Contribution ID: **11** Type: **not specified**

Test of the superposition principle: matter-waves and beyond

Tuesday, 29 April 2014 09:30 (45 minutes)

Hendrik Ulbricht Physics and Astronomy, University of Southampton, SO17 1BJ, Southampton, UK e-mail: hendrik.ulbricht@soton.ac.ukmailto:hendrik.ulbricht@soton.ac.uk New technological developments allow to explore the quantum properties of very complex systems, bringing the question of whether also macroscopic systems share such features, within experimental reach. The interest in this question is increased by the fact that, on the theory side, many suggest that the quantum superposition principle is not exact, departures from it being the larger, the more macroscopic the system [1]. Testing the superposition principle intrinsically also means to test suggested extensions of quantum theory, so-called collapse models. We will report on three new proposals to experimentally test the superposition principle with nanoparticle interferometry [2], optomechanical devices [3] and by spectroscopic experiments in the frequency domain [4, 5]. We will also report on the status of optical levitation and cooling experiments with nanoparticles in our labs, towards an Earth bound matter-wave interferometer to test the superposition principle for a particle mass of one million amu (atomic mass unit). References [1] Bassi, A., K. Lochan, S. Satin, T.P. Singh, and H. Ulbricht, Models of Wave-function Collapse, Underlying Theories, and Experimental Tests, Rev. Mod. Phys. 85, 471 - 527 (2013). [2] Bateman, J., S. Nimmrichter, K. Hornberger, and H. Ulbricht, Near-field interferometry of a free-falling nanoparticle from a point-like source, arXiv:1312.0500 (2013). [3] Xuereb, A., H. Ulbricht, and M. Paternostro, Optomechanical interface for matter-wave interferometry, Sci. Rep. 3, 3378 (2013). [4] Bahrami, M., A. Bassi, and H. Ulbricht, Testing the quantum superposition principle in the frequency domain, Phys. Rev. A 89, 032127 (2014), [5] Bahrami, M., M. Paternostro, A. Bassi, and H. Ulbricht Non-interferometric Test of Collapse Models in Optomechanical Systems, arXiv:1402.5421 (2014).

Presenter: Dr ULBRICHT, Hendrik (University of Southampton)