Combined fractional charge-spin vortices in spin density waves

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As electronic crystals, the charge/spin density waves (CDW/SDW) possess such common topological defects as dislocations – the vortices of their displacements' phases which appear under the application of the electric field or other stresses. Less commonly, the density waves possess also the space-time vortices, the phase slip centers as a kind of instantons, which are necessary for the onset of the collective sliding and the conversion among the normal and condensed carriers. SDWs, as itinerate antiferromagnets, possess also the spin-rotation degree of freedom which can give rise to vorticity of their staggered magnetization. The rich multiplicative order parameter of SDWs allows for an unusual object of a complex nature: topologically bound half - integer dislocation combined with a semi - vortex of a staggered magnetization [1,2]. These objects become energetically favorable in comparison with conventional integer vortices due to the enhanced Coulomb interactions. Their generation affects the static vortex arrays and also the time-periodic phase slips responsible for the phenomenon of the so called narrow band noise.

1. S. Brazovskii and N. Kirova, "Phase slips, dislocations, half-integer vortices, two-fluid hydrodynamics and the chiral anomaly in charge and spin density waves.", *I.E. Dzyaloshinskii 90 anniversary volume*, JETP, **159**, 806-814 (2021).

2. S. Brazovskii and N. Kirova, "Simulations of dynamical electronic vortices in charge and spin density waves", *in* "Topological Objects in Correlated Electronic Systems", MDPI Symmetry, **15** (2023) 915.