THE PATH OF MILUTIN MILANKOVIĆ'S BOOK MANUSCRIPT "MATHEMATICAL THEORY OF THERMAL PHENOMENA CAUSED BY SOLAR RADIATION"

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Abstract. While working on the correspondence of Milutin Milanković (Dalj, 1879 – Belgrade, 1958) at the Serbian Academy of Sciences and Arts (SASA) in Belgrade, I came across a letter sent by Milanković to the Royal Hungarian Academy of Sciences in Budapest. In it, Milanković thanks the Academy for allowing him to spend his years of internment during the First World War in its library and enabling him to engage in scientific work. In those years, the text of his book "*Mathematical theory of thermal phenomena caused by solar radiation*" was written, and as a sign of gratitude he sent them its original typescript, which he wrote at the time under the title "*Mathematische Grundlagen der kosmischen Strahlungslehre*". The letter is dated April 2, 1941. Given that Belgrade was bombed just a few days later, on April 6, 1941, I was interested in whether the manuscript reached the Hungarian Academy. To my inquiry, they replied that they had received it and that it was in the archive.

The path of the manuscript did not go as Milutin Milanković planned. After the First World War, it was desirable that the book be printed in French. Given that Milanković did not speak French well enough, the translation from German to French was entrusted to Ivan Djaja (Le Havre, 1884 – Belgrade, 1957) and Mihailo Petrović Alas (Belgrade, 1868 – Belgrade, 1943). Milanković duly copied his original manuscript in German and handed it over to Djaja and Petrović. After completing their translation, Milanković also copied the translation. Both manuscripts are in SASA. The book was published in Paris in 1920 under the title "Théorie mathematique des phénomènes thermiques produits par la radiation solaire". The results published in this book have attracted the attention of many scientists. Wladimir Köppen and Alfred Wegener invited Milutin Milanković to collaborate in their book "The climates of the geological past".

On April 20, 2017, in the Library and Information Centre of the Hungarian Academy of Sciences a memorial plaque in memory of Milutin Milanković was unveiled.

1. INTRODUCTION

During the First World War, although Milutin Milanković was in captivity, he was allowed to continue his scientific work in the library of the Hungarian Academy of Sciences in Budapest (Milanković, 1952). Starting in 1912, Milanković dealt with climate change based on mathematical calculations with the aim of calculating the temperature at different points on Earth (Szarka, Soon, Cionco, 2021).
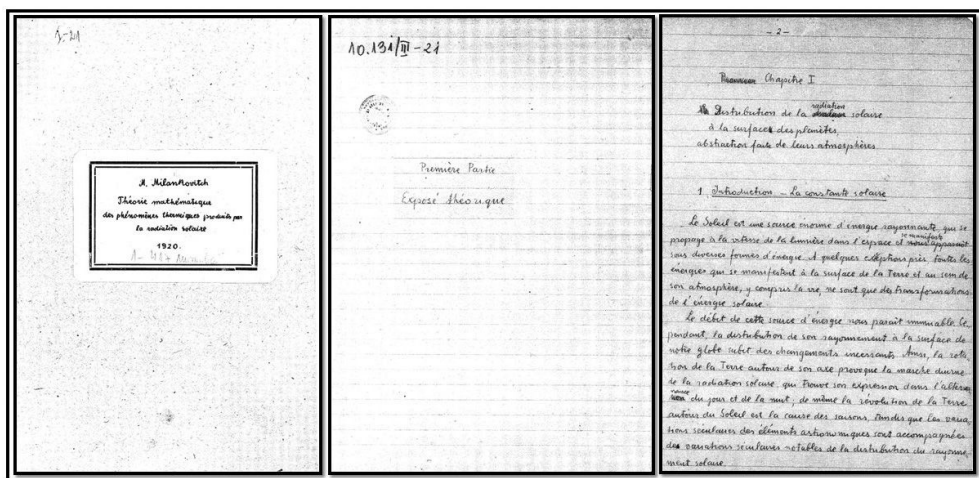
Figure 1: The manuscript of the book "Théorie mathematique des phénomènes thermiques produits par la radiation Solaire," in French (SASA Archive – 10.131/III-21).

