works*, Book 14) (Digital Legacy of Mihailo Petrović)

developing his theory of causes, activities and analogies in a number of scientific discussions and books: *Analogies among Disparate Phenomena* (1902), *An Attempt at a General Mechanics of Causes* (1905, translated into French in 1906), *Elements of Mathematical Phenomenology* (1911), *On Mihailo Petrović's Works* (1921), *Phenomenological Mapping* (1933), *Mathematical Analysis and Oceanographical-Biological Problems* (1939) etc.

It is impossible to briefly present Petrović's theory, nevertheless, one may caught a glimpse of the goal of his approach in the following quotes:

> "If activities of all the factors that either actively or passively participate in causing or maintaining a certain phenomenon would be known, the phenomenon would be fully understandable and its state would be known in advance at any moment, the same way as in rational mechanics, where the state of a movement is known at any moment, provided that the forces that cause it, resistances that hinders it, and material relations that are maintained during the movement are known. A form of mathematical laws concerning phenomena primarily depends on the roles and activities of causes that participate in them: in two phenomena, no matter how mutually disparate they may be in terms of their specific nature, *mathematical laws will be the same by their form if the corresponding factors in them play the same roles and if they have the same dynamic nature of activity.....*
>
> The common characteristics of the flow, imposed by a certain type of a mechanism on various disparate phenomena, clad in specific meanings contained in the observed specific natural phenomenon are also externally expressed by specific properties that are immeasurably versatile, depending on the specific nature of the phenomenon. Thus, the growth of an element will be manifested either as an increase of translation or rotation in movement, or as a gradual change of some color from red to purple, or as warming of an object, or as an electrical current that is becoming stronger and stronger, speeding up of a chemical reaction, worsening condition of a disease, etc."[146]

Given the previously said, one can easily perceive the similarities with the idea of the Grand Unified Theory the physicists have been dealing with, in particular since the mid– twentieth century, under the influence of Einstein's research. In the last decades of his life, Einstein was preparing himself to develop a unified field theory, i.e. a theory that would unify all natural laws owing to a unified mathematical language. Instead of separate groups of laws for individual physical phenomena, Einstein wanted to discover the whole, which would unite all the laws. More precisely, it was a search for a "mathematical sentence" that would include gravity and electromagnetism. Gravity was described by Einstein's Theory of General Relativity, whereas the other force, electromagnetism, was described by Maxwell's equations from 1864. Maxwell's unification of electrical and magnetic forces in the 19th century has been one of the invaluable scientific contributions. "Before Maxwell, the electricity flowing through a wire, the force generated by a child's magnet, and the light streaming to earth from the sun were viewed as three separate, unrelated phenomena. Maxwell revealed that, in actuality, they formed an intertwined scientific trinity. Electric currents produce magnetic fields; magnets moving in the vicinity of a wire produce electric currents; and wavelike disturbances rippling through electric and magnetic fields produce light.[147] Einstein intended to generalize Maxwell's program by formulating a theory of unified description of natural law that would include electromagnetism and gravity.

In the meantime, two more forces were experimentally discovered: strong nuclear force and weak nuclear force, and eventually the unified theory was to include all four forces. During the late 1960's and 1970's physicists managed to describe the weak nuclear force and the strong nuclear force by applying the methods of the quantum field theory to electromagnetic force. Therefore, all three forces that are not related to gravity can be described by using the same mathematical language. Nevertheless, when those methods are applied to the fourth force of nature, gravity, mathematical description becomes useless, unusable.[148]

Among numerous examples that Petrović used to corroborate the ideas of his phenomenology there is a detailed description of a research conducted by professor Umberto D'Ancona in the field of biocenosis.[149] In this research from 1926, empirical data from fish markets in Rijeka, Trieste and Venice were observed. D'Ancona studied a natural balance between predator and prey fish species and eventually found an optimum related to fishing activity. When this activity drops below a certain level, predators are favorized, whereas when fishing increases above this optimum level, the effect is opposite. Petrović states that this result fits into the mathematical model that was previously formulated by the Italian mathematician Vito Volterra[150] in the form of differential equations, as well as some known fluctuations of fish species that were observed and explained by Volterra's equations.

