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Enhanced estimation of quantum evolution parameters with entangled states DAVID COLLINS, MIKE FREY — Quantum estimation considers the issue of estimating parameters associated with the description of a quantum state or of the evolution of a quantum state when only a finite number of copies of the quantum system are available. The accuracy of any estimation scheme is limited by both standard statistical sampling issues as well as the inherent statistical nature of measurement outcomes for quantum systems. We consider rotations of a spin-1/2 particle about a fixed axis and which are parametrized by a rotation angle, which is to be estimated. We use the quantum Fisher information to establish optimal bounds on the variance in any estimator of this parameter in scenarios involving one use of the rotation upon each of a collection of spin-1/2 particles. We show that optimal estimation occurs when all spin-1/2 particles are entangled and present exact analytical results for the bound that is generated and the required input state. We show that this offers a significant advantage over the use of unentangled states.

David Collins
APS

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