Public Symposium: 100 Years of Quantum Physics & Public Lecture

Monday, 18.08.2025, Room Großer Festsaal

Time	ID	100 YEARS OF QUANTUM PHYSICS *Chair: Jérôme Baudry, EPF Lausanne*
14:00	11	**The Tangled Tale of Entanglement: New Discoveries from Schrödinger's Research Notes** *Christoph Lehner, Max-Planck-Institut für Wissenschaftsgeschichte Berlin* Today, entanglement is commonly accepted as the most striking and characteristic phenomenon of quantum mechanics. But this realization was slow to emerge, in the early years of quantum mechanics, entanglement was just seen as a normal statistical correlation. Only with Einstein, Podolsky and Rosen's "Can quantum mechanical description of reality be considered complete?"(1935) and Schrödinger's "Die gegenwärtige Situation in der Quantenmechanik" (1936) did the phenomenon come into focus as a central and puzzling feature of quantum mechanics. However, not much has been known about the prehistory of these papers. Jos Uffink and me were able to trace the development of both Einstein's and Schrödinger's thought, using Schrödinger's correspondence and especially his extensive research notes. We especially found that they both got important input from Leo Szilard, who proposed in 1931 a thought experiment that is a direct precursor to the EPR experiment and a quantum mechanical state that is essentially identical to the EPR state.
14:45	12	**Scenes from the Quantum Century: From Curious Hippies to Novel Tests of Bell's Inequality** *David Kaiser, Department of Physics, MIT* The hundredth anniversary of quantum mechanics in 2025 offers opportunities to consider the history of quantum theory and ask how some of our core ideas were introduced, debated, tested, and ultimately accepted. One of the most central conceptual ingredients of quantum theory is entanglement, nowadays so important to the burgeoning field of quantum information science and technology. Yet the history of quantum entanglement---and of physicists' efforts to understand whether entanglement is a robust feature of the world rather than merely an intriguing hypothesis---has been far from straightforward. In this talk I will describe how a colorful group of physicists during the 1970s wrestled with entanglement and with John Bell's now-famous inequality, exploring the subtle interplay between quantum nonlocality and relativity amid the California counterculture scene. More recently, retracing the history of efforts to conduct experimental tests of Bell's inequality helped to catalyze novel tests, which have aimed to close a series of loopholes, including the recent "Cosmic Bell" experiments. These experiments provided compelling evidence for quantum entanglement while constraining certain classes of alternative models – which exploit a particularly subtle loophole – more thoroughly than ever before.
15:30		***Coffee Break***
		Chair: Christian Wüthrich, Université de Genève
16:00	13	**Philosophy of Quantum Mechanics Beyond the Measurement Problem** *Alyssa Ney, LMU München* One hundred years after Heisenberg's discovery of quantum mechanics, there is still no consensus over even basic facts about its interpretation. One reason for this impasse can be traced to a disagreement in the first place about the role of the observer in quantum physics. Since the development of the Copenhagen interpretation in 1927, observers and measurements have been central elements in orthodox presentations of quantum mechanics. And yet in the philosophy of physics, there is a persistent narrative that such interpretations face a "measurement problem," that references to observers or measurements should not be included in presentations of our

		fundamental physical theories, but rather such phenomena should be regarded as emergent from more fundamental ontologies described by the quantum wave function or other parameters. This paper proposes a way of reconciling this disagreement by developing the ideas of John Archibald Wheeler. It finds particular inspiration in the reaction of Wheeler, over several decades, to the interpretation of his doctoral student, Hugh Everett, which later became the many worlds interpretation
16:45	**14**	**Wolfgang Pauli's and Erwin Schrödinger's Insights from the Perspective of a Modern Quantum Technologist** *Beatrix Hiesmayr, Universität Wien* This lecture examines the scientific insights of Wolfgang Pauli and Erwin Schrödinger—two outstanding yet very different personalities—from the perspective of current research. It addresses both their ideas, which are now considered universally accepted knowledge, and their misconceptions. A particular focus is placed on how the scientific discourse distinguishes between "right" and "wrong" and how the daily life of researchers has changed compared to the past.
17:30		***END, Welcome Reception***
18:00		***General Assemblies of ÖPG * and SPS *****
		Public Lecture *Chair: Michel Calame, Empa & Universität Basel*
19:00	**15**	**The European X-Ray Free Electron Laser** *Thomas Feurer, European XFEL GmbH, Holzkoppel 4, DE-22869 Schenefeld* X-ray Free Electron Lasers (XFELs) have greatly enhanced our ability to observe transient nuclear and electronic motions in real time at atomic resolution, thereby deepening our fundamental understanding of matter across different disciplines. Moreover, XFELs offer several significant advantages in High Energy Density (HED) science, which deals with matter under extreme conditions of temperature and pressure. For instance, XFELs can probe structure and ionization dynamics in warm dense matter, a regime between solid and plasma states, investigate material response to ultra-high pressures, help refine models of radiation transport at extreme conditions, and recreate and study conditions inside gas giants or white dwarfs. Most XFELs today generate pulses that consist of amplified noise, leading to significant shot-to-shot fluctuations. While these pulses exhibit high transverse coherence, their longitudinal coherence remains very low. In this talk, I will present two methods for controlling longitudinal coherence and demonstrate their application in X-ray spectroscopy. Such experiments are made possible only by the resulting exceptional spectral brilliance of XFEL sources. Specifically, I will discuss a nuclear clock transition in one of the scandium isotopes. By controlling the nonlinear phase-space dynamics of ultrashort electron bunches, undulators can be made to emit pulses as short as attoseconds. Such pulses are ideal for probing electron dynamics on their natural timescales. In this presentation, I will highlight applications where attosecond pulses are used to create transient population inversion in inner-shell electrons. Lastly, I will discuss several applications of XFELs in the area of high energy density science. For example, I will present the first experimental evidence of liquid carbon, formed by shock-compressing graphite with a high-energy laser and probing it transiently using ultrashort XFEL pulses. Additionally, I will show the first experimental observation of plasma compression driven by relativistic currents in a cylindrical geometry; this effect was predicted over two decades ago but never confirmed until now. These experiments underscore the transformative impact of XFELs on advancing inertial fusion energy research.
20:15		***END***

* ÖPG: Room HS 31, ** SPS: Room HS 30