SFB/TRR 21 - Seminar
22. November 2007, Stuttgart


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### How to split a Bose-Einstein condensate in two? A direct observation of number squeezing


In photon optic, interferometer experiments were dramatically improved by the use of laser light. In atom optic, the realization of Bose-Einstein condensates has not yet lead to the same improvement. State of the art atomic interferometer (clocks, gravimeter,...) make use of cold but not quantum degenerated atomic samples. Some technical arguments can explain this paradox, e.g. the smallness of the atomic flux in BEC experiments. However a more fundamental reason is the appreciable amount of interactions between atoms in a BEC which makes much more difficult the realization of a beam splitter, the key element of any interferometer. Indeed, a superfluid split in two weakly coupled parts is a well known system in condensed matter, a Josephson junction. In Heidelberg, we have experimentally studied the separation of a BEC in two parts and the associated Josephson effect. I will try to show the continuous link between a "classical" atom interferometer without interaction and the Josephson regime. In this latter regime, we have recently observed sub-shot-noise fluctuations of the atom number difference after splitting the BEC in two. I will discuss the degree of squeezing of the state we have observed, and its possible application to enhance the sensibility of an atomic interferometer below the quantum projection noise.


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