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Quantum-limited measurement of magnetic-field gradient with entangled atoms[1] HO TSANG NG, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University — Probing the magnetic field is important in different areas of science. Recently, ultracold atoms have been used for detecting magnetic field due to negligible Doppler broadening and long coherence times. In this talk, I will discuss a method to detect the microwave magnetic-field gradient by using a pair of entangled two-component Bose-Einstein condensates [1]. We consider the two spatially separated condensates to be coupled to the two different magnetic fields. The magnetic-field gradient can be determined by measuring the variances of population differences and relative phases between the two-component condensates in two wells. The precision of measurement can reach the Heisenberg limit. The effects of one-body, two-body atom losses and atom-atom interactions on the detection will be discussed.

[1] H. T. Ng, arXiv:1301.3242.

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