III

According to Mihajlo Pantić, among all his interests and preoccupations, Mihailo Petrović – Mika Alas attached undeniable importance to his primordial passion – fishing.[151] In similar manner, Dragan Trifunović writes that the life of Mihailo Petrović was fulfilled with fishing and science, two natures constantly complementing one another, thus creating a unity and harmony, making Petrović the fisherman always present in Petrović the scientist. To his colleague Milutin Milanković, who was not at all interested in fishing, Mika Alas used to say that the best combination was: "A little bit of fish, a little bit of book!"

Petrović developed a passion for fishing prior to his passion for science. After his father Nikodim Petrović passed away (in 1875), his grandfather Novica Lazarević introduced him to the world of fishermen on the Danube and the Sava rivers. "Fishermen's life, charm of many nights spent on the Sava and the Danube rivers, passion and experience when fish is caught, all those things attracted the young Petrović to this sort of life."[152]

Even in the formal sense, Petrović was a fisherman by vocation: in 1882, at the age of fifteen, he became an apprentice (with fisherman Čuklja), then in 1888 he became a fishing journeyman, and upon his return from his doctoral studies in Paris, he became a master fisherman. In the meantime, during his stay in Paris, Mika was dreaming about his master's diploma, yearning for it as much as he was yearning for his doctorate degree in mathematics:

> "I used to wander and walk along the river Seine watching how they caught fish, dreaming of becoming a professional fisherman after I finish my studies and return to Belgrade. It was when I was a student back in Belgrade that I learned the fisherman trade and got my certificate of craftsmanship; I prefer it to my doctoral diploma."[153]

As a professional fisherman, Mika Alas took part in a number of important social activities. Thus, for instance, he participated in drafting the Law on Freshwater Fishing (1900), as well as in resolving the disputes with the neighboring countries, Austria-Hungary and Romania, and in developing the relevant conventions (1905–1908), in London he organized a well-noted exhibition of Serbian fishing (1907), whereas in Belgrade he organized the first exhibition of Belgrade fishing where he displayed the 83 kilo catfish that he caught in the Sava (1908), he founded a stock company with the purpose of organized exploitation of fish harvested from Ohridsko and Prespansko lakes (1921).

Still, he preferred life with fishermen on the Sava and the Danube to all these activities. There are many testimonies about this, especially about the allure of the fishermen's way of life, their joint work, code of conduct, mutual understanding and solidarity. Thus, for instance, M. Milanković wrote that, on one occasion, Mika Alas announced he would go to the river, but he unexpectedly came to his office in the Institute, because his fellow fishermen, after a good catch and good income, got drunk, got into a fight and finally ended up in custody. Academician Petrović was obviously fond of these "common" and "uneducated" people who were, plainly speaking, "honest and good-natured".[154]

Academician Stevan Sremac also spent some time with Petrović on the Sava and the Danube, in an environment totally new to him. On the occasion of publishing Stevan Sremac's Collected works in 1938[155], Petrović recalled their past adventures and retold the content of a story which Sremac was preparing, and eventually published his own story about the life and adventures of fishermen in the prewar period.

Prince Đorđe Karađorđević had similar experience, writing in his autobiography that, during the mathematics class, he complained to professor Petrović that he got bored in the palace, and it was then when the professor proposed to take him to the Sava river and teach him the craft of fishing: "Fishermen greeted the professor as an old friend. He knew everybody, and everybody knew him. Nobody stood up to pay him respect, everybody was going about their business, and greetings were expressed by shouts. My presence did not bother anyone, and it did not raise any major curiosity. Even if someone had recognized me, it could not have been noticed."[156] However, these activities did not sit well with his father, king Petar: "I am not against fishing. It is a good sport, and fishermen are honest people. I even used to fish myself, but this was during my leisure time, and I was not an heir to the throne. You are in a different situation. Your actions are in the limelight, and everything you do is commented among people. You do not belong only to yourself anymore, remember this, and take care not to cause any unwanted reaction by your behavior."[157]

