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Vortex pinning in a fast rotating Bose-Einstein condensate SHIHKUANG TUNG, VOLKER SCHWEIKHARD, ERIC CORNELL, JILA-NIST/ University of Colorado at Boulder — We present the first experiment on vortex pinning in a fast rotating Bose-Einstein condensate. The attractive pinning potential for the vortices is constructed by a two-dimensional optical lattice, centered and co-rotating with a rotating BEC. We report the results of vortex pinning with two different applied optical lattices, triangular and square, respectively. When a triangular optical lattice is applied, the angular orientation of the vortex lattice locks to the optical lattice. A pinning phase diagram is mapped out as a function of optical lattice rotation rate and optical potential depth. In another experiment when a square optical lattice is applied, we observe the structural phase transition from a triangular vortex lattice to a pinned square vortex lattice. The transition takes place via a "half pinned" phase where one plane of vortices locks to the optical lattice while the structure remains close to triangular. With increasing optical potential depth the lattice structure changes to the fully pinned square structure. We again present a phase diagram for this transition.

Shihkuang Tung
JILA

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