

Universal digital quantum simulation with trapped ions

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A digital quantum simulator is a quantum device that can be programmed to efficiently simulate any other quasilocal system. In this talk I will present our recent work on implementing digital quantum simulations in a system of trapped calcium ions¹. Using sequences of up to 100 gates and 6 qubits, the full time dynamics of a range of spin systems are digitally simulated. Interactions beyond those naturally present in our simulator are accurately reproduced and quantitative bounds are provided for the overall simulation quality. Our results highlight limiting sources of error and provide evidence that the level of control required for a full-scale quantum simulator will soon be within reach.

¹B. P. Lanyon, et al. Science 334, 57 (2011)