



A quantum bouncing ball gravity resonance spectrometer

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Abstract

Inspired by DeBroglie's now famous *Recherches sur la théorie des quanta*, Erwin Schrödinger set-up an equation for matter waves. For a reflected neutron falling in the gravity potential of the earth, the solutions are so-called Airy functions, which Sir George Airy used to explain the interference pattern in connection with a rainbow.

The coherent superposition of such Airy functions describes the time and space evolution of the quantum bouncing ball measured by neutron detectors with spatial resolution. Such matter wave interference is still good for a surprise.

The discrete eigen-energy spectrum of a neutron on a reflector allows to develop a gravity resonance spectroscopy (GRS) technique for ultra-cold neutrons. The application of Ramsey spectroscopy to GRS permits to test basic symmetries and questions about the origin of gravity at different levels.