Optimal feedback scheme for Hamiltonian parameter estimation

HAIDONG YUAN, Chinese University of Hong Kong — Measurement and estimation of parameters are essential for science and engineering, where the main quest is to find out the highest achievable precision with given resources and design schemes to attain it. Two schemes, the sequential feedback scheme and the parallel scheme, are usually studied in quantum parameter estimation. We show that the sequential feedback scheme has a 3-fold improvement over the parallel scheme for Hamiltonian parameter estimations on 2-dimensional systems, and an order of $O(d+1)$ improvement for Hamiltonian parameter estimation on $d-$dimensional systems. We also show that, contrary to the conventional belief, it is possible to simultaneously achieve the highest precision for estimating all three components of a magnetic field, which sets a benchmark on the local precision limit for the estimation of a magnetic field.

Haidong Yuan
Chinese University of Hong Kong