Contribution ID: **649** Type: **talk**

Neutrons test Gravity, Dark Matter and Dark Energy: Snapshots of a Quantum Bouncing Ball & Gravity Resonance Spectroscopy

Thursday, July 23, 2015 12:00 PM (15 minutes)

This talk focuses on two different kinds of gravity tests at short distances using ultracold neutrons within the qBounce experiments.
One class of gravity experiments focuses on the realization of a Quantum Bouncing Ball, i.e. a measurement of the time evolution of a neutron bouncing above a horizontal plane. In 2014, the spatial probability distribution of this Schrödinger wave packet has been measured for different observation times with a spatial resolution of about 1.5µm. Here, we illustrate the role of interference weaving the quantum carpet of several quantum states.
The second type of experiments deals with the control and understanding of a gravitationally interacting elementary quantum system using the techniques of resonance spectroscopy. It offers a new way of looking at gravitation based on quantum interference. The ultra-cold neutron reflects from a mirror in well-defined quantum states in the gravity potential of the earth allowing to apply the concept of gravity resonance spectroscopy (GRS). GRS relies on frequency measurements, which provide a spectacular sensitivity. We present limits on dark energy and dark matter candidates.

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Session Classification: Astroparticle Physics, Cosmology, Gravitation

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