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Quantum Beams (aka single electron/photon physics)

Thursday 21 October 2021 16:15 (1 hour)

Charged particle beams in accelerators behave classically in general, with quantum effects, if any, being negligible. Radiation from a charged particle beam, however, can be analyzed for its statistical properties in terms of 'incoherent' or 'coherent' states of light in classical, semiclassical and quantum regimes. The physics can become important in particle beam collisions at very high energies and high intensities (e.g. 'beamsstrahlung' limitations in electron-positron collisions), but more importantly at very low intensities of a few charged particles and photons (e.g. a single electron or a single photon). Understanding single photon/electron classical, semiclassical and quantum statistical dynamics can be useful in such processes as 'optical stochastic cooling' etc.

I will give a general introduction to the subject and limited results from experiments to date. I will also touch upon quantum aspects of 'Atomic Beams' and 'Cavity Electrodynamics' in search of the 'dark' sector the vacuum.

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