Crystalline coatings: An unexpected spin-off of cavity optomechanics

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Cavity optomechanics has recently emerged as one of the most dynamic fields in modern optics. The ultimate objective of this interdisciplinary endeavor is to gain access to a completely new parameter regime, in terms of size and complexity, for experimental quantum physics. The fundamental process at the heart of this effort is the enhancement of radiation pressure within a high-finesse optical cavity. Exploiting this weak interaction, i.e. the momentum transfer of photons onto the cavity boundaries, requires the development of mechanical resonators simultaneously exhibiting high reflectivity and low mechanical dissipation. Interestingly, similar requirements—as a means of minimizing the deleterious effects of thermal noise—are found in a broad spectrum of applications, ranging from interferometric gravitational wave detectors to cavity-stabilized lasers for optical atomic clocks. This overlap leads to an intimate link between advances in the disparate areas of optical precision measurement and micro- and nanoscale optomechanical systems. In this presentation I will outline the fascinating perspectives of cavity optomechanics and introduce an entirely unanticipated spin-off technology focused on the development of ultra-stable optical reference cavities.