Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Quantized vortices and superflow in arbitrary dimensions: Structure, energetics and dynamics FLORIN BORA, PAUL GOLDBART, University of Illinois at Urbana-Champaign — The structure and energetics of superflow around quantized vortices, and the motion inherited by these vortices from this superflow, are explored for the superfluidity of helium-four in arbitrary dimensions. The vortices may be idealized as objects of co-dimension two, such as two-dimensional surfaces in the case of four-dimensional superfluidity. The energy of the superflow is found to take on a simple form for vortices that are smooth and asymptotically large, compared with the vortex core size. The motion of vortices is analyzed in general, as well as for the special cases of hyper-spherical and weakly distorted hyper-planar vortices. In all dimensions, vortex motion reflects vortex geometry. In dimension four and higher, this includes not only extrinsic but also intrinsic aspects of the vortex shape. For the generalizations of the vortex rings of three dimensional superfluidity, the energy-momentum relation is determined. Simple scaling arguments recover the essential features of these results, up to numerical and logarithmic factors.

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Date submitted: 20 Nov 2008 Electronic form version 1.4