MAR12-2011-007084

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Observation of the dynamical Casimir effect in a superconducting circuit

CHRISTOPHER WILSON, Chalmers University

Modern quantum theory predicts that the vacuum of space is not empty, but instead teeming with virtual particles flitting in and out of existence. While initially a curiosity, it was quickly realized that these vacuum fluctuations had measurable consequences, for instance producing the Lamb shift of atomic spectra and modifying the magnetic moment for the electron. This type of renormalization due to vacuum fluctuations is now central to our understanding of nature. 40 years ago, Moore suggested that a mirror undergoing relativistic motion could convert virtual photons into directly observable real photons. This effect was later named the dynamical Casimir effect (DCE). Using a superconducting circuit, we have observed the DCE for the first time. The circuit consists of a coplanar transmission line with an *electrical length* that can be changed at a substantial fraction of the speed of light. The length is changed by modulating the inductance of a superconducting quantum interference device (SQUID) at high frequencies ($>$ 10 GHz). In addition to observing the creation of real photons, we observe two-mode squeezing of the emitted radiation, which is a signature of the quantum character of the generation process.