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Precision measurements with strongly correlated atoms: beating the decoherence limit LIANG YIANG, Physics Department, Harvard University, ANA MARIA REY, M. FLEISCHHAUER, MIKHAIL LUKIN, ITAMP, Cambridge, MA, USA — It is well-known that entangled atomic states (e.g. so-called spin squeezed states) potentially allow to significantly improve resolution in Ramsey spectroscopy. However, entangled states are more fragile to phase decoherence than uncorrelated states and when decoherence is taken into account both of them yield the similar limit to resolution. We propose a method to improve the limit associated with decoherence by using strongly correlated atoms with dynamics governed by a spherically symmetric and gapped Hamiltonian. We show that under certain conditions the gapped evolution of the atoms, can provide an increase in the signal-to-noise ratio even in decoherence-limited measurements. Finally, we discuss possible physical systems that can be used to implement this technique in real experiments.

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