Titolo: Macroscopic quantum analogs

Proponente: Giuseppe Pucci (giuseppe.pucci@cnr.it)

Tipologia: lezioni frontali + ciclo di seminari

Descrizione: About fifteen years ago, Yves Couder, Emmanuel Fort and collaborators in Paris discovered that a droplet may "walk" by virtue of a resonant interaction with the wavefield that it generates by bouncing on the surface of a vibrating liquid bath. This walker is a classical system that couples a particle and a wave at the macroscopic scale and exhibits a number of quantum-like behaviors. I will present the quantum analogs observed in experiments and with models inspired by the walker system in order to systematically approach the following question: to what extent can a classical wave-driven system reproduce phenomena that are thought to be peculiar to the quantum realm?
Tentative plan of the lectures (may change along the way by following the students' and the teacher's curiosity)
- Introduction to the walker system.
- Quantum analogs with walkers: tunnelling, level splitting, quantization of orbits and angular momentum, wavelike statistics in cavities, Friedel-like oscillations, diffraction and interference.
-Discussion of analogies and differences with de Broglie's pilotwavetheory and Bohm's pilot-wave theory.
- Hydrodynamic spin lattices (non-quantum).
Current research and future directions: what is really quantum?
(a) Oblique view of a walking droplet (picture from J. Bush's groupat MIT).
(b) Long-term statistical distribution of the dropletposition in a circular cavity
(D. M. Harris et al. Phys. Rev. E88:011001(R), 2013).
References
Y. Couder, S. Protière, E. Fort, and A. Boudaoud, Walking and Orbiting Droplets, Nature 437, 208 (2005).
J. W. M. Bush and A. U. Oza. Hydrodynamic quantumanalogs. Rep. Prog. Phys. 84, 017001 (2020) and references therewith.

Impegno orario stimato: 25

Destinatari/e: III anno triennale, II anno magistrale

Modalità di verifica: colloquio