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Supersolid-like magnetic states in a mixed honeycomb-triangular lattice system.[1]

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Field-induced magnetic states that occur in layered triangular antiferromagnets have been of broad interest due to the emergence of new exotic phases, such as topologically ordered states and supersolids. Experimental realization of the supersolid states where spin components break simultaneously the translational and rotational symmetries remains scarce. In this context, the mixed vanadate−carbonate K2Mn3(VO4)2CO3 is a very promising system. This compound contains two types of two-dimensional layers alternately stacked along the crystallographic c-axis: one layer consists of a honeycomb web structure made of edge sharing MnO6 octahedra, while the other consists of MnO5 trigonal bipyramids linked by [CO3] triangles to form a triangular magnetic lattice. Magnetization and heat capacity measurements reveal a complex magnetic phase diagram that includes three phase transition associated with sequential long range magnetic ordering of the different sublattices. The lowest temperature state resembles a supersolid state that was predicted to occur in two-dimensional frustrated magnet with easy axis anisotropy. Such a supersolid phase is defined by a commensurate $\sqrt{3}\sqrt{3}$ magnetic superlattice, where two thirds of the spins are canted away from the easy axis direction. Applied magnetic field destabilizes this ordered state and induces a cascade of new exotic magnetic ground states. The nature of these field-induced magnetic states is evaluated by using neutron scattering techniques.

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