

Abstract Submitted  
for the DAMOP15 Meeting of  
The American Physical Society

**Testing the quantum superposition principle: matter waves and beyond** HENDRIK ULBRICHT, University of Southampton — 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).

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Date submitted: 30 Jan 2015

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