History and Philosophy of Physics

Wednesday, 11.09.2024, Room ETZ E 7

Time	ID	History and Philosophy of Physics *Chair: Claus Beisbart, Universität Bern, NN*
14:30	**71**	**Philosophical Implications of Quantum Gravity** *Baptiste Le Bihan, Université de Genève, Département de Philosophie* Although extremely successful in their domains of description, general relativity and the Standard Model of particle physics rest on very different conceptual foundations, making it extremely difficult to describe phenomena involving gravity and high energies, such as black holes. The talk will provide a brief description of the most popular approaches to quantum gravity being investigated and will show how philosophical arguments can be applied in contexts where very different alternative research programs coexist in theoretical physics. Focusing on the concept of spacetime emergence, it will be shown that even in the absence of a complete theory of quantum gravity, one can already draw interesting implications regarding the nature of spacetime, for example such as whether spacetime could have failed to exist according to the laws of nature.
15:00	**72**	**Quantum mechanics in a course on "Higher algebra": Wolfgang Pauli, Emil Artin, and the representation theory of semi-simple systems** *Peter Ullrich, University of Koblenz* Bartel Leendert van der Waerden's (1903–1996) 1932 book Die gruppentheoretische Methode in der Quantenmechanik (translated as Group theory and quantum mechanics) benefited from his contacts with Werner Heisenberg (1901–1976) at the University of Leipzig and documents the early collaboration between quantum mechanics and the – then – "modern" algebra. However, personal relationships had already played an important role before: In the winter semester of 1927/28, Wolfgang Pauli (1900–1958) attended a lecture course on "Ausgewählte Kapitel der höheren Algebra" (= "Selected chapters of higher algebra") which Emil Artin (1898–1962) gave at the University of Hamburg and in which he dealt with representation theory. That Artin cared about Pauli's need to apply this theory to quantum mechanics is shown by studying a set of notes which Pauli took during the lecture course and which he later referred to several times.
15:30	**73**	**Dichroic Light Polarizers from Tourmaline to Polaroid and Bernotar Filters** *Jean-François Loude, EPFL* The surprising optical properties of tourmaline were studied soon after the discovery of the polarization of light. Thin slices worked as polarizers, enabling the construction of simple, handheld polariscopes. The tourmaline tongs described by Karl Michael Marx in 1828 were a great success, especially after Nörrenberg simplified their construction. The fortuitous discovery in 1852 of almost colourless herapathite aroused great interest. However, efforts to produce crystals exceeding about one square centimetre remained unsuccessful until the early 1930s, when Edwin Land in the USA and Ferdinand Bernauer in Jena succeeded in manufacturing large sheets, thus extending the field of applications beyond mineralogy.ge sheets, thus extending the field of applications beyond mineralogy.

16:00	**74**	**Can machine learning models provide an understanding of physical systems?** *Claus Beisbart, Universität Bern* These days, machine learning (ML) is all the rage in physics and other disciplines. While there is agreement that ML can be strong at classification and prediction tasks, it has remained controversial what it can contribute to the understanding of real-world phenomena. Some authors claim that the opacity of ML is an obstacle to the use of ML for understanding, while others have given examples in which ML seems to have contributed to understanding. In my talk, I try to negotiate between these opposing views. I argue that ML models as such do not provide humans with understanding unless humans can tell what the explanation is – and this requires transparency. However, ML models can be used to identify difference makers at the level of known variables and thus contribute to causal understanding. I illustrate my argument with examples from physics.
16:30		***END; Coffee Break***