Analogs to the dynamical Casimir effect in Bose Condensates

Christoph Westbrook

Institut d'Optique, Graduate School, Paris Tech

Although we often picture teh quantum vacuum as containing virtual quanta whose observable effects are only indirect, it is a remarkable prediction of quantum field theory that the vacuum can generate real particles when boundary conditions are suddenly changed. Thus the 'dynamical Casimir effect' results in the spontaneous generation of photon pairs in an empty cavity with nonuniformly accelerating boundaries. Recent advances have permitted the realization of this effect, or analogs to it in a variety of systems, which I will briefly review. Bose Einstein condensates are attractive candidates in which to study acoustic analogs to such phenomena because their low temperatures promise to reveal quantum effects. I will discuss a recent experiment in our group to realize an acoustic analog to the dynamical Casimir effect by modulating the confinement of a Bose-Einstein condensate. We observe correlated pairs of Bogoliubov quanta, both phonon-like and particle-like, which are excited by this modulation in a process that formally resembles parametric down conversion.