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Superpositions of Mesoscopic Objects for Sensing Quantum Gravity and Gravitational Waves

Thursday, 10 October 2019 11:25 (45 minutes)

We will show two fundamental applications of quantum superpositions of spatially separated states of mesoscopic objects (nano- and micro-spheres). Firstly we are going to show how convenient it may be to prepare and probe such superpositions through a pure ancillary system such as a spin. Next, we are going to show how an entanglement between two such interferometers can be generated purely through the Newtonian interaction between the masses and that this can be probed, at the end of the interferometry, purely by measuring the correlations between spins. We are going to justify why, under the assumption of locality of physical interactions and under a reasonable definition of classicality, the above entanglement signifies the qualitatively quantum nature of gravity. We are also going to discuss how the same spin-induced and probed superpositions will open up the ability to detect low frequency gravitational waves, immune to initial thermal noise, with a meter-scale apparatus.

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Session Classification: Investigating the fundamental properties of physics