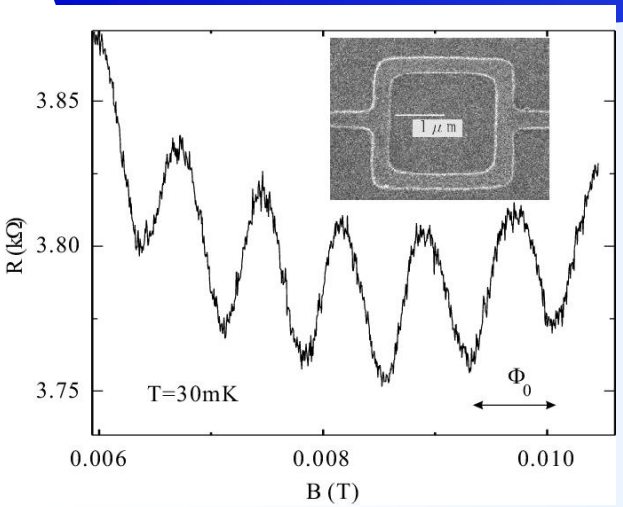
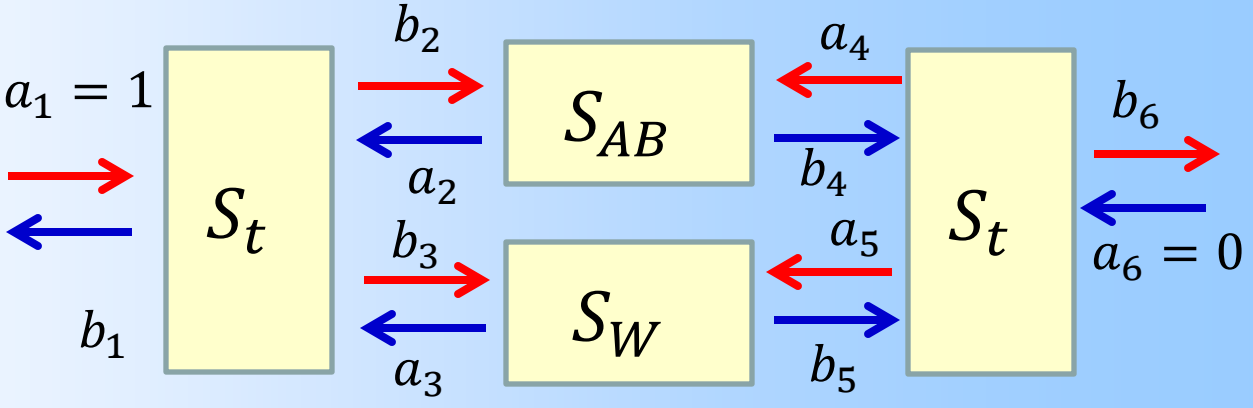
Physics of Semiconductors (12)

Shingo Katsumoto
Institute for Solid State Physics,
University of Tokyo

2013/7/19

Aharonov-Bohm ring S matrix model





$$S_t = \begin{pmatrix} 0 & -1/\sqrt{2} & -1/\sqrt{2} \\ -1/\sqrt{2} & 1/2 & -1/2 \\ -1/\sqrt{2} & -1/2 & 1/2 \end{pmatrix}$$

Three terminal

$$S_{\mathrm{w}} = \begin{pmatrix} 0 & e^{i\theta_0} \\ e^{i\theta_0} & 0 \end{pmatrix}$$

