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Forum de Physique Statistique @ ENS

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Titre : *How to avoid a first-order phase transition in quantum annealing systems for finite-dimensional Ising spin-glass models*

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Résumé : *Quantum annealing (QA), or quantum adiabatic computation, is one of the quantum computing technologies used to search for solutions to combinatorial optimization problems. While its application in real machines has been actively studied, it is not believed to efficiently solve NP problems, a class of difficult problems in computational complexity theory. For this reason, the physical mechanisms by which QA fails to solve the problem have been studied, and one scenario of failure has been proposed to be the emergence of a first-order phase transition during the QA computation process. We have shown mathematically that a certain first-order phase transition can be easily avoided in random spin systems on finite-dimensional lattices, including the three-dimensional Ising spin-glass model, which is one of the NP- hard problems[1]. I would like to discuss the implications of this finding.*
[1] Mizuki Yamaguchi, Naoto Shiraishi, Koji Hukushima, Proof of avoidability of the quantum first-order transition in transverse magnetization in quantum annealing of finite-dimensional spin glasses, https ://arxiv.org/abs/2307.00791
