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MÜNCHNER PHYSIK KOLLOQUIUM

Am 07. Juni 2010, 17:15 Uhr

spricht

Prof. Dr. Serge Haroche

Ecole Normale Supérieure and
Collège de France, Paris, France

über das Thema

Fundamental Tests of Quantum Physics in a “Photon Box“

Hörsaal H 030 (alt E7), Fakultät für Physik der LMU, Schellingstr. 4, München

In Cavity Quantum Electrodynamics experiments, microwave fields trapped between highly reflecting mirrors are manipulated and detected via their interaction with excited Rydberg atoms. These experiments are modern realizations of the thought experiment imagined by Bohr and Einstein to test with a “photon box” fundamental concepts of quantum theory. The atoms, behaving as microscopic clocks whose ticking rate is affected by light, cross, one at a time, our photon box. By measuring the atomic clocks' delay, we extract information from the field without energy absorption and the microwave progressively collapses into a Fock state of well-defined photon number. Residual absorption or emission by the mirrors results in quantum jumps, recorded as sudden random changes of the photon number. This quantum non-demolition way to "look" at light leads to novel procedures for manipulating, reconstructing and controlling trapped photonic states. We have used non-demolition photon counting to generate field state superpositions known as "Schrödinger cats", to fully reconstruct their quantum state (represented by their Wigner functions) and to record movies of their decoherence. Future experiments will implement quantum feedback methods to counteract decoherence and to maintain the cavity field in Fock or Schrödinger cat states over time intervals largely exceeding their natural lifetimes. These studies open new avenues for the exploration of the boundary between the quantum and classical worlds.

Einführung: Prof. I. Bloch

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