Seminar/Talk

Cavity cooling of optically levitated nanoparticles: Towards quantum experiments at room temperature

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Optically levitated nanoparticles in ultra-high vacuum promise access to quantum behavior of massive objects at room temperature. Coupling the nanoparticle center-of-mass motion to an optical cavity provides a route to control its motion at the quantum level and gives rise to a new type of light-matter interface. As a first step toward quantum state preparation of nanosphere motion, cavity sideband cooling technique has already been demonstrated several years ago [1].Here we demonstrate a new method of cavity cooling a silica nanosphere based on coherent scattering. An optical tweezer allows for precise positioning of the nanosphere inside an empty optical cavity [2]. In contrast to standard optomechanics, cooling of its motion is performed by cavity-enhanced coherent scattering of the red-detuned optical tweezer. We demonstrate genuine three-dimensional cavity cooling, which also allows for stable levitation in high vacuum [3]. Our observed cooling performance and absence of laser phase noise heating indicates that this new method enables ground state cooling of levitated nanoparticles in our current experiment.References:[1] Kiesel, Blaser, Delic et al., PNAS 110: 14180-14185 (2013)[2] Delic, Grass et al., arXiv:1902.06605 (2019)[3] Delic et al., Phys. Rev. Lett. 122, 123602 (2019)

Tuesday, July 2, 2019 11:00am - 12:00pm
Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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