Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

Half-quantum vortices in $p_x + ip_y$ superconductors[1]

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Half-quantum vortices, each with flux of h/4e, are needed to realize topological quantum computation in a p+ip superconductor. However, until recently, there had not been any clear experimental observation of such vortices. We point out, although the magnetic energy is reduced by breaking full vortices into half-quantum vortices, there is an energy cost (which diverges with system size) due to the unscreened spin current and the spin state locking. The recent observation of half-quantum vortices by the Budakian group can be best explained by the fact that the magnetic energy savings can dominate over the spin energy cost in a mesoscopic setting. A finite density vortex lattice may have similar energetics, leading to a lattice of half-quantum vortices. Lastly we show that there can be entropy driven dissociation of a full vortex into two half-quantum vortices.

[1]Supported in part by Stanford Institute for Theoretical Physics