Critical Casimir forces from the equation of state of quantum critical cold gas

Adam Rançon, Laboratoire de Physique, Ecole Normale Superieure de Lyon

Thermal fluctuations in classical systems give rise to effective forces reminiscent of the paradigmatic Casimir force induced by the fluctuations of the electromagnetic vacuum. These forces have been thoroughly studied numerically for varieties of boundary conditions relevant for experiments in classical statistical physics, as well as periodic boundary conditions, which were a priori theoretical curiosities. Using the well-known correspondence between finite temperature quantum statistical systems and classical statistical field theory on a torus, I will show that the equation of state of a quantum critical system can be described by the critical Casimir force induced by periodic boundary conditions. This universality will be shown to hold for a variety of systems, using different numerical approaches, and I will comment on possible experimental realizations.