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Statistical mechanical studies on the information processing with quantum fluctuation[1] YOSUKE OTSUBO, Graduate School of Frontier Sciences, The University of Tokyo, JUN-ICHI INOUE, Graduate School of Information Science and Technology, Hokkaido University, KENJI NAGATA, Graduate School of Frontier Sciences, The University of Tokyo, MASATO OKADA, Graduate School of Frontier Sciences, The University of Tokyo / Brain Science Institute, RIKEN — Quantum fluctuation induces the tunneling between states in a system and then can be used in combinatorial optimization problems. Such an algorithm is called quantum adiabatic computing. In this work, we investigate the quality of an information processing based on Bayes inference with the quantum fluctuation through the statistical mechanical approach. We then focus on the error correcting codes and CDMA multiuser demodulation which are described by conventional solvable spin glass models and can be analyzed by replica method in the thermodynamic limit. Introducing the quantum fluctuation into the decoding process of each problem, which is called quantum maximizer of the posteriori probability (QMPM) estimate, we analyze the decoding quality and then compare the results with those by the conventional MPM estimate which corresponds to finite temperature decoding From our limited results, the MPM based on the quantum fluctuation seems to achieve the same decoding quality as the thermal MPM does. We clarify the relationship between the optimal amplitude of transverse field and temperature for the mixture of quantum and classical MPMs.

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