# A new route to a finite center-of-mass momentum pairing state; current driven FFLO state

Hyeonjin Doh,* Matthew Song, and Hae-Young Kee†

*Department of Physics, University of Toronto, Toronto, Ontario M5S 1A7, Canada*

(Dated: April 21, 2006)

The previously studied Fulde-Ferell-Larkin-Ovchinnikov (FFLO) state is stabilized by a magnetic field via the Zeeman coupling in spin-singlet superconductors. Here we suggest a new route to acheive non-zero center-of-mass momentum pairing states in superconductors with Fermi suface nesting. We investigate two-dimensional superconductors under a uniform external current, which leads to a finite pair-momentum of $\mathbf{q}_e$. We found that a FFLO state with a spontaneous pair-momentum of $\mathbf{q}_s$ is stabilized above a certain critical current which depends on the direction of the external current. The total pair-momentum of $\mathbf{q}_t(=\mathbf{q}_s+\mathbf{q}_e)$ is perpendicular to the nesting vector in order to maximize the Cooper pairing between electrons with momentum $-\mathbf{k}+\mathbf{q}_t$ and $\mathbf{k}+\mathbf{q}_t$. We also suggest experimental signatures of the FFLO state.

PACS numbers: 71.10.Hf,71.27.+a

*Electronic address: hdoh@physics.utoronto.ca

†Electronic address: hykee@physics.utoronto.ca