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Towards quantum superposition of a levitated nanodiamond with a NV center TONGCANG LI, Purdue University — Creating large Schrödinger's cat states with massive objects is one of the most challenging goals in quantum mechanics. We have previously achieved an important step of this goal by cooling the center-of-mass motion of a levitated microsphere from room temperature to millikelvin temperatures with feedback cooling. To generate spatial quantum superposition states with an optical cavity, however, requires a very strong quadratic coupling that is difficult to achieve. We proposed to optically trap a nanodiamond with a nitrogen-vacancy (NV) center in vacuum, and generate large spatial superposition states using the NV spin-optomechanical coupling in a strong magnetic gradient field. The large spatial superposition states can be used to study objective collapse theories of quantum mechanics. We have optically trapped nanodiamonds in air and are working towards this goal.

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