2. TRACE OF THE BOOK'S MANUSCRIPT

Milanković continued to work on the study of climate change during his entire stay in Budapest during the First World War. The manuscript that was created at the time was in German with the title "Mathematische Grundlagen der kosmischen Strahlungslehre" ("Mathematical foundations of the theory of cosmic radiation") on 334 pages.

Milanković finished the work in the middle of 1917 and it was handed over to the publisher B. G. Teubner in Leipzig, the largest publishing company for works with a mathematical content (Milanković, 1952). Milanković's work was ready for printing at the beginning of 1918, but the company ran out of paper (Milanković. 1952). However, since after the First World War it was recommended not to publish works in German, the book was translated into French (Trifunović, 2007). The translation from German to French was done in collaboration by Ivan Djaja[1] and Mihailo Petrović - Alas[2] (Trifunović, 2007). The manuscript in French is kept in the Serbian Academy of Sciences and Arts (Fig. 1).

The work was published in 1920 under the title "Théorie mathematique des phénomènes thermiques produits par la radiation solaire" ("Mathematical theory of thermal phenomena caused by solar radiation") and was a crucial forerunner in the field of (paleo)climatology (Fig. 2). It was this book that launched Milanković into the scientific world in the field of (paleo)climatology, which enabled Milanković to meet, contact and collaborate with many scientists, primarily Wladimir Köppen and Alfred Wegener (Janc et al., 2018).

Milanković wanted to bequeath the original manuscript in German (Fig. 2) to the

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[1]Ivan Djaja (Le Havre, 1884 – Belgrade, 1957) was a Serbian biologist and physiologist, professor and member of the Serbian Academy of Sciences. French was his mother tongue, so he was entrusted with the translation of Milanković's monograph.

[2]Mihailo Petrović - Alas (Belgrade, 1868 – Belgrade, 1943) was a well-known professor of mathematics at Belgrade University and a member of the Serbian Royal Academy.
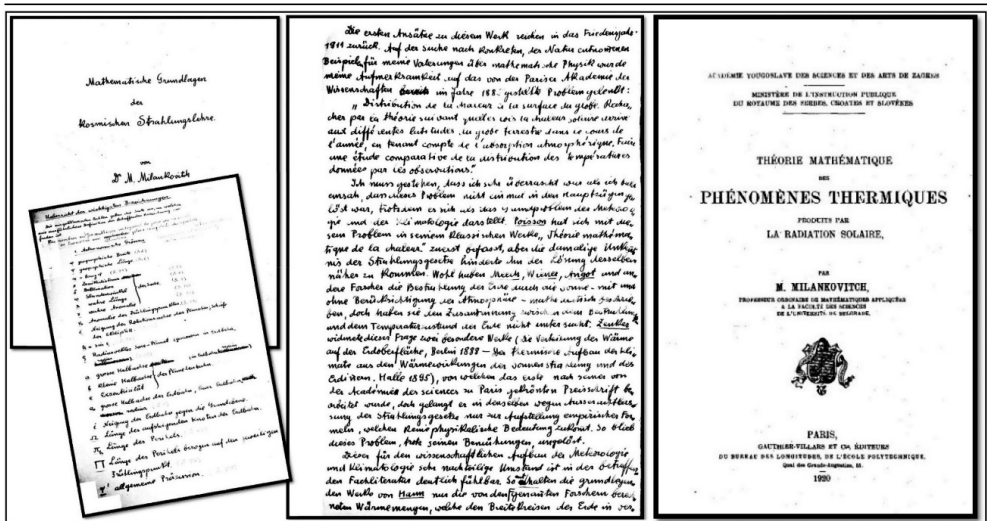
Figure 2: Title page of the manuscript "Mathematische Grundlagen der kosmischen Strahlungslehre" ("Mathematical Foundations of the Theory of Cosmic Radiation"), first page of the manuscript and list of mathematical symbols (copies obtained courtesy of the Hungarian Academy of Sciences on 15 December 2023), (left). The title page, théorie mathematique des phénomènes thermiques produits par la radiation solaire (Mathematical theory of thermal phenomena caused by solar radiation), M. Milankovitch, 1920. (right).

Hungarian Academy of Sciences, and sent it with a cover letter written on April 2, 1941 (Fig. 3), just a few days before the bombing of Belgrade, which began at dawn on April 6, 1941. The concept of the cover letter is kept in Archives of the Serbian Academy of Sciences and Arts. Fortunately, the manuscript reached the Hungarian Academy of Sciences undamaged, where it is kept in their archives.[3]

Milutin Milanković to the Hungarian Academy of Sciences, (SASA Archive, 10.131/10).

2-IV-1941

To the Hungarian Academy of Sciences, Budapest

The accompanying manuscript, which was later published in a French translation under the title "Théorie mathématique des phénomènes thermiques produits par la radiation solaire", Paris 1920, was written by myself in 1915–1917. in the reading room of this Academy thanks to the hospitality of the "Royal Hungarian Academy of Sciences". I allow myself to present this manuscript, which was the starting point and on which all my further works in this field were built, as a token of my deepest gratitude to the Hungarian Academy of Sciences.

In memory to the stay and scientific work of Milutin Milanković in the Hungarian Academy of Sciences, a memorial plaque was installed, which was ceremonially unveiled on April 20, 2017 (Fig. 3).

The text on the memorial plaque reads: "Serbian geophysicist and astronomer

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[3]Information obtained from the Hungarian Academy of Sciences, (author's note).
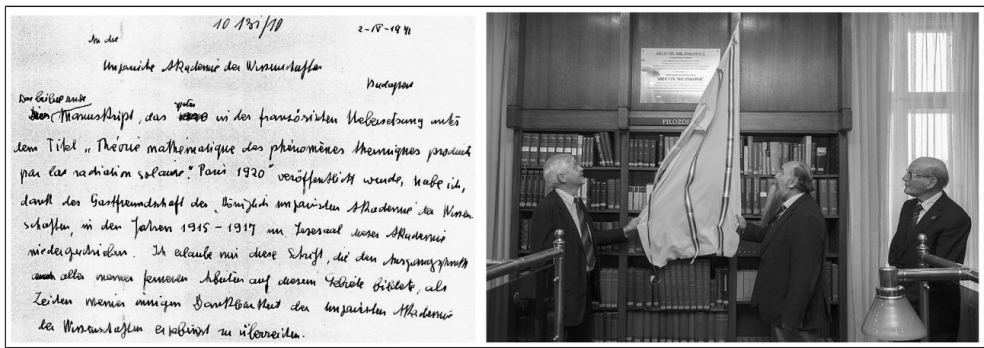
Figure 3: Facsimile of Milutin Milanković's letter to the Hungarian Academy of Sciences, (SASA Archive 10.131/10), (left). Unveiling the memorial plaque to Milutin Milanković in the Library of the Hungarian Academy of Sciences where he was doing his research work during his WWI internment period (1914-1918). Aföld Napja - 2017 - Earth Day, MTA CSFK, MTA KIK (Photos by Dóra Velican-Patrus, Courtesy of the Library and Information Center of the Hungarian Academy of Sciences.) (right).

Milutin Milanković was allowed to spend his internment during the First World War (1914-1918) working on research in the Library of the Hungarian Academy of Sciences. The theory of the connection between long-term climate changes and astronomical factors that affect the amount of solar energy that the Earth receives is established here. Aföld Napja - 2017 - Earth Day, MTA CSFK, MTA KIK".

Acknowledgements

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