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**Large Scale Quantum Computation in an Anharmonic Linear Ion Trap** GUIN-DAR LIN, FOCUS Center and MCTP, Department of Physics, University of Michigan, SHI-LIANG ZHU, LQT and ICMP, Department of Physics, South China Normal University, Guangzhou, China, RAJIBUL ISLAM, KIHWAN KIM, MING-SHIEN CHANG, SIMCHA KORENBLIT, CHRISTOPHER MONROE, JQI and Department of Physics, University of Maryland, LUMING DUAN, FOCUS Center and MCTP, Department of Physics, University of Michigan — We propose a large-scale quantum computer architecture by stabilizing a single large linear ion chain in a very simple trap geometry. By confining ions in an anharmonic linear trap with nearly uniform spacing between ions, we show that high-fidelity quantum gates can be realized in large linear ion crystals under the Doppler temperature based on coupling to a near-continuum of transverse motional modes with simple shaped laser pulses.

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