Traversal phase

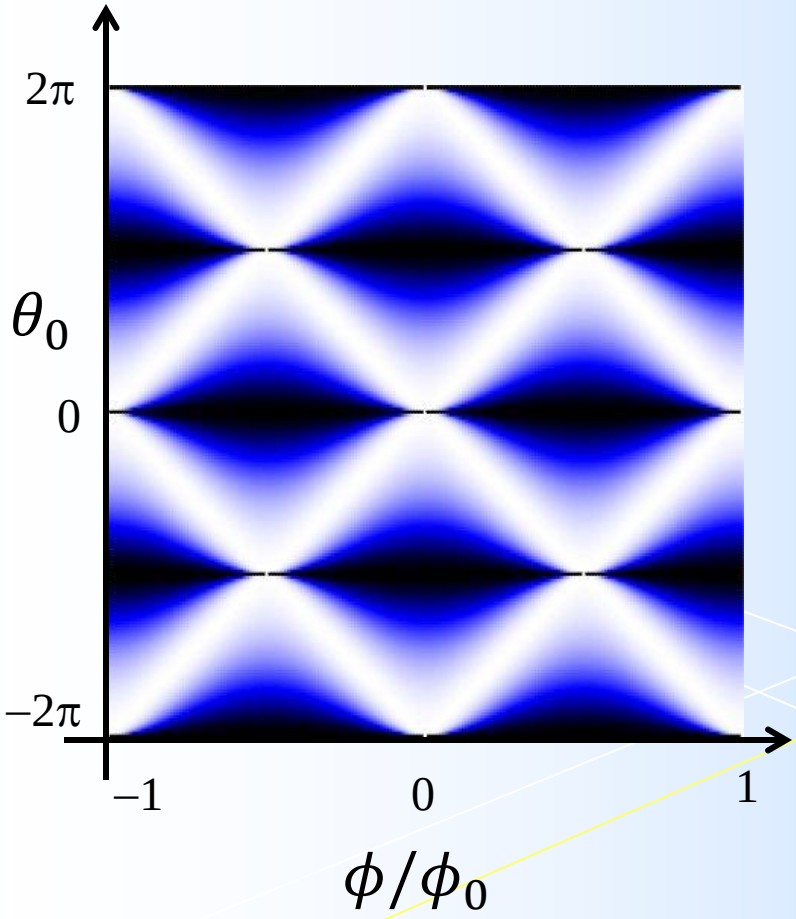
$$S_{\mathrm{AB}} = \begin{pmatrix} 0 & e^{i\theta_{\mathrm{AB}}} \\ e^{-i\theta_{\mathrm{AB}}} & 0 \end{pmatrix}$$

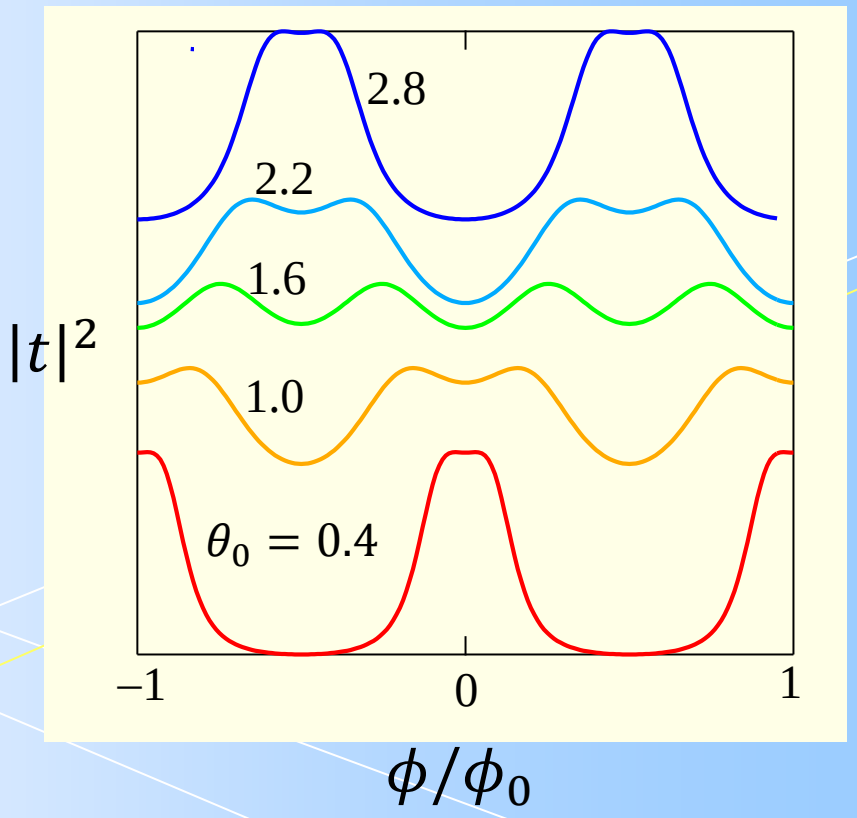
$$\theta \equiv 2\pi \frac{\phi}{\phi_0} = \frac{e}{\hbar}\phi$$

