
# Optomechanics: From Ultra-Sensitive System Engineering to Quantum Physics

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Optomechanics is the field of Physics that studies the reciprocal interactions between coherent light and the motion of macroscopic mechanical resonators. The extreme weakness of quantum optomechanical effects raises a number of technological challenges aiming at developing optomechanical systems with enhanced light-motion interaction. In particular, the approach of cavity optomechanics has proven to be remarkably efficient, enabling the first displacement measurement below the attometre level ($10^{-18}m$) as well as the first radiation pressure cooling of a gram-scale object in the late 1990's.

Since then, optomechanics has considerably developed and improved in a plethora of unexpected and exciting ways, with the emergence of a variety of systems ranging from the centimetre down to the nanometre scale, see Fig. 1. Thereby, within just 15 years of experimental research, optomechanics has been at the origin of such major achievements as the demonstration of macroscopic vibrational states close to the groundstate, the demonstration of the quantum backaction noise in interferometric measurements or the generation of entangled optomechanical states.

At present, optomechanics is rapidly extending to a number of diverse physical topics, opening radically new perspectives both in fundamental and applied Science, such as the dynamical study of astrophysical phenomena, the coherent control of quantum information through novel hybrid optomechanical interactions, the unprecedentedly sensitive measurement of nano-optical interactions and correspondingly novel, unexplored thermodynamics regimes, the elucidation and control of molecular dynamics, the emergence of a new generation of versatile, highly integrated sensors and quantum-limited converters.

Our mini-colloquium "Optomechanics: Exploring Physics from the macroscopic down to the nanometric scale" aims at reviewing the most recent advances in our rapidly growing field, with specific attention being devoted to highlighting its interdisciplinary potential. Contributions to this session should be given in English.

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