

Weak measurements and feedback on coherent atomic states

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Atom-based sensors have been used to measure fundamental constants and their time variation, as well in more applied contexts for example to realize gravity surveys for ore and oil prospecting. We investigate novel detection technique for quantum sensors using non-destructive measurements on rubidium atoms trapped in a high finesse cavity. Unlike conventional atom interferometers based on a destructive probe, the weak measurement approach determines only a partial reduction of the atomic coherence. It is thus possible to use the measurement result to steer the atomic state using feedback. We have experimentally implemented such a scheme to recover the loss of coherence of a spin states because of random collective microwave rotations [1]. We are now trying to use coherence preserving detection techniques to increase the effective interrogation time in a Ramsey sequence, as proposed in [2]. The measurement of the phase drift between the local oscillator and the atomic reference can continue for several cycles until there is a sufficient residual coherence.

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