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Isothermal quantum annealing of the 1D transverse Ising chain DAVIDE VENTURELLI, VADIM SMELYANSKIY, ALEJANDRO PERDOMO-ORTIZ, NASA Ames Research Center, SERGEI ISAKOV, Google, SERGEY KNYSH, NASA Ames Research Center, MARK DYKMAN, Michigan State University — We present a quantum annealing strategy to solve optimization problems that relies on the effect of the external environment on the quantum system (isothermal protocol). We define the isothermal complexity as the scaling of the longest instantaneous relaxation time with the number of qubits in the region after the critical point where the first excitation gap equals to the temperature. We calculate this complexity for the case of 1D transverse field Ising chain coupled to the bosonic environment. We show that the quantum annealing complexity bottleneck is determined by the quantum diffusion limited recombination of the fermions that represent system excitations. We present the analytical results as well as numerical study of the system dynamics and annealing complexity.

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