Abstract Submitted
for the APR13 Meeting of
The American Physical Society

**Macroscopic Quantum Mechanics in a Classical Spacetime** HUAN YANG, California Institute of Technology, TAPIR, CALIFORNIA INSTITUTE OF TECHNOLOGY COLLABORATION — We apply the many-particle Schrödinger-Newton equation, which describes the co-evolution of an many-particle *quantum* wave function and a *classical* space-time geometry, to macroscopic mechanical objects. By averaging over motions of the objects' internal degrees of freedom, we obtain an effective Schrödinger-Newton equation for their centers of mass, which are degrees of freedom that can be monitored and manipulated at the quantum mechanical levels by state-of-the-art optoemchanics experiments. For a single macroscopic object moving quantum mechanically within a harmonic potential well, we find that its quantum uncertainty evolves in a different frequency from its classical eigenfrequency — with a difference that depends on the internal structure of the object, and can be observable using current technology. For several objects, the Schrödinger-Newton equation predicts semiclassical motions just like Newtonian physics, yet it is not allowed that quantum uncertainty to be transferred from one object to another through semiclassical gravity.

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Date submitted: 10 Jan 2013 Electronic form version 1.4