Quantum Sensors

The development of new classes of quantum sensors is one of more active lines of research in the field of quantum technologies, for a brief introduction see [1]. Among them one of the more promising schemes is provided by the so-called “Sagnac interferometers”. They are based on the splitting and recombination of an initial quantum state on a ring geometry, and from the final measurement it is possible to determine the quantity one is looking for. Putting matter-wave packets at low temperature, one can aim at measuring rotations [2]. A crucial fact is in general that stronger is the amount of quantum correlations in the initial state, and larger is the precision and accuracy of the measurement (see [3] and references therein). In this proposal we plan to characterize the effect of interactions and temperature on the efficiency of these and related quantum sensors. Different schemes will be considered to determine the optimal efficiency, and as well the effect of the quantum statistics. Comparison with existing classical sensors will be instrumental to assess the highlight the effect of the quantum correlations and the potential technological usefulness of the studied devices.

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References:
[1] *Quantum sensors and high-precision measurements: what are they, and how do they work? See the article in “Trieste All News” website:* *https://www.triesteallnews.it/2021/05/03/quantum-sensors-and-high-precision-measurements-what-are-they-and-how-do-they-work/*
[2] Y. Zhou, I. Lesanovsky, T. Fernholz, and W. Li, *Controlling the dynamical scale factor in a trapped atom Sagnac interferometer*, Phys. Rev. A 101, 012517 (2020)
[3] S. A. Haine and J. J. Hope, *Machine-Designed Sensor to Make Optimal Use of Entanglement-Generating Dynamics for Quantum Sensing*, Phys. Rev. Lett. 124, 060402 (2020)