

Polar gases: from supersolids and rotons to peculiar disorder models

Prof. Dr. Luis Santos

Institut für Theoretische Physik, Leibniz Universität Hannover

Dipolar gases present a qualitatively new physics compared to their non-dipolar counterparts due to the crucial role played by the dipole-dipole interactions. In this talk, I will briefly discuss various scenarios, in which this new physics is particularly apparent.

I will start with dipolar Bose-Einstein condensates, and in particular with recent developments involving quantum droplets [1], roton-like excitations [2], and condensates with supersolid properties [3]. I will then move to polar lattice gases, discussing in particular how the dipole-induced inter-site interactions lead to peculiar dynamics.

I will first show that these inter-site interactions lead to quasi-localization in absence of disorder even for very dilute lattice gases and moderate dipoles [4]. In the final part, I will comment on dipole-induced transport of spin excitations, which realize peculiar disorder models, characterized by exotic localization properties and the appearance of extended but non-ergodic states [5,6,7].

[1] L. Chomaz et al., Phys. Rev. X 6, 041039 (2016).

[2] L. Chomaz et al., Nature Phys. 14, 442 (2018).

[3] L. Tanzi et al., Phys. Rev. Lett. 122, 130405 (2019).

[4] W. Li et al., arXiv:1901.09762.

[5] X. Deng et al., Phys. Rev. Lett. 117, 020401 (2016).

[6] X. Deng et al., Phys. Rev. Lett. 120, 110602 (2018).

[7] X. Deng et al., arXiv:1808.03585.