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A quantum-classical hybrid variational algorithm using trapped ions ANTONIOS KYPRIANIDIS, GUIDO PAGANO, PATRICK BECKER, KATHERINE COLLINS, HARVEY B. KAPLAN, WEN-LIN TAN, ANIRUDDHA BAPAT, JQI, NIST/University of Maryland, College Park, MD 20742, USA, LUCAS BRADY, QuICS, NIST/University of Maryland, College Park, MD 20742, USA, ALEXEY V. GORSHKOV, JQI, NIST/University of Maryland, College Park, MD 20742, USA and QuICS, NIST/University of Maryland, College Park, MD 20742, USA, STEPHEN JORDAN, QuICS, NIST/University of Maryland, College Park, MD 20742, USA and NIST, Gaithersburg, MD 20899, USA, CHRISTOPHER MONROE, JQI, NIST/University of Maryland, College Park, MD 20742, USA and IonQ, College Park, MD 20740 — Trapped atomic ions are an excellent platform for probing dynamics of many-body systems, allowing the study of quantum magnetism models both in equilibrium and after a quantum quench. We use chains of 171Yb+ ions confined in a rf Paul trap to simulate the transverse field Ising model with tunable long-range interactions, generated with spin-dependent optical dipole forces. Experiments are run in two quantum simulators operating at room and cryogenic temperature, respectively. Our platform is used to implement Quantum approximate optimization algorithms [1] and to study confinement of low-energy quasi-particles after a quantum quench [2]. [1] Farhi *et al*, arXiv:1602.07674 [quant-ph] [2] Liu *et al,* arXiv:1810.02365 [cond-mat.quant-gas]

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