

Continuous Real-Time Tracking of a Quantum Phase Below the Standard Quantum Limit (Q)

Wednesday, 23 October 2019 14:00 (20 minutes)

We propose a scheme for continuously measuring the evolving quantum phase of a collective spin composed of N pseudospins. Quantum nondemolition measurements of a lossy cavity mode interacting with an atomic ensemble are used to directly probe the phase of the collective atomic spin without converting it into a population difference. Unlike traditional Ramsey measurement sequences, our scheme allows for real-time tracking of time-varying signals. As a bonus, spin-squeezed states develop naturally, providing real-time phase estimation significantly more precise than the standard quantum limit of $\Delta\phi_{\text{SQL}} = 1/\sqrt{N}$ rad.

Available as: Athreya Shankar, Graham P. Greve, Baochen Wu, James K. Thompson, and Murray Holland, Phys. Rev. Lett. 122, 233602 (2019).

Summary

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