Immediately after his abdication in 1909, prince Đorđe spent some time on the Danube, and in his memoirs he gave a touching description of this period: "I am running away from my home, I am running away from my family – I am running away from myself. I am spending days and days on the Danube. Together with professor Petrović I am camping in fishermen's cottages, sharing life with common fishermen. I am dressed just like them – I have one cap which I never take off. And the professor is wearing always the same straw hat. His face has gotten dark and rough from wind and sun. We keep fishing constantly, day and night, and old fishermen, my friends, keep shaking their heads worryingly, watching me depressed... The professor keeps quiet... On the lapel of his coat, even here, on the water, the pen which I used to sign my abdication sticks out..."[158]

Mihailo's life was full of curiosities. The same was with his transoceanic voyages. He crossed the Atlantic for the first time in 1924, to attend the mathematicians' congress in Toronto. He set out on his next transoceanic journey seven years after that. He was 63 at the time. During five consecutive summers from 1931, he cruised all over the Atlantic Ocean, getting into its polar areas and finally sailed deep into the Indian Ocean. He converted memories from those voyages into interesting travelogues, among which the most known one is *The Novel of an Eel,* published in 1940.

Regarding his first stay at the Sargasso Sea (1932), a few years later he complained to Milanković that he was walking around like an idle tourist, and that he could have solved the interesting, centuries-old problem of the breeding process of an eel instead. This "centuries-old problem" Mihailo Petrović tried to solve during his next two missions heading toward the Sargasso Sea in 1938 and 1939. A fishing net, which was specially prepared for this second mission, unhooked during the lifting and stayed at the bottom of the Sargasso Sea for good. Upon his return, Petrović was making design for the improved fishing net for his next trip that was planned for 1940, but the trip never happened because World War II broke out. The secret of the eels has not been fully resolved up to the present day.

In his essay "The Secret of Fish" from 1985[159] Živojin Pavlović wrote: "Thus he named his book on eel a *novel* (although it was written as a mixture of a travelogue and a scientific discussion), because the life of eels contains two characteristics of this literary genre: *adventure* and *mystery*. But, unlike fictional stories (the plot of which, in the final instance, must also have an outcome), this story, at least during Mika's life, in spite of his three attempts to resolve it by himself, remains deprived of its outcome and the resolution of a mystery."

IV

The fish is a symbol of Christianity, from its very beginning.[160] However, the carved carp that decorates the entrance door of Petrović's house in Kosančićev venac and testifies of his love for fishing, hardly symbolizes the house owner's faith.

In the voluminous written legacy of Mihailo Petrović, there are almost no clues that would shed light on his views concerning Christianity. His worldview must have been formed under the influence of his father Nikodim, who was a priest and professor at seminary, and, after his death, of his grandfather Novica Lazarević, archpriest at the Cathedral church. In such an environment, Mihailo Petrović adopted patriarchal principles and respect for traditional values, above all in the customary sense. Mihailo Petrović was dealing with scientific facts, tangible phenomena, and therefore religious topics were not the subject of his numerous discussions, because he obviously deemed them scientifically irrelevant. Since he thought very highly of Napoleon,[161] it is appropriate to mention here an anecdote familiar to mathematicians. The story has it that Napoleon, after Laplace gave him a copy of his new book titled *Celestial Mechanics*, asked the author how it was possible that in the book on the structure of the universe there was no mention of its creator, God. Laplace replied: "Your Highness, I did not need such a hypothesis". The same goes for the entire work of Mihailo Petrović, in which there is no place for contemplating and speculating about extrasensory phenomena, because he was focused on visible phenomena and the rationalistic explanation of this world's phenomena.

Still, as mentioned before, Mihailo Petrović cherished customs, so, for instance, he set St. Apostle Philemon's Day, December 5, as patron saint's day for his musical troupe "Suz". The troupe's patron saint's day was celebrated in line with all the customary rules, and there were usually more than 500 guests. Since this was the period of Nativity fast, it was necessary to catch sufficient quantities of fish on time, so 10 to 15 days prior to the patron saint's day Mika Alas went fishing everyday with his fellow fishermen. J. Mihailović testifies:

