

Probing the Superfluid and Solid Properties of a Dipolar Supersolid

Dr. Thomas Bland, Dr. Pramodh Senarath Yapa

University of Innsbruck

For a supersolid state to exist, it must spontaneously break two types of symmetry: phase (gauge) symmetry, which imparts superfluid-like properties, and translational invariance, which gives it solid-like characteristics. A key question is: how do the expected superfluid and solid properties modify each other in the presence of both?

In these talks, we will explore recent theoretical and experimental advances in understanding supersolids in dipolar quantum gases, focusing first on their superfluid properties through quantum vortex nucleation [1] and the application of these results to develop a quantum simulator of a rotating neutron star [2], followed by their solid properties through shear wave propagation [3].

[1] E. Casotti*, E. Poli* et al., Observation of vortices in a dipolar supersolid, to appear in *Nature*, arXiv:2403.18510 (2024)

[2] E. Poli et al., Glitches in rotating supersolids, *Phys. Rev. Lett.* 131, 223401 (2023)

[3] P. Senarath Yapa and T. Bland, Supersonic shear waves in dipolar supersolids, arXiv:2410.16060 (2024)