Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Displacement linear detection down to thermal fluctuations of a silicon nitride membrane with self-mixing technique[1] LORENZO BALDACCI, ALESSANDRO PITANTI, LUCA MASINI, ANDREA ARCANGELI, DANIEL NAVARRO URRIOS, NEST, Istituto Nanoscienze - CNR and Scuola Normale Superiore, ALESSANDRO TREDICUCCI, NEST, Istituto Nanoscienze - CNR and Dipartimento di Fisica E. Fermi, Universit'a di Pisa, SOULMAN RESEARCH GROUP TEAM — Active optomechanical systems exploit the interaction between photons and mechanical vibrations inside a laser cavity. A compound cavity made of a laser diode and an external vibrating reflector is a suitable platform, due to its ease of construction and coupling modulation. Here we use it as a linear displacement detector, by studying the motion of a silicon nitride suspended membrane as the external mirror of a near infrared laser diode. The membrane vibrations cause fluctuations in the laser optical power, which are collected by a photodiode and measured with a spectrum analyzer. The dynamics of the membrane driven by a piezo actuator was investigated in a homodyne configuration. The high Q-factor ($\sim 10^5$ at low pressure) of the fundamental mechanical mode at 74 kHz enabled direct measurement of thermal motion at room temperature, which holds an average displacement of 20 pm. Therefore, compound cavity systems can be employed as table-top, cost-effective displacement linear detectors. Furthermore, nonlinear optomechanical interactions could be observed, with new possibilities in the study of non-Markovian quantum properties at the mesoscale.

[1]Work supported by European Research Council, advanced grant No. 321122 SouLMan

Lorenzo Baldacci
NEST, Istituto Nanoscienze - CNR and Scuola Normale Superiore

Date submitted: 24 Nov 2015 Electronic form version 1.4