> "We were preparing for St. Philemon's Day, 5 December 1913. We had been fishing for several days now. When we went fishing on December 3, we had no luck the entire morning. We hardly provided enough for lunch that day.
>
> Right after noon, we continued fishing. When we were already on the water, before throwing the fishnet, Mika prayed to Saint Philemon, and we all prayed together with him. He uttered these words: – Help us, our patron saint, Saint Philemon, we are doing this for you, not for ourselves!
>
> Then he threw the fishnet into the river, and when we pulled it, a catfish was rolling inside it, almost two meters long. When we lifted it, it weighed 124 kilograms. Beside it, there was a lot of other fish. That afternoon we had a very good harvest."[162]

When, apart from this and some similar examples, he was supposed to state his view on the experience of perceptions outside the worldly reality, Petrović was doing it in the spirit of his worldview and positions of from his phenomenology's point of view. For instance, he concludes his book *Phenomenological Mapping* from 1936 with Chapter XI "Mythology of Facts" in which he wrote:

On the Danube shore with a foreign delegation (Belgrade, 1898: Professor Petrović is wearing a cap) (SASA Archive, 14197/II-8)

> "The oldest, more voluminous human perceptions of the outer world, myths of various peoples in the childhood stage of awareness and cognition development, are nothing but a special form of mapping. The basis for mythical mapping lies in the mystical anticipation of a primitive mind implying that, beyond the visible, concrete world, there is another one, inaccessible to it, filled with entities whose play behind the scene determines the events that take place in the visible world."

This quote brings us back to the idea of fishing in psychoanalysis. In a dictionary of symbols[163], fishing is the extraction of elements of the unconscious, but not by directed and rational research, but rather by allowing them to emerge spontaneously. Here, the unconscious is compared to a water expanse, a river, a lake or a sea in which many riches are hidden, and which will be lifted to the surface by anamnesis and analysis, just like a fisherman lifts fish in his fishnet.

Based on this symbolism, we introduce the analogy based on which the water expanse of the unconscious is equal to the space of ignorance or hidden knowledge. Thus fisherman becomes the symbol of knowledge bearer or mediator, and fishnet becomes a knowledge medium or a carrier. The fish caught in this mystical mapping become the owners of knowledge that transforms them into knowledge bearers – fishermen.

Mihailo Petrović's memory from fishing (SASA Archive, 14197/II-24-1)

By using this analogy, fishing which Mihailo Petrović took up literally, i.e. "in the visible world" is expanded by fishing where the catch was of different nature. In the mathematical net of professor Petrović, the first such net in Serbia, his doctoral students were caught. 11 doctoral theses in total were defended under his mentorship from 1912 to 1938. Petrović's students then taught their students to fish in mathematical sense, so the tree of mathematical fishermen grew wider, and most of our professional mathematicians can be found in it, whereas Mihailo Petrović is in the root of this tree. About eight hundred mathematicians, out of which more than five hundred are Serbian, are connected by mentorship of their doctoral dissertations, as successors of the "arch-mentor" professor Petrović.[164]

Professor Vladeta Janković writes that, in a sense, it could be said that the Christian church was born at the moment when Jesus invited four fishermen to follow him.[165] By analogy among disparate phenomena, we could say that mathematical sciences in Serbia were born when Mihailo Petrović returned from Paris, and owing to his enormous efforts invested in the field of education, scientific work, seminars, founding of the Academy's journal titled *Publications de l'Institut Mathématique*, and his mentorship of the first generation of professional mathematicians in Serbia.

Finally, near the end of his life filled with fishing, when setting out on long journeys, Mika Alas used to say: "I am already in my late years, what I have done, I have done. If I return from this journey alive and manage to do something else, it is pure benefit. And if I die, it does not matter. I will be buried there where the death finds me. It would be best if I died on a ship and they throw me into the sea so that fish can eat me and have their revenge because I was catching and eating them a lot."[166]

Something similar was said by Serbian Patriarch Pavle, when he was flying over the sea and the airplane got into the zone of turbulence. Asked what he thought about the possible airplane crash, the Patriarch replied: "In relation to myself, I will see it as an act of justice, because during my lifetime I ate so much fish that it would be strange if they would not eat me now."[167]

These quotes bring us back to Mihailo Petrović's thought which says "it is not rare in science that a certain phenomenon, with its appearance, more or less has point of semblance to other phenomenon, totally different from it and with no real relations with it, but similar to it in a way."[168]