

## Joint seminar of the NPI of the CAS

23. 1. 2025

**Prof. Jiří Chýla, CSc. (Institute of Physics, CAS):**  
*Knowledge born of despair*

Abstract:

The true story how Planck discovered quantum, but never understood its meaning.

The standard description of the situation in physics at the end of 19. century and what motivated Planck in his work on black body radiation is a fairy-tale that has nothing to do with reality, which was quite different and much more interesting. It shows how difficult it was even for the brightest physicists to accept the idea that atoms are not governed by classical physics. The road to quantum theory started, although nobody realized it, already in 1896 when Wilhem Wien derived his law of black body radiation that until the very end of 19th agreed perfectly with all data. I will trace Planck in his effort to derive Wien formula from Second Law of Thermodynamics, which he considered dynamical law and recall his shock when data of Lummer and Pringsheim and Kurlbaum and Rubens at the turn of 19th century showed deviations from Wien law at large temperatures and large wavelength. I will discuss his two attempts to derive the formula that agreed with all the available data, and which is now called Planck law. I will recall his own words to justify the title of this seminar and close the first part of the seminar with explanation of the meaning of its subtitle.

Then I will turn to Einstein and his 1905 paper Concerning an Heuristic Point of View Toward the Emission and Transformation of Light which contains the key concept of the photon as manifestation of wave-particle duality and its application to explanation of the photo-effect, for which Einstein got in 1922 the 1921 Nobel Prize in Physics. I will emphasize the fact, that Einstein arrived at the concept of photon without using Planck law. Einstein was first and for next two decades the only physicist who understood the truly fundamental meaning of Planck quantum. I will end by recalling that Einstein's idea of wave-particle duality motivated Louis de Broglie to extend it to the electron, which was in turn used by Schrödinger to propose his equation.