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Seeking Quantum Speedup Through Spin Glasses: Evidence of Tunneling?

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Quantum annealing machines use a non-mainstream method known as adiabatic quantum annealing to perform optimization tasks. Very recently, tests performed by different research teams on the D-Wave Two quantum annealer using spin glasses as a benchmark have shown that, although the machine indeed appears to tap into quantum effects, it shows no speedup over traditional computing architectures. We present results that suggest that the benchmark instances used are too simple to detect quantum speedup and based on insights from spin-glass physics outline strategies to develop hard instance classes. With our choice of benchmark strategy, we show that the D-Wave Two quantum annealer does not outperform current computer technologies, mainly due to noise and calibration errors of the device. However, our results do indicate that quantum tunneling might be present.

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