

SESSIONS

Plenary Session

Thursday, 27.03.2008, Room 0080 (Ground floor)

Time	ID	PLENARY SESSION AND SPS AWARD CEREMONY <i>Chair: Ø. Fischer, Uni Genève</i>
08:30	901	Bose-Einstein condensation meets Cavity QED <i>Tilman Esslinger, Department of Physics, ETH Zürich</i> Cavity quantum electrodynamics (cavity QED) has proven to be exceedingly successful in illuminating matter-light interaction and in providing a platform to test ideas for quantum information processing. In this talk I will report on the strong coupling of a Bose-Einstein condensate to the quantized field of an ultrahigh-finesse optical cavity. By trapping the Bose-Einstein condensate inside the cavity we enter a new regime of cavity QED where all atoms occupy a single mode of a matter-wave field and couple identically to the light, sharing a single excitation [1]. <small>[1]: Cavity QED with a Bose-Einstein condensate, F. Brennecke, T. Donner, S. Ritter, T. Bourdel, M. Köhl, and T. Esslinger, Nature 450, 268 (2007).</small>
09:15	801	Molecular Electronics: The Limits of Miniaturization <i>Christian Schönenberger, Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i> While present-day electronic appliances already encompass organic materials, there remains an enormous potential for molecules and their assemblies as functional components in future electronic devices. Molecules are the smallest building blocks that still provide designable functionalities, including optoelectronic ones. Hence, their integration in electronic circuits - today referred to as Molecular Electronics - is considered as the ultimate size reduction of functional electronic devices. Driven by the large application potential and the new fascinating scientific challenges, chemists, physicists, engineers and material scientists are gathering to pursue the development of a novel molecule-based nano-electronics. However, despite all the enthusiasm which has been generated by this field, it is not clear whether a functional electronics based on single molecules will ever emerge. As compared to today's processors, containing millions of transistors, the state-of-the-art in Molecular Electronics is ways off. In the present talk, research in this field which is conducted at the Swiss Nanoscience Institute at Basel, will be presented.
10:00		Coffee Break

10:30	701	<p style="text-align: center;">Spintronics: fundamentals and recent developments</p> <p style="text-align: center;"><i>Albert Fert, UMR CNRS/Thales, F-91767 Palaiseau and Université Paris-Sud, F-91405 Orsay</i></p> <p>Spintronics, at the interface between magnetism and electronics, is a research field in considerable expansion. It takes its roots in results of fundamental research on the electrical conduction in ferromagnetic conductors and its development followed the discovery of the Giant Magnetoresistance (GMR) of the magnetic multilayers in 1988. Its basic concept is the manipulation of spin currents, in contrast to mainstream electronics in which the spin of the electron is ignored.</p> <p>After an introduction on the fundamentals of spin dependent conduction, the GMR and the applications of GMR, I will focus on the most recent developments of spintronics. This will include a review of results on spin transfer (magnetic switching or generation of microwave oscillations by injection of spin angular momentum from an electrical current), spin injection into semiconductors, spin transport in a semiconductor between spin-polarized source and drain, spin transport in molecules. The synchronization and phase locking of a collection of STO's (Spin Transfer Oscillators) is an example of important new problem raised by the progress in the generation of microwave oscillations by spin transfer. Finally, the natural evolution of spintronics towards nanospintronics will be illustrated by recent results on single-electron spintronics.</p>
11:15 SPS AWARD CEREMONY		
11:45	601	<p style="text-align: center;">Time, Frequency and Atomic Clocks</p> <p style="text-align: center;"><i>Gaetano Mileti, Uni Neuchâtel</i></p> <p>The talk concerns the latest developments in the field of measurement of time (and of frequencies). We will first give a short historical overview and present the basic notions and tools necessary to predict or characterise the stability and the accuracy of oscillators: resonance quality factor (Q), Allan deviation, etc. Then, we will describe how the progress in atomic physics, photonics and quantum metrology has allowed to improve both the primary and the secondary frequency standards, during the last fifty years. In particular, we will explain how the control and manipulation of atoms with photons was used to build better clocks: from optical pumping to laser cooling and trapping. We will also comment on the direct impact of recent technological developments in the domain of laser sources: narrowband, tuneable laser diodes and optical combs. Examples of practical and fundamental applications on ground and in space will be given, and the main contributions of Switzerland in this strategic domain will be highlighted, nonetheless the realisation of the two types of atomic clocks for the European satellite navigation system GALILEO, and their improved versions currently under development. Finally, two promising research areas will be outlined: optical frequency standards (which may lead to the redefinition of the second) and chip-scale atomic clocks.</p>
12:30	Postersession, Lunchbuffet	
14:00	Parallel Sessions	
18:00	END	