GRK 2905 Ultrafast Nanoscopy

Colloquium

Part 2: 15:15 PM

Unpacking Electromagnetic Quantum Fluctuation-Induced Interactions

Fluctuations are ubiquitous in both classical and quantum realms, underpinning a wide range of phenomena across physics, from biophysics and chemistry to gravity and cosmology. In the ongoing race toward miniaturization, interest in electromagnetic quantum fluctuation-induced interactions has surged—not only for foundational insights but also for technological applications. While many of these interactions are negligible at macroscopic scales, they become crucial at microscopic scales, posing both challenges and opportunities for modern quantum technologies. Paradigmatic examples include van der Waals and Casimir interactions, which can be either advantageous or disruptive in the design of microscopic devices.

The study of these phenomena draws on a highly interdisciplinary background, merging advances in nonequilibrium physics, quantum electrodynamics, atomic physics, and condensed matter physics. Unpacking electromagnetic quantum fluctuation-induced interactions opens up new perspectives, deepening our understanding of the underlying physics and paving the way for future advancements in the field.

Dr. Francesco Intravaia

Humboldt University of Berlin,
Department of Physics, AG
Theoretical Optics & Photonics