Aharonov-Bohm phase

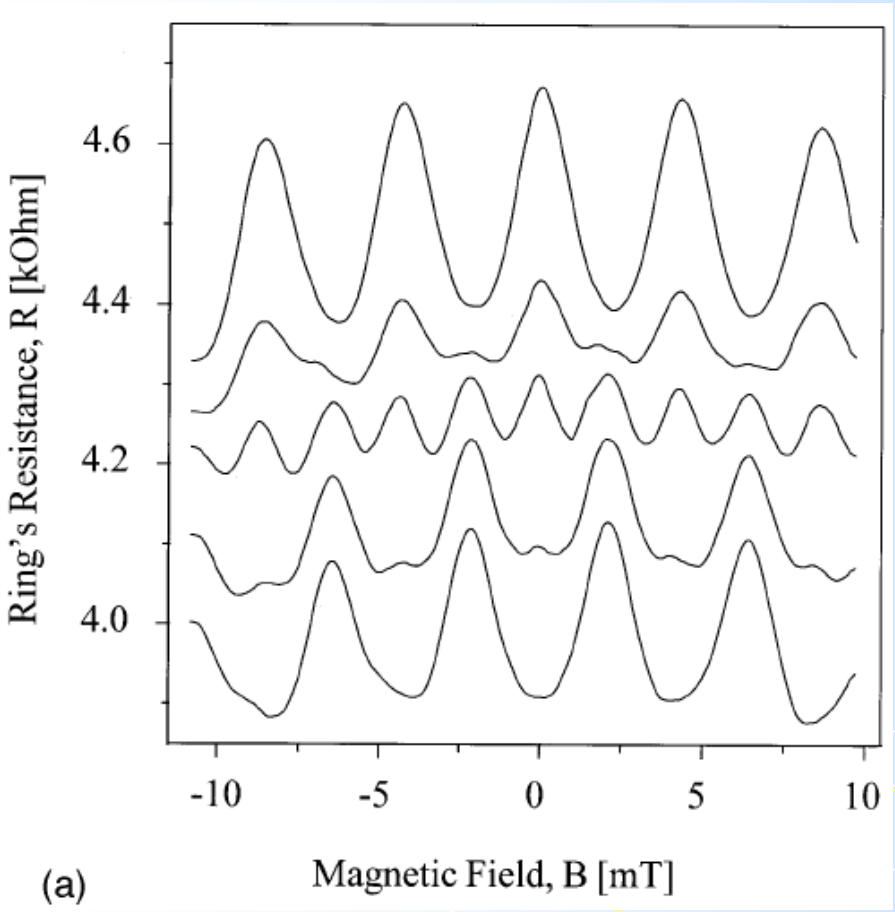
"Phase rigidity" in AB ring

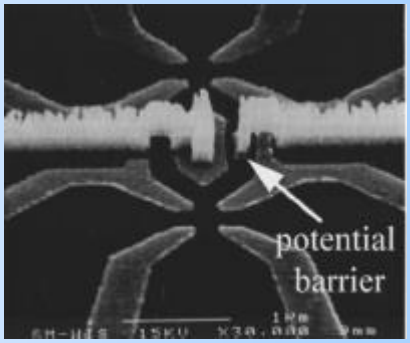
$$t = \frac{4 \sin \theta_0}{1 + e^{i\theta_{\mathrm{AB}}}\left(e^{i\theta_{\mathrm{AB}}} + e^{i\theta_0} - 3e^{-i\theta_0}\right)}$$





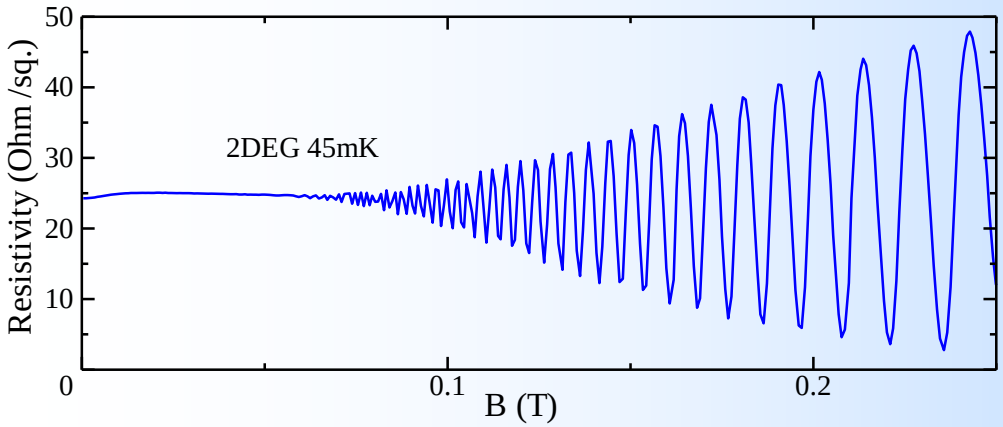
Experiment on phase rigidity

