

Finite current supersolids in dipolar BECs

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We theoretically investigate supersolids in a cylindrical tube under finite supercurrent and show that both the contrast of the density modulation and superfluid fraction depend sensitively on the imposed flow. By imposing a phase twist on the condensate wave function, we demonstrate the existence of stationary supersolid states carrying finite current. Furthermore, we find that a superfluid near the roton instability can be driven into the supersolid phase via phase twisting, providing an alternative route to supersolidity that does not rely on modifying interparticle interactions, as is commonly done in experiments. At sufficiently large currents, Landau and dynamical instabilities emerge, beyond which stationary solutions cease to exist and the system evolves into time-dependent states. For strong phase twists, phase slips can occur, leading to current reversal.

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