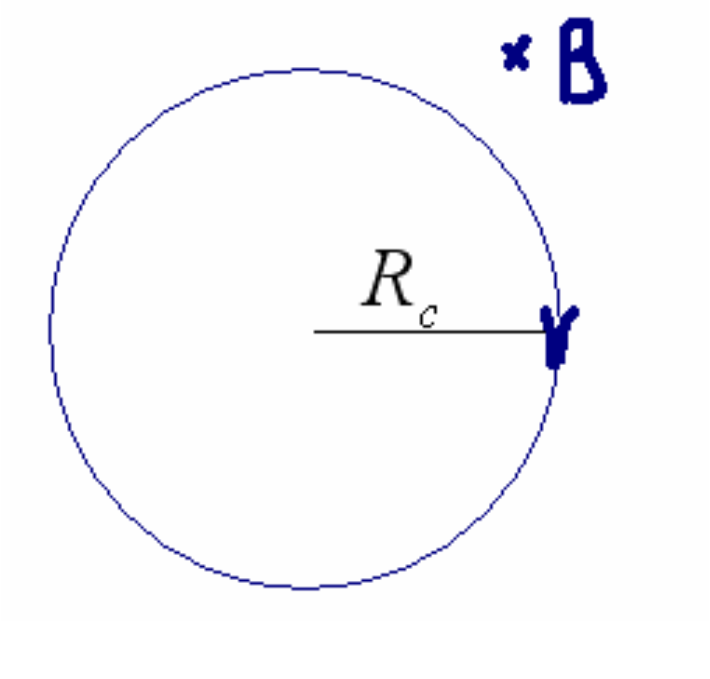
Cyclotron motion in a magnetic field



$$\frac{d\vec{v}}{dt} = \frac{\vec{F}_{Lorentz}}{m_e} = \frac{eB}{m_e}\vec{l}_z \times \vec{v}$$

