TIFR Centre for Interdisciplinary Sciences
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# Seminar

## Optomechanics with superconducting quantum circuits

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Cavity optomechanics, which utilizes the interaction between light and mechanical motion has been extremely successful in detecting and controlling the mechanical motion with high sensitivities. To reach the quantum coherent regime of the mechanical motion, several optomechanical systems have been developed both in microwave and optical domain of light. In this talk, I will present two examples of such optomechanical systems in microwave domain with superconducting cavities.

By coupling a high quality-factor multilayer graphene mechanical resonator to a superconducting microwave cavity, we achieve a displacement sensitivity of 17 fm-Hz-0.5. The large optomechanical coupling is further demonstrated by observing effects such as optomechanically induced transparency, microwave-mechanical gain of 17 dB, and a cooperativity of 8, which is promising for the quantum regime of graphene motion.

In a new implementation of an optomechanical setup based on a silicon-nitride membrane resonator and a 3-dimensional superconducting microwave cavity, we achieve a cooperativity C of 146,000. Utilizing the sideband cooling technique, we cool a large 123 kHz mechanical resonator down to an occupancy of 5.2 phonons, corresponding to a mode temperature of 34 micro-Kelvin. This system has the potential of reaching the elusive single-photon strong coupling regime.

***Tuesday, May 5$^{th}$ 2015***

***2:30 PM (Tea/Coffee at 2:15 PM)***

***Seminar Hall, TCIS***