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Goldiocks probes for noisy interferometry via quantum annealing to criticality GABRIEL DURKIN, Berkeley Center for Quantum Information and Computation — Quantum annealing is explored as a resource for quantum information beyond solution of classical combinatorial problems. Envisaged as a generator of robust interferometric probes, we examine a Hamiltonian of $N1$ uniformly coupled spins subject to a transverse magnetic field. The discrete many-body problem is mapped onto dynamics of a single one-dimensional particle in a continuous potential. This reveals all the qualitative features of the ground state beyond typical mean-field or large classical spin models. It illustrates explicitly a graceful warping from an entangled unimodal to bimodal ground state in the phase transition region. The transitional Goldilocks probe has a component distribution of width $\propto N^{2/3}$ and exhibits characteristics for enhanced phase estimation in a decoherent environment. In the presence of realistic local noise and collective dephasing, we find this probe state asymptotically saturates ultimate precision bounds calculated previously. By reducing the transverse field adiabatically, the Goldilocks probe is prepared in advance of the minimum gap bottleneck, allowing the annealing schedule to be terminated early. Adiabatic time complexity of probe preparation is shown to be linear in N.

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