$$R_c = \frac{v_F}{\omega_c}$$

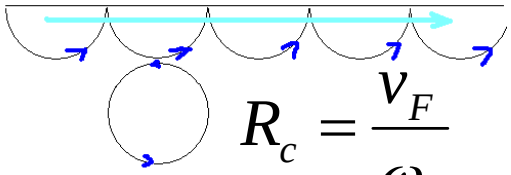
cyclotron radius

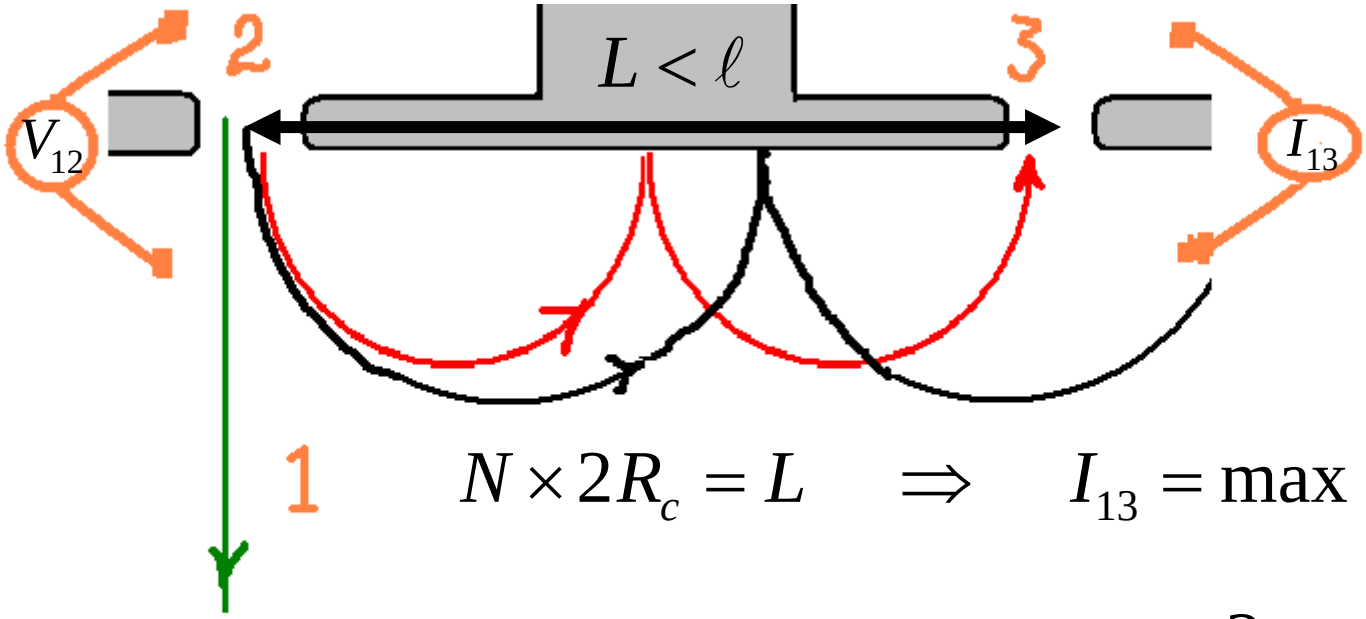
$$\omega_c = \frac{eB}{m}$$

cyclotron frequency

$$\vec{v} = \left(\vec{l}_x \cos \omega_c t + \vec{l}_y \sin \omega_c t\right) \cdot v$$

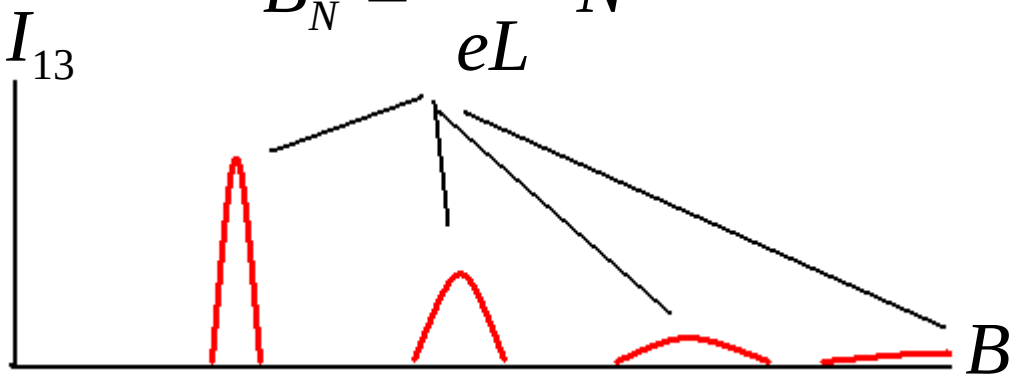
Skipping orbits and electron focusing lead to a non-local current in ballistic devices.





$$N \times 2R_c = L \quad \Rightarrow \quad I_{13} = \max$$

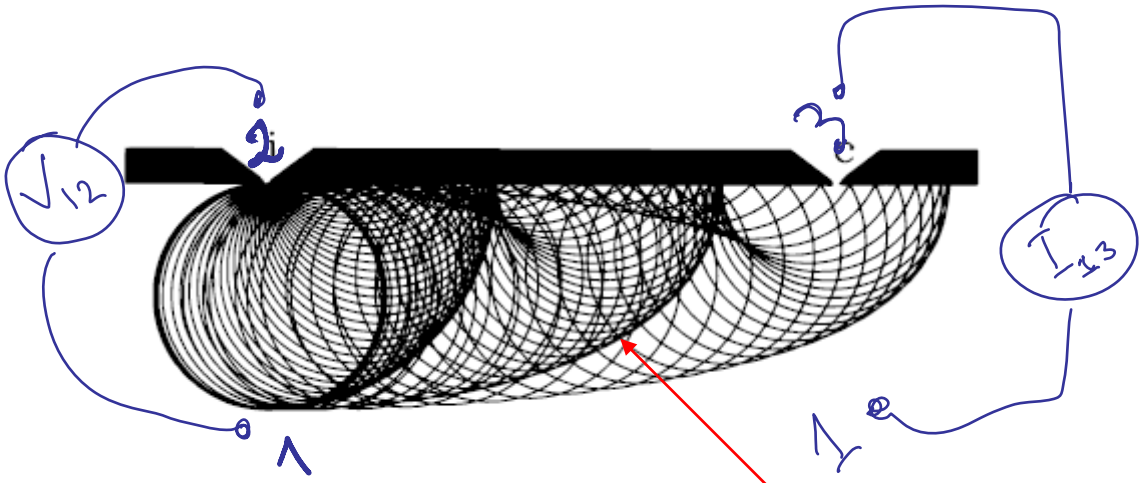
$$B_N = \frac{2p_F}{eL} N$$



$$\frac{2N}{L} = \frac{1}{R_c} = \frac{\omega_c}{v_F} = \frac{eB_N}{m_e v_F}$$

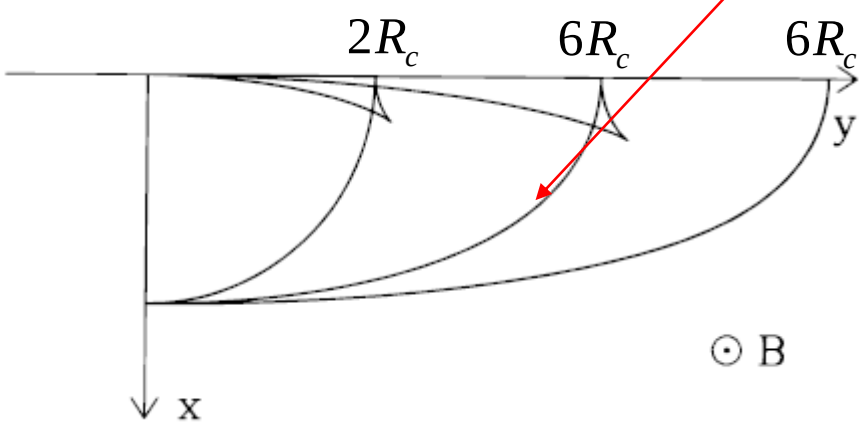
p_F

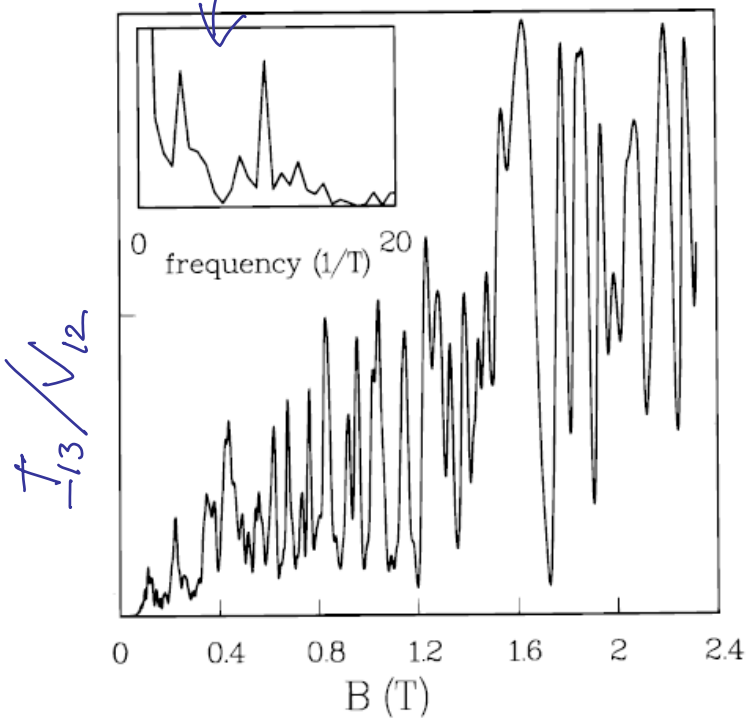
Caustics in a skipping motion of electron.



corresponds to $N \times 2R_c = L$

Densely appearing trajectories – caustics





C. Beenakker (theory), 1992

B. van Wees (exp), 1989-1992