



Institut für
Angewandte Physik



Physikalisches
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RHEINISCHE
FRIEDRICH-WILHELMS-
UNIVERSITÄT BONN

COLLOQUIUM „OPTICS AND CONDENSED MATTER“

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Testing and Exploiting Macroscopic Quantum Physics

Controlling the quantum dynamics of massive and complex objects, such as large molecules and nanoparticles, requires a detailed understanding of how their many interacting degrees of freedom couple to control and manipulation fields. In this talk, I will discuss how light scattering induces non-reciprocal interactions between co-levitated nanoparticles [1], how the rotational motion of aspherical objects gives rise to novel quantum phenomena [2], and how surface-induced decoherence affects the dynamics of charged particles [3]. These examples illustrate the potential of macro-mechanical quantum systems for novel force and torque sensing schemes and for high-mass tests of quantum physics.

- [1] Rieser, Ciampini, Rudolph, Kiesel, Hornberger, Stickler, Aspelmeyer, and Delić, Tunable light-induced dipole-dipole interaction between optically levitated nanoparticles, *Science* 377, 987 (2022).
- [2] Stickler, Hornberger, and Kim, Quantum rotations of nanoparticles, *Nat. Rev. Phys.* 3, 589 (2021).
- [3] Martinetz, Hornberger, and Stickler, Surface-induced decoherence and heating of charged particles, *PRX Quantum* 3, 030327 (2022).

October 11th, starting with discussion at 16:45 h, talk at 17:15 h, live IAP lecture hall or via Zoom

<https://uni-bonn.zoom.us/j/98441612025?pwd=a01SSjlkY1Q3SDFhL09JQk1qc1V6dz09>

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