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The Unruh effect and oscillating neutrinos

Abstract

We point out that neutrino oscillations imply an ambiguity in the definition of the vacuum and the coupling to gravity, with experimentally observable consequences due to the Unruh effect. In an accelerating frame, the detector should see a bath of mass Eigenstates neutrinos. In inertial processes, neutrinos are produced and absorbed as charge Eigenstates. The two cannot be reconciled by a spacetime coordinate transformation. This makes manifestations of the Unruh effect in neutrino physics a promising probe of both neutrinos and fundamental quantum field theory. In this respect, we suggest pn^{+++} ($=e^{+,+,+}$) transitions in strong electromagnetic fields as a promising avenue of investigation. In this essay we discuss this process both in the inertial and comoving frame, we briefly describe the experimental realization and its challenges, and close by speculating on possible results of such an experiment in different scenarios of fundamental neutrino physics.

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