UNIVERSITÀ DI PAVIA
Dipartimento di Fisica

Dottorato di Ricerca in Fisica

COLLOQUIA DI DOTTORATO, A.A. 2023/2024

Dipartimento di Fisica, A101

Giovedì 18 Gennaio 2024 ore 16:00

Quantum simulation of gravitational problems using quantum fluids of atoms and of light

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(INO-CNR BEC Center and Università di Trento)

In this Colloquium, the state of the art and the new perspectives in the theoretical and experimental work on the quantum simulation of gravitational problems using condensed matter and optical systems, the so-called analog models of gravity, will be discussed.

It will start with a pedagogical presentation of the general concept of analog mode and a review of milestone theoretical and experimental works on Hawking emission of phonons from acoustic horizons in trans-sonic flows of ultracold atoms.

It will then proceed with an outline of a joint theoretical-experimental effort that is on-going at the BEC Center on false vacuum decay processes: I will present experimental evidence of the decay of an extended metastable state via the nucleation of spatially localised bubbles in a two-component atomic superfluid and I will highlight its connection to open questions in quantum field theory and cosmology.

The seminar will conclude with a presentation of on-going theoretical work on analog Hawking emission processes in quantum fluids of light and the promising perspectives for its experimental observation. In particular, an unexpected interplay between Hawking emission and the quasi-normal modes of the black hole will be discussed, as well as its anticipated consequences on the zero-point fluctuations of the gravitational field around astrophysical black holes.

The seminar is in presence up to the maximum occupancy of the lecture hall.