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Unruh effect via radiative energy level shift

The Unruh effect states that the transition rates of a uniformly accelerated atom in the inertial vacuum has a thermal character at a temperature proportional to the atom's acceleration. Numerous proposals, studying different system properties under varied settings, to detect the Unruh effect still await fruition as the signal of interest is very weak. Here, we make case for a suitably modified density of field states to be complemented by a judicious selection of the system property to be monitored. We study the radiative energy level shift in a uniformly accelerated atom coupled to a massless quantum scalar field inside a long cylindrical cavity. The interest in the shifts in atomic energy levels as an observable for the detection of the Unruh effect stems from an experimental precision that the atomic spectroscopy has achieved so far. We show that the noninertial contribution to the energy shift can be isolated and enhanced relative to the inertial contribution by suitably modifying the density of field modes. Further, we show that monitoring the radiative energy shift, as compared to transition rates, allows us to reap even stronger purely-noninertial signal.

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