

PHYSICS AND ASTRONOMY COLLOQUIUM

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Cavity optomechanics with a gas of cold atoms

In cavity optomechanical systems, the motion of a mechanical element is sensed by its influence on the field within an electromagnetic resonator. While their experimental realizations are diverse, with mechanical elements ranging from picogram-scale nanofabricated filaments to the kilogram-scale mirrors of the LIGO detector and optical systems ranging from stripline resonators to kilometers-long optical cavities, such systems are converging on the common goal of quantum limited operation. I will discuss the use of ensembles of ultracold trapped atoms as mechanical elements within a high-finesse optical cavity. With this system, we realize cavity optomechanics in a regime where both the “opto” and the “mechanics” portions of the hybrid system show distinct quantum mechanical features. I will conclude by describing experiments to sense forces at the standard quantum limit.



THURSDAY, JANUARY 16, 2014 | 4:00 PM | HAWKING AUDITORIUM



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