

Marian Smoluchowski (1872 – 1917)



Marian Smoluchowski was an outstanding Polish theoretical physicist, fine experimentalist and also a great personality from the intellectual and ethical point of view. He was born on 28 May 1872 in Vorderbrühl, the Vienna suburb, in the family of Wilhelm Smoluchowski and Teofila Szczepanowska. His father, Doctor of Law, graduate of the Jagiellonian University in Cracow, was a high rank official in the Cabinet's Chancellery of the Emperor Franc Joseph I. In German documents Smoluchowski's family appear as Ritter von Smolan-Smoluchowski, but in spite of living under Austro-Hungarian Empire Marian's parents cultivated their Polish roots and traditions.

From 1880 to 1890 Marian attended the Collegium Theresianum in Vienna, a prestigious school, one of the best in Central Europe at that time. Graduated and awarded certificate with distinction, he entered in 1890 the University of Vienna, Faculty of Philosophy, to study physics. Toward the end of his university years (1894/1895), Smoluchowski served for a year in the Austrian army. At the same time he defended his PhD thesis entitled "Acoustic studies of the elasticity of soft bodies", graduating the University of Vienna with distinction in 1895.

Having finished the university education at the age of 23, he was offered a trip around the world with a son of the Vienna Rotschilds. However, Marian preferred to set off to several European laboratories of physics. He worked in Paris, at the Sorbonne, in the laboratory of Gabriel Lippmann, then in Glasgow under William Thompson (Lord Kelvin), and in Berlin under Emil Warburg.

In 1898 Smoluchowski became Privatdozent, i.e. obtained habilitation, back at the University of Vienna. In 1900, at the age of 28, Marian Smoluchowski got the Chair of Theoretical Physics at the Lvov University (now Ukraine), becoming the youngest University professor (from 1903 – full professor) in the whole Austro-Hungarian Empire. Smoluchowski worked in Lvov until 1913, when he accepted the Chair of Experimental Physics at the Jagellonian University in Cracow. He was elected for the Rector of this University just before his premature death on 5 September 1917, at the age of 45.

Marian Smoluchowski made outstanding contributions to physics and mathematics. He laid the foundations of modern statistical physics and the theory of stochastic processes, in particular. Smoluchowski was the first to introduce fluctuations into physics (in 1904). Arnold Sommerfeld wrote: "His name will, forever, be associated with the first flowering of atomic theory". Theoretical descriptions of the Brownian motion phenomenon by Albert Einstein (published in May 1905) and Marian Smoluchowski (July 1906) significantly contributed to the breakthrough in understanding of the structure of the matter – the reality of atoms. Smoluchowski would probably have been the first to publish a quantitative theory of the Brownian motion if he had not had objections to print his early theoretical findings without a proper experimental verification. Einstein acknowledged the value of Smoluchowski's theory with words: "Smoluchowski delivered particularly beautiful and descriptive theory of Brownian motion".

Smoluchowski derived equations describing the Brownian motion of a suspended particle in terms of probability, both in the absence of, and under external fields. The equations, named after him, are commonly used in various physical, chemical and other problems. He was the first to realize and mathematically prove that "the process of diffusion is the superposition of Brownian motions of the molecules of the substance under consideration" (1915), which made it possible to link theoretically the microscopically reversible nature of molecular fluctuations with the macroscopically irreversible nature of diffusion.

In 1908 Marian Smoluchowski proposed a theory of critical opalescence which explains the fluctuations in the refractive index of a fluid, liquid or gas. In addition, Smoluchowski's research interests covered topics such as application of probability theory to radioactivity, ionization of gas molecules by X-rays, heat conductivity of gases, aerodynamics and glacier movement.

During his short life Smoluchowski received many honors for scientific achievements. He was awarded an honorary doctorate by the University of Glasgow in 1901 and the Haitinger's Prize of Vienna Academy of Sciences in 1908. He was the Wolfskehl Foundation lecturer at Göttingen in 1913 and again in 1916. In 1908 Smoluchowski was elected a Corresponding member of the Academy of Sciences in Cracow, becoming a full member in 1917. He was also a member of the Copernicus Society of Natural Scientists in Lvov, being a President of Society in 1906 – 1908. Besides physics, he published in the fields of physical chemistry, geophysics and geology. After Smoluchowski's death, two scientists, who collaborated with him in the area of the kinetic theory of matter, received Noble Prizes (R. Zsigmondy in 1925 and T. Svedberg in 1926).

Apart from the scientific activity, Marian Smoluchowski had two lifelong passions; one of them was mountain climbing, and the other was music. He climbed in Alps, East Carpathians, Scotland and Tatra Mounts. Together with his brother Tadeusz, they belong to the pioneers of modern alpinism. In a letter to the German and Austrian Alpine Association Marian Smoluchowski wrote:

“There are three most valuable things which I get from the mountains:

- I get used to undertaking difficult tasks,
- I get happiness from overcoming the challenges,
- They embellish my everyday life with the loftiest poetry: the poetry of the world of mountains.”

Smoluchowski loved also music and played the piano with special affection for the works by Wagner, Brahms, Brückner, Franck and Karłowicz. Among his family and friends he played also accompaniment for the songs by Schubert, Schumann and Mendelssohn.

A view into personality of Marian Smoluchowski may also be found in his words devoted to the problem of difficult conditions for women in science in that time: “Women who decide for the scientific career should be strongly supported; all societal obstacles, all those ridiculous old views which for women ... make difficult the education, scientific work and access to leading university positions should become extinct. In science (and also in other areas) the principle of independent contest should prevail” (Lvov, 1912).

Albert Einstein wrote after Smoluchowski’s death: “All people, who personally knew Smoluchowski closer, loved in him not only a brilliant researcher, but also a noble, sensitive and friendly man”. Władysław Natanson, a prominent Polish physicist, wrote in Smoluchowski’s obituary: “With great pleasure I would revive the charm of his life, knightly softness of his heart, combined with exquisite kindness. I wish I could reconstruct the odd appeal of his personality, recall how restrained he was, modest, and beautifully timid, yet always full of pure, almost unintentional joy.”