Robin Corgier - Quantum-Enhanced Atom Interferometry

Rapport sur les contributions

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Quantum-Enhanced Atom Interferometry

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The possibility to overcome the standard quantum limit (SQL) by engineering specific quantum correlations between the atoms is attracting increasing interest in the field of atom interferometry. Recently, Bose-Einstein condensates (BECs) have been pinpointed as optimal candidates for the realization of entanglement-enhanced atom interferometers with spatially separated arms either in trapped [1] or free-fall [2] configurations. However, either due to the presence of residual interactions during the interferometer sequence or due to the fast expansion of the BEC during the state preparation, only a modest sub-SQL sensitivity gain is predicted.
To overcome these problems, we recently proposed a novel method we refer to as Delta-Kick Squeezing (DKS) [3]. This method involves the rapid action of an external trap focusing the matter-waves to significantly increase the atomic densities during a preparation stage. This method is explored in the two relevant cases of Raman or Bragg scattering light pulses. In the second case, we demonstrated the possibility to implement a non-linear readout scheme making the sub-SQL sensitivity highly robust against imperfect atom counting detection [4,5]. We predict more than 30 dB of sensitivity gain beyond the SQL, assuming realistic parameters and millions of atoms in the BEC.

References:
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Quantum phase magnification

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