Contribution ID: **122** Type: **Poster - red fee req.**

Towards sub-Hz ultralight dark matter searches with atom multi-gradiometry

Monday 8 August 2022 14:36 (3 minutes)

Single-photon atom gradiometry is a powerful experimental technique that can be employed to search for the oscillation of atomic transition energies induced by ultralight scalar dark matter (ULDM). Previous studies have focused on the sensitivity reach of these experiments down to ULDM masses of $\sim 10^{-16}$~eV, which would induce a signal oscillating at $\sim 10^{-1}$~Hz, where gravity gradient noise (GGN) is expected to dominate over atom shot noise. In this talk, I'll provide a careful treatment of the dominant contribution to GGN that arises from surface Rayleigh waves and I will present a likelihood-based analysis that consistently folds GGN into the sensitivity estimates of vertical atom gradiometers, like AION and MAGIS, down to $\sim 10^{-2}$~Hz. Using this framework, we show that GGN can be significantly mitigated when operating three or more atom interferometers in the same baseline, which we define as an atom multi-gradiometer. In turn, this configuration would allow these large-scale quantum sensors to probe large parts of dark matter parameter space that are yet unconstrained by existing experiments.

Primary author: Mr BADURINA, Leonardo (King's College Lodond)

Presenter: Mr BADURINA, Leonardo (King's College Lodond)

Session Classification: Poster Lightning Talks