

# Additional Seminar

Tuesday, 20th October 2009

11 am - Room 701

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## ***Photon Emission near Superconducting Bodies and Atom Chips***

As was already pointed out by E.M. Purcell in 1948, the rate of spontaneous emission of atoms will be modified due to the presence of a dielectric body.

Spontaneous emission can be thought of as a physical process, where the emission of a photon is stimulated by vacuum fluctuations. The presence of a medium will change the properties of the vacuum and, hence, also the rate for decay processes. This so called Purcell effect has been one of several central topics in the field of modern experimental cavity quantum electrodynamics.

In current investigations and engineering of nano-scale atom microtraps, this issue is also of fundamental importance since such spontaneous emission processes, due to hyperfine spin-flip transitions, have a direct bearing on the stability of atom chips.

In the present talk, we give a brief introduction to some of these issues in terms of photon emission due to a magnetic spin-flip transition of a two-level atom in the vicinity of a dielectric body like a normal conducting metal or a superconductor. In the analysis of this physical system one has to address issues like the notion of a photon propagating close to or in a dissipative medium. A simpler but analogous problem is how to quantize a damped harmonic oscillator.

For temperatures below the critical temperature of a superconductor, the corresponding spin-flip lifetime can be boosted by almost twenty orders of magnitude as compared to the case of a normal conducting body! This recent finding of ours has opened up the window for the design of new superconductor based atom chips. We also report on some recent work on the related attractive (!) Casimir-Polder force.

*All Welcome*