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VITALITY

Progetto VITALITY | Programma di Consulenza Specialistica | **Seminario**

There's plenty of energy in noise

Abstract

In 1959 Richard Feynman gave an inspiring talk entitled "There's plenty of room at the bottom", which led us into a new era of nanotechnology. By now, that room has been exhausted. I argue that the 21st century challenge is not just to shrink technology, but mainly to make it energy efficient, fast, and precise. To achieve that, we need to understand and harness the energy in noise. In this spirit, I will discuss challenges and opportunities that emerge in nanoscale optical technologies where fluctuations in light and matter are relevant. I will begin this lecture by introducing Langevin-type equations for optical systems, highlighting their similarities and differences with standard Langevin equations for material systems. I will then illustrate various potential benefits of noise in optical systems, such as broadband signal amplification and enhanced sensing. Finally, I will discuss our recent discovery of a set of three laws that govern the random behavior of light in any resonator with noise. These laws imply that, given a fixed energy budget, time and ensemble averaging are not equal when measuring the time-integrated intensity transmitted by one or many resonators, respectively. In a nutshell, these results illustrate how the right averaging strategy (one that leverages fluctuations) can enhance the precision of an optical sensor with zero energy cost.

lunedì 19 maggio 2025 - Ore 10.00

Aula E

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Said Rahimzadeh-Kalaleh Rodriguez is the leader of the Interacting Photons group, starting in November 2017 at the Center for Nanophotonics in AMOLF. Said got his PhD (Cum Laude) at TU Eindhoven, for his research at AMOLF and Philips with Prof. J. Gomez Rivas. Next he worked at the Center for Nanoscience and Nanotechnologies (France) as a Marie-Curie fellow with Prof. J. Bloch and Dr. A. Amo. Said's research interests include nanophotonics, nonlinear & quantum optics, and polaritons. He has worked with a wide range of hybrid light-matter systems involving organic and inorganic luminescent materials as well as metallic and dielectric optical resonators. Currently, he is fascinated with emergent phenomena in driven-dissipative photonic systems with nonlinearity and noise.