

MEAN FIELD LIMITS FOR PHOTONS - A WAY TO ESTABLISH  
THE SEMICLASSICAL SCHRÖDINGER EQUATION

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The semi-classical Schrödinger equation, i.e. the Schrödinger equation coupled to a classical electromagnetic field, is a good model to describe many physical effects in quantum mechanics. In the talk I will show for the special case of a Bose Einstein condensate, how one can derive the semi-classical Schrödinger equation from QED: Consider a condensate of  $N$  interacting bosons. It is well understood that for certain scalings of the interaction the bosons remain in a condensate as time evolves. Now turn on the coupling to a radiation field, scaling the coupling constants such, that the interaction with the radiation field is of order one. I will show that for large  $N$  the created photons are (in some sense) close to a coherent state and that the system is well described by the Hartree equation coupled to Maxwell's equations.

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