

Acoustic analog of the dynamical casimir effect in a BEC

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Abstract

Although we often picture the 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 whose boundaries are rapidly moving. Bose Einstein condensates are attractive candidates in which to study acoustic analogs to such phenomena, because their low temperatures promise to reveal quantum effects. Here we exhibit an acoustic analog to the dynamical Casimir effect by modulating the confinement of a Bose-Einstein condensate. We show that correlated pairs of Bogoliubov quanta, both phonon-like and particle-like, are excited by this modulation in a process that formally resembles parametric down conversion.