SYLV 1: SYLV I

Zeit: Montag 14:00–16:00 Raum: VMP 8 HS

Hauptvortrag SYLV 1.1 Mo 14:00 VMP 8 HS

Coherence, interference and entanglement in the photoionization of homonuclear diatomic molecules — •Reinhard Dörner[1], M. Schöffler[1], T. Jahnke[1], K. Kreidi[1], D. Akoury[1], L.Ph.H. Schmidt[1], H. Schmidt-Böcking[1], J. Titze[1], N. Neumann[1], T. Weber[2], M.H. Prior[2], A. Belkacem[2], P. Ranitovic[3], C.L. Cocke[3], A. Landers[4], S. Semenov[5], and N. Cherepkov[5] — [1]J. W. Goethe-Universität Frankfurt, Max von Laue Str. 1, D-60438 Frankfurt am Main — [2]Lawrence Berkeley National Laboratory, Berkeley CA 94720 — [3]Kansas State University, Manhattan KS 66506 — [4]Auburn University, Auburn AL 36849 — [5]State University of Aerospace Instrumentation, 190000 St. Petersburg, Russia

Emission of two electrons from N_2 and H_2 by absorption of one photon resembles a two particle double slit experiment in which both particles are entangled. We report experiments [1,2,3] in which both electrons and both ions resulting from this process are measured in coincidence showing these interference structures and the entanglement of the two electrons.

[1] Akoury et al., Science **318**, 949 (2007)
[2] Kreidi et al., Phys. Rev. Lett. **100**, 133005 (2008)
[3] Schöffler et al. Science**320**, 920 (2008)

Hauptvortrag SYLV 1.2 Mo 14:30 VMP 8 HS

Quantum Interfaces between Nanomechanical Systems and Cold Atoms — •Peter Zoller — Institut für Theoretische Physik, A-6020 Innsbruck, Austria

We propose and analyze quantum interfaces between nanomechanical systems and single atoms, or to ensembles of atoms, where the exchange of optical photons plays the role of the quantum data bus. Specific examples to be discussed include the generation of a continuous variable EPR-state and teleportation protocol between a nanomechanical oscillator and a distant atomic ensemble [1], the strong coupling of single atoms in cavities in an optomechanical setup [2], and couplings of cold atoms in an optical lattice to a moving mirror or membrane [3].

[1] K. Hammerer, M. Aspelmeyer E.S. Polzik, and P. Zoller, Phys. Rev. Lett. in press

[2] K. Hammerer, M. Wallquist, H.J. Kimble, J. Ye and P. Zoller, in preparation

[3] P. Treutlein, S. Camerer, D. Hunger, T. W. Hänsch, M. Wallquist, K. Hammerer, C. Genes and P. Zoller, in preparation

Hauptvortrag SYLV 1.3 Mo 15:00 VMP 8 HS

Electron entanglement studied by Dopppler-resolved electron spectroscopy — •Svante Svensson — Uppsala University, Uppsala, SWEDEN

A review of the research on x-ray quantum optics based on the studies of emitted electrons and ions will be given. The starting point is the discovery of the Auger Doppler effect and the far reaching consequences of the possibility to "mark" core ionized species in an ultra-fast dissociation process. The presentation will end in the most recent results on the subject.

Hauptvortrag SYLV 1.4 Mo 15:30 VMP 8 HS

Entanglement-assisted Ramsey Spectroscopy with Atomic Ensembles — •Eugene Polzik — The Niels Bohr Institute, Copenhagen University, Blegdamsvej 17, Copenhagen, Denmark

Ultimate quantum fluctuations which limit the fundamental precision in metrology can be only reduced by entanglement of particles. In particular, squeezing of the fluctuations called the spin projection noise by means of generation of entanglement in an ensemble of atoms can improve the precision of Ramsey spectroscopy and of atomic clocks. A powerful tool for generation of multiparticle entanglement is a quantum nondemolition measurement (QND). We will describe the fundamentals of QND measurement of atomic collective state with light and present a recent experiment [1] where this method has been used to reduce the projection noise on the clock transition in an ensemble of 105 cold and trapped Cesium atoms. Nondestructive probing can be also used to monitor classical properties and dynamics of atoms with excellent S/N ratio [2].

[1] J. Appel, P. J. Windpassinger, D. Oblak, U. B. Hoff, N. Kjærgaard, and E. S. Polzik. Quantum noise squeezing and entanglement on the atomic clock transition. Submitted for publication. arXiv:0810.3545
[2] Windpassinger, P. J., Oblak, D., Petrov, P. G., Kubasik, M., Saffman, M., Alzar, C. L. Garrido, Appel, J., Mueller, J. H., Kjærgaard, N., and Polzik, E. S. Nondestructive probing of Rabi oscillations on the cesium clock transition near the standard quantum limit. Phys. Rev. Lett., 100, 103601 (2008); Windpassinger, P. J., Oblak, D., Hoff, U.B., Appel, J., Kjærgaard, N., and Polzik, E. S., Inhomogeneous light shift effects on atomic quantum state evolution in non-destructive measurements. New J. of Physics, 10, 053032 (2008).