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Supersolidity of a dipolar Bose gas in an infinite tube: ground states and excitations

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I will discuss the results of a theoretical investigation into the supersolid state of a dipolar quantum Bose gas confined within an infinite tube potential [1-3]. This system serves as a thermodynamic idealization of cigar-shaped dipolar Bose gases, which have been utilized in recent experiments to prepare supersolids [4]. Our study presents phase diagrams as a function of the average linear density and s-wave scattering length, wherein we have observed that the supersolid transition exhibits both continuous and discontinuous regions as the average density varies. Additionally, we have explored the excitations of the system, which reveal softening of roton-like and Higgs-like modes at the continuous transition [7], and analyzed the behavior of sound speeds. Our results show that the sound speeds and compressibility exhibit a discontinuity at the transition, indicating a second-order phase transition. We have also compared our full numerical results [2,3] with those of a simpler reduced theory [1], which describes the transverse part of the field variationally (see also [5,6]).

References

[1] P. B. Blakie, D. Baillie, L. Chomaz, and F. Ferlaino, Supersolidity in an elongated dipolar condensate, Physical Review Research 2, 043318 (2020).
[2] Joseph C. Smith, D. Baillie, and P. B. Blakie, Supersolidity and crystallization of a dipolar Bose gas in an infinite tube, Physical Review A 107, 033301 (2023)
[3] P. B. Blakie, D. Baillie, L. Chomaz, and F. Ferlaino, in preparation.
[4] L. Tanzi, et al., Physical Review Letters 122, 130405 (2019); F. Böttcher, et al., Physical Review X 9, 011051 (2019); L. Chomaz, et al., Physical Review X 9, 021012 (2019).
[5] Santo Maria Roccuzzo and Francesco Ancilotto, Supersolid behavior of a dipolar Bose-Einstein condensate confined in a tube, Physical Review A 99, 041601(R) (2019)
[6] Tobias Ilg and Hans Peter Büchler, Ground-state stability and excitation spectrum of a one-dimensional dipolar supersolid, Physical Review A 107, 013314 (2023)
[7] J. Hertkorn, F. Böttcher, M. Guo, J. N. Schmidt, T. Langen, H. P. Büchler, and T. Pfau, Fate of the Amplitude Mode in a Trapped Dipolar Supersolid, Physical Review Letters 123, 193002 (2019)

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