

Rearrangement of two dimensional dipolar supersolids under dipole tilt

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A Supersolid is an exotic phase of matter known for its non-intuitive property of exhibiting both superfluidity and crystalline order. In our experiment at Heidelberg we investigate two dimensional dipolar supersolids of dysprosium atoms. We are able to control the interplay of contact and dipolar interactions as well as the orientation of the dipoles and thus access a variety of crystal arrangements, including triangular, square and stripe lattice types. Here we report on our investigations into the phase diagram of finite sized supersolids focusing on the rearrangement of crystal structure between a triangular lattice to a stripe-like density modulation as the dipole orientation is varied. For high and low values of the dipole tilt, we observe global phase coherence in a narrow window of scattering lengths below the superfluid to supersolid transition point. At intermediate dipole tilt angles, we observe bistability between crystal structures, indicating metastable states and suggesting a first-order structural transition.

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