APC Colloquium
Wednesday, Feb 5 at 11am
Room Luc Valentin, 454A

Raffaele Tito D'Agnolo
IPhT, Université Paris Saclay

A New Chapter in the Quest for Dark Matter and its Connection to Gravitational Waves

Dark Matter was discovered more than 90 years ago through its gravitational effects. It makes up 80% of the matter in our Universe and about a quarter of its present energy density. We have spent decades trying to detect it in the laboratory, but to date its microscopic origin remains mysterious. The vast majority of our theoretical and experimental effort has been devoted to the exploration of relatively heavy dark matter candidates, with masses comparable to particles that we can produce at our highest energy colliders. In this talk I will review how in the last five to ten years a new perspective has emerged in particle theory, shifting our attention to ultralight dark matter candidates, in particularly the axion. This has generated a flurry of experimental activity, with a few pioneering efforts now setting up prototypes, and new ideas appearing almost weekly on the arXiv. I will review both the theoretical appeal of these dark matter candidates and the new ideas proposed to detect them experimentally. Furthermore, ultralight dark matter is well described in the laboratory as a coherent classical field. Its detection has interesting overlaps with that of high-frequency gravitational waves. I will show how thinking about ultralight dark matter was useful to establish a fundamental detection limit on gravitational waves. In practice it is not feasible to detect gravitational waves from primordial stochastic backgrounds at frequencies above those probed by existing interferometers.