Solid State Institute
המכון למצב מוצק

TECHNION
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הטכניון
מכון טכנולוגי
לישראל

SPECIAL SEMINAR **סמינר מיוחד**

Experimental generation and verification of non-classical states of engineered mechanical objects

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Abstract

First and foremost, placing macroscopic objects in superposition states has captured the imagination and interest of physicist for over a century. Today, at 2019, researchers are able to fulfill some of these dreams and gendanken experiments with bigger and bigger objects (heavier, larger and involving more atoms). On a log scale, we moved from controlling the mechanical motion of a single atom (~10-100 x 10^-27 Kg) to controling the collective motion of 10^12 atoms (~ 50 pg) or more. Mechanical quality factors of various systems have been improving, from 10^5-10^6 to more than 10^9, in the past 5 years alone (!). Since no inherent obstacle has been found to prohibit quantum mechanical control of even larger objects, the quest goes on.

Second, engineered mechanical systems stand out also in the context of Quantum Information Processing. They can be compact, and easily fabricated. Their good quality factors means they are good quantum memories. They can accommodate multiple transduction mechanisms (electric, magnetic, piezo-electric etc.). Finally, because their frequency can be very different than their environment resonances, mechanical elements can decouple from the outside world, and couple only when needed.

Here we will review some of the work done at NIST and JILA in pursuit of these goals:

1. What kind of resources are needed to generate non-classical states. Specifically I will talk about **membrane to ion** coupling (resonant), **superconducting qubit to mechanical drum** coupling (dispersive) and **superconducting resonator to mechanical drum(s)** (parametric).

2. Why verifying that indeed the state is non-classical is important and in some cases takes most of the work. Here we will focus on the Simon-Duan criteria for Gaussian states, when we analyze entangled states of **two mechanical drums**.

ההרצאה תתקיים ביום ראשון, ה-3. 2.19 בשעה 12:30*
באודיטוריום המכון למצב מוצק, קומת כניסה

The lecture will take place on Sunday, 3.2.19 at 12:30*
at the Solid State Institute auditorium, entrance floor

***Refreshments: before the seminar at 12:10.**

Host: Assistant Professor Yoav Sagi