GR 20: Main talk: Experimental Gravitation

Time: Thursday 14:00–14:45 Location: SPA SR220

Invited Talk GR 20.1 Thu 14:00 SPA SR220

Quantum & Gravitation — •Hartmut Abele — Atominstitut - TU Wien, Stadionallee 2, 1020 Wien, Österreich

Gravitation: Newton's Law of Gravity is considered valid from sub-millimetre distances up to inter-galactic space. Nevertheless it fails to describe important features of cosmology like the accelerating expansion component of our universe. While the most straightforward candidate for such a component is Einstein's cosmological constant, a plausible alternative is dynamical vacuum energy, or 'quintessence', changing over time. So far, distinguishing between these two explanations has eluded experimental tests. Here, we present a novel search strategy using a quantum interference technique with neutrons to differentiate between Einstein's cosmological constant and quintessence, see below.

Quantum: Ultra-cold neutrons are falling in the gravity potential of the earth and are retroreflected by a neutron mirror. The quantum nature allows them to be manipulated in novel ways, which are being used to create new instruments for gravity research. We are now developing a gravity resonance spectroscopy technique by vibrating the mirror underneath thus providing a coupling between different energy levels. The sensitivity for deviations on Newton's gravity law right now is E = 10ˆ{-14} eV, providing severe restrictions on any possible new interactions on that level of accuracy. If some undiscovered dark matter or dark energy particles interact with a neutron, this should result in a measurable energy shift of the observed quantum states.