Novel Supersolid Phase of a Dipole-Blockaded Gas

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A novel supersolid phase is predicted for an ensemble of Rydberg atoms in the dipole-blockade regime, interacting via a repulsive dipolar potential "softened" at short distances. Using Quantum Monte Carlo simulations based on the Continuous-space Worm Algorithm, we study the low temperature phase diagram of this system. We observe an intriguing new phase, consisting of a crystal of mesoscopic superfluid droplets. At sufficiently low temperature, phase coherence throughout the whole system, and the ensuing bulk superfluidity, are established through tunnelling of identical particles between neighbouring droplets.