Supercurrent transport via Andreev bound states in an external magnetic field

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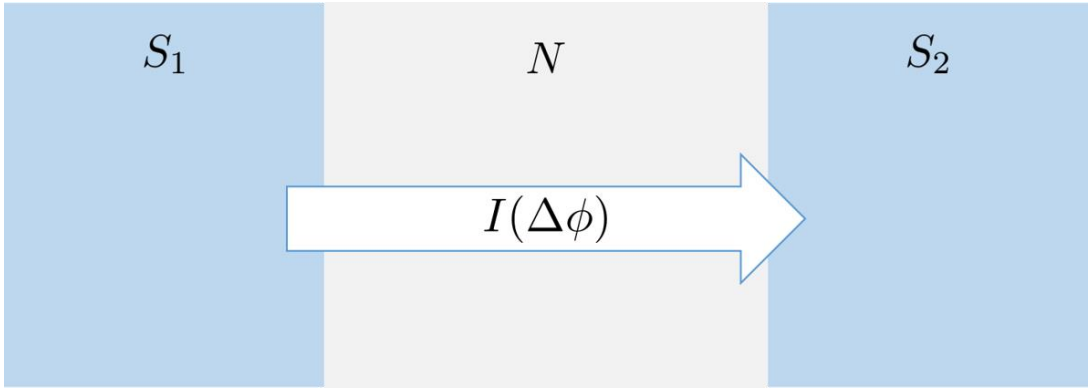
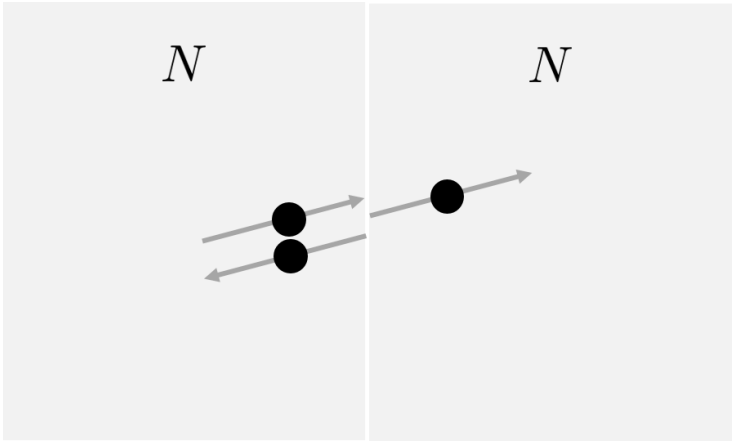
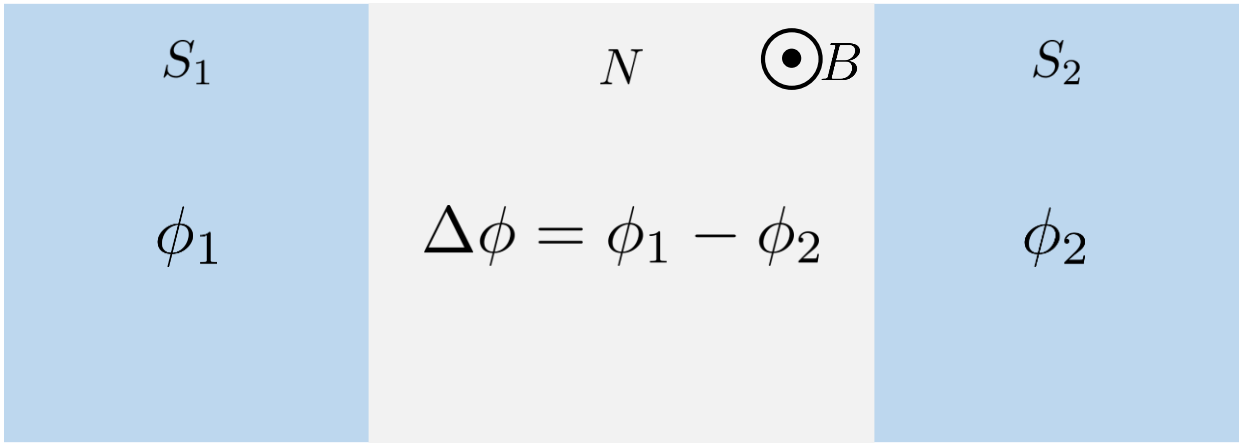
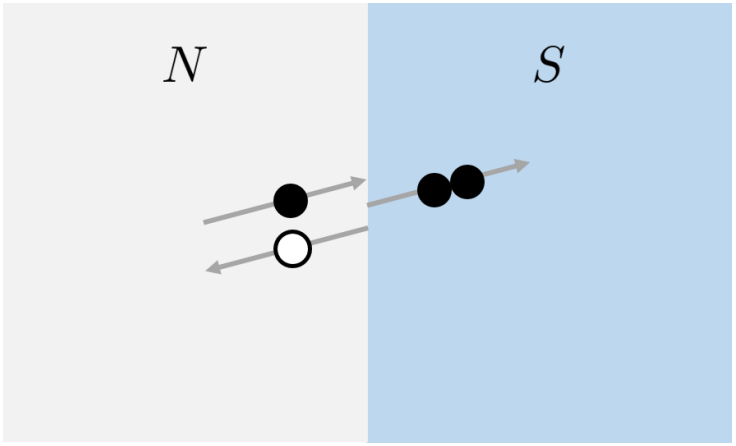


Mechanism of supercurrent transport

- Cooper-pairs transport supercurrent in superconductor
- Andreev Bound States transport supercurrent in normal metal
- The supercurrent is phase driven

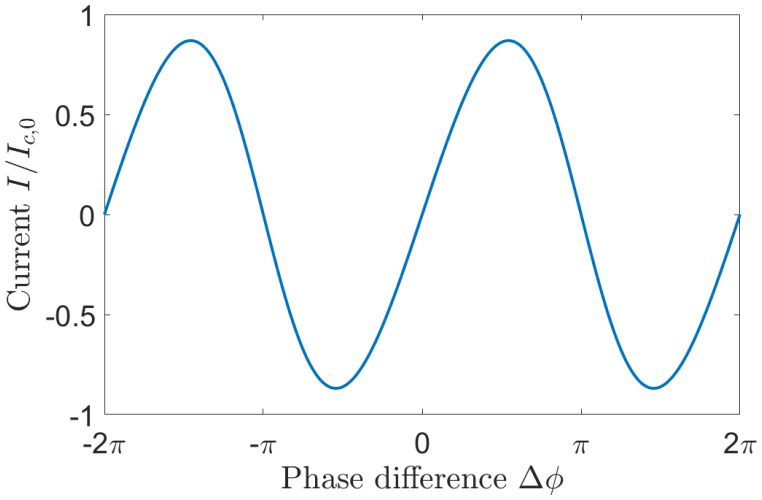


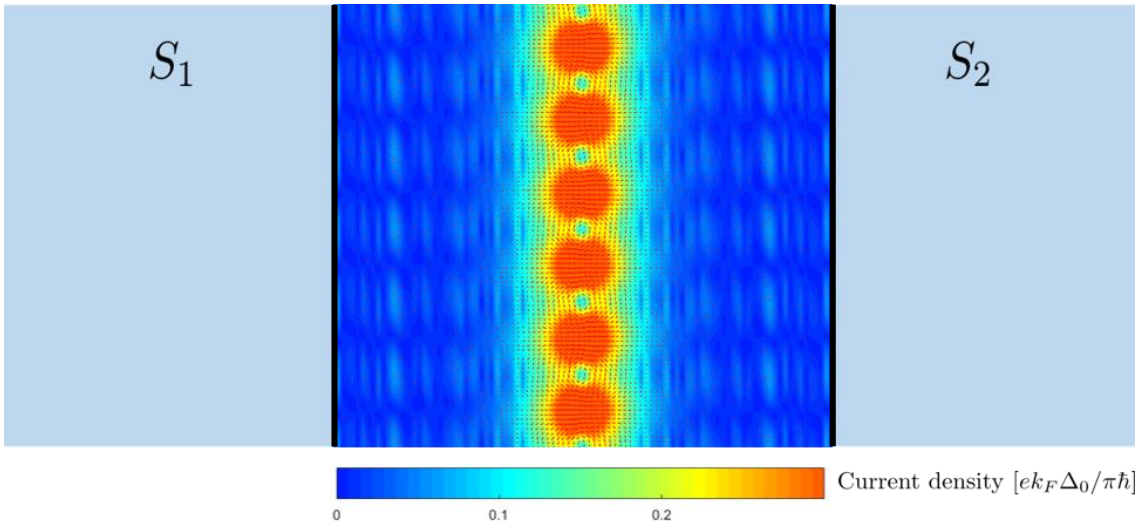


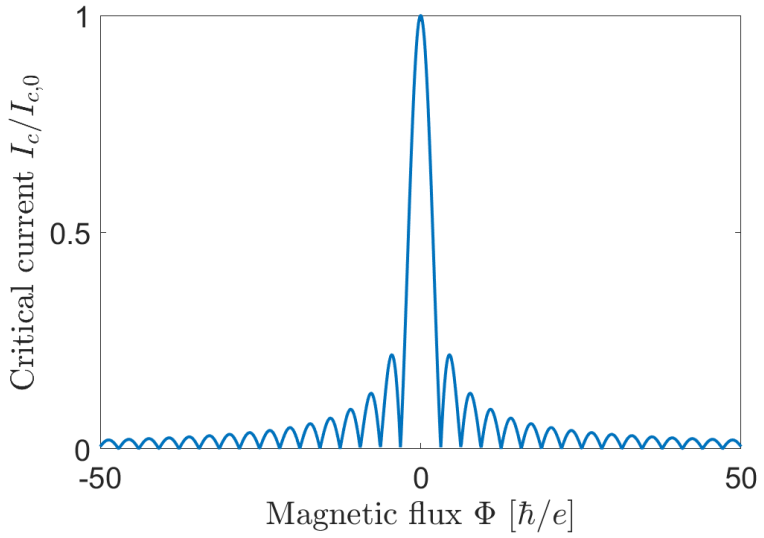


Some Results

$$\delta I_k(\Delta\phi) = \frac{e\Delta_0}{\hbar}\sin\left(\frac{\Delta\phi}{2} - \frac{\gamma_k}{2}\right)\tanh\left(\frac{\Delta_0\cos\left(\frac{\Delta\phi}{2} - \frac{\gamma_k}{2}\right)}{2k_BT}\right)$$







Conclusion and outlook

- Supercurrent vortices
- Apply non-constant magnetic field
- Use magnetic field to control the supercurrent