Partially quantized currents in supersolids

Niccolò Preti,[1,2,3] Charles Drevon,[2,3] Nicolò Antolini,[3] Giulio Biagioni,[4] Giovanni Ferioli,[1,2] Andrea Fioretti,[3] Carlo Gabbanini,[3] and Giovanni Modugno[1,2,3]

[1] *Dipartimento di Fisica e Astronomia, Università di Firenze, Firenze, Italy*
[2] *European Laboratory for Nonlinear Spectroscopy, Università di Firenze, Firenze, Italy*
[3] *Consiglio Nazionale delle Ricerche, Istituto Nazionale di Ottica, Sede Secondaria di Pisa, Pisa, Italy*
[4] *Universite Paris-Saclay, Institut d' Optique Graduate School, CNRS, Laboratoire Charles Fabry, Palaiseau, France*

It has been predicted [1] that a supersolid could host persistent currents whose nature strongly depend on the superfluid fraction f_s of the system. In particular, the angular momentum of these currents is not quantized as in the case of regular superfluids, but depends on f_s, thus making these currents partially quantized. I will showcase experimentally accessible protocols to both excite partially quantized currents for a supersolid on a ring and also to measure its angular momentum. These protocols were valided by making numerical simulations of the excitation and probing schemes using the Gross-Pitaevskii equation. I will also report on an ongoing experiment aimed at trapping a supersolid on a ring where we will apply our protocol to observe the partial quantization of the current states of a supersolid [2,3].

[1] Tengstrand, M. Nilsson, et al. "Persistent currents in toroidal dipolar supersolids." Physical Review A 103.1 (2021): 013313.
[2] Preti, Niccolò, et al. "Blue repulsive potential for dysprosium Bose-Einstein condensates." Physical Review A 110.2 (2024): 023307.
[3] Preti, N. "Towards dipolar supersolids in a ring." IL NUOVO CIMENTO 100.256 (2024): 47.