

Relativistic effect in quantum states of a bouncing particle in a gravitational field

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Abstract

We discuss relativistic effect on the energy level in quantum states of a bouncing particle in a uniform gravitational field. In this paper, we investigate the mode functions of a scalar field and a Dirac field in the Rindler spacetime under the mirror boundary condition. We show that the problems reduces to the familiar eigenvalue problem for the Schrödinger equation in a uniform gravitational field in the non-relativistic limit, as expected from the equivalence principle. We derive the correction term for the energy level in the non-relativistic limit, although the deviation is quite small in a realistic experimental setup.

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