Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Supersolidity in a trapped dipolar quantum gas TIM LANGEN, MINGYANG GUO, FABIAN BOETTCHER, JAN-NIKLAS SCHMIDT, JENS HERTKORN, KEVIN NG, VIRAATT ANASURI, MATTHIAS SCHMIDT, SEAN GRAHAM, TILMAN PFAU, University of Stuttgart — A supersolid is a counterintuitive state of matter that combines the frictionless flow of a superfluid with the crystal-like periodic density modulation of a solid. It thus simultaneously breaks both global gauge and translational symmetry. Although the existence of this counterintuitive state has been predicted more than 50 years ago, only recently it has become possible to realize and study its properties using ultracold quantum gases. In our experiment with strongly-dipolar dysprosium atoms, we realise a supersolid state based on an array of quantum droplets that is both self-organized and coherent. We observe a low-energy Goldstone mode, which manifests itself as an out-of-phase oscillation of the crystal array and the superfluid density. The corresponding dynamics directly prove the genuine superfluidity of the observed state. By theoretically studying the excitation spectrum, we further show that the Goldstone, as well as a distinct Higgs amplitude mode, emerge from softening roton modes at the phase transition point.

Tim Langen
University of Stuttgart

Date submitted: 28 Jan 2020 Electronic form version 1.4