

qBounce: Gravity Resonance Spectroscopy to test Dark Energy and Dark Matter models

Tuesday 10 September 2013 18:00 (3 hours)

We present observations of transitions between quantum states of gravitationally bound neutrons using a three-part Rabi resonance spectroscopy setup.

In our experiments, ultra-cold neutrons are trapped in the gravitational field of the Earth. Quantum interferences between different states are observed by inducing transitions by mechanical vibration. The latest improvement, omitting the upper confining mirror, allows the shift from a frequency reference to a frequency standard, where the transition frequency depends solely on the neutrons mass, Plancks constant and Earth's gravity.

This tests Newton's Inverse Square Law of Gravity in the micrometer range, which is sensitive to hypothetical Fifth Forces, the origin of the cosmological constant, as well as potential large extra dimensions of submillimetre size of space-time. Our experimental results agrees with Newton's Inverse Square Law at the present sensitivity of $\Delta E = 10^{-14}$ eV.

Author: CRONENBERG, Gunther (Atominstitut, Vienna University of Technology)

Co-authors: Mr FILTER, Hanno (Atominstitut TU Wien); ABELE, Hartmut (Atominstitut); Dr GELTENBORT, Peter (Institut Laue-Langevin); Dr JENKE, Tobias (Universitätsassistent)

Presenter: CRONENBERG, Gunther (Atominstitut, Vienna University of Technology)

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