Contribution ID: **52** Type: **not specified**

QUANTUM SENSING WITH COLD ATOMS and MATTER WAVES

Thursday, 7 September 2023 12:00 (1 hour)

Abstract: Cold atoms represent an ideal platform for the implementation of second-generation quantum technologies. Particularly interesting opportunities emerge from a coherent coupling of the atoms to single-mode light fields enabled by resonant optical cavities. In this lecture, after a general introduction into the world of cold atoms, I will present two of our research lines. In the first one, we study the interaction of ultracold atoms with a ring cavity in parameter regimes suitable for the creation of non-classical collective states of the atomic cloud with possible application in Heisenberg-limited interferometry. The regime may also allow for a global synchronization of the atomic dipoles with application in superradiant lasing. In a second research line, we are setting up a high sensitivity matter-wave interferometer for inertial sensing and gravimetry. It is based on observing in real time Bloch oscillations performed by atoms located inside a periodic optical lattice formed by two counter-propagating modes of the a cavity and exploits the fact that the periodicity of the oscillations is strictly proportional to external forces.

Lecturer: Philippe Courteille is Professor at the São Carlos Physics Institute of the University of São Paulo with a background in atomic interferometry and Bose-Einstein condensation. Currently, he coordinates an experimental research group studying collective effects in the interaction of ultracold atoms with light. He is interested in the question, how collective coupling between atoms may be harnessed for applications in second-generation quantum sensing of time and gravity.(Text informed by the Lecturer)

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Session Classification: THE QUANTIC WORLD: DAY 1