

Abstract Submitted
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Quantum simulation with two dimensional Wigner crystal in monolithic ion trap¹ MU QIAO, YE WANG, PENGFEI WANG, MARK UM, Institute for Interdisciplinary Information Sciences, Tsinghua University, NAIJUN JIN, Department of Physics, Tsinghua University, JUNHUA ZHANG, HAIYAN WANG, YIPU SONG, JINGNING ZHANG, KIHWAN KIM, Institute for Interdisciplinary Information Sciences, Tsinghua University — We report adiabatic quantum simulation with two dimensional crystals of ions. Our trap is a three-dimensional monolithic Paul trap, where we can generate the pan-cake type of 2 dimensional harmonic potential by squeezing only one of the radial frequency with proper principle axis. We observe the two dimensional Wigner crystal of ions, where the direction of main micromotion is perpendicular to the net-propagation vector of Raman laser beams, which allows us to perform coherent quantum operation without serious problem of micromotion. By shining Raman beams of 355 nm laser on the crystal, we generate the Ising type interaction between ions. We perform the adiabatic ground state preparation of the transverse Ising model and observe different character of the ground state with various number of ions. Moreover, we can control the connection graph of the Ising interaction by using different motional sidebands. Our work would open a new path for quantum simulation.

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