PROPOSAL OF A NEW QUANTUM ANNEALING SCHEDULE FOR STUDYING QUANTUM ANNEALING OF TRANSVERSE FIELD ISING MODELS

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*Recently, Heim, Rønnow, Isakov and Troyer [Science **348** (2015) 215] have reported that Monte Carlo simulations for the Ising spin glass model on the square lattice in the physically relevant continuous-imaginary-time limit do not show superiority of quantum annealing (QA) using transverse field against classical annealing (CA). Although the QA schedule that they had used has been using conventionally, however the QA schedule mathematically has no guarantee that the used schedule is the best QA schedule for performance of optimization. We propose a new QA schedule for studying transverse-field-based quantum versus classical annealing of the Ising model. The present QA schedule utilizes a smallest effective transverse field derived in this article. This QA schedule is made for the comparison between the system with no transverse field and the system with the smallest effective transverse field. As a case study, we study QA of the Ising spin glass model on the square lattice at low but finite temperature. A Monte Carlo algorithm using the physically relevant continuous-imaginary-time limit is performed. As the simulation results, we show superiority of QA against CA when the annealing time is sufficiently spent.*