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Gradient Magnetometry with Atomic Ensembles

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We calculate precision bounds for estimating the gradient of the magnetic field based on the quantum Fisher information for various types of ensembles, such as for example, a single atomic ensemble with an arbitrary density profile, where the atoms cannot be addressed individually and which is a very relevant case for experiments.

We present a method to find spin states for gradient magnetometry with two spatially separated atomic ensembles based on states for sensing a global phase shift, such as the GHZ state or the Dicke state.

[1] I. Apellaniz et al., Phys. Rev. A, 97 053603 (2018)

[2] G. Vitagliano et al., arXiv:2104.05663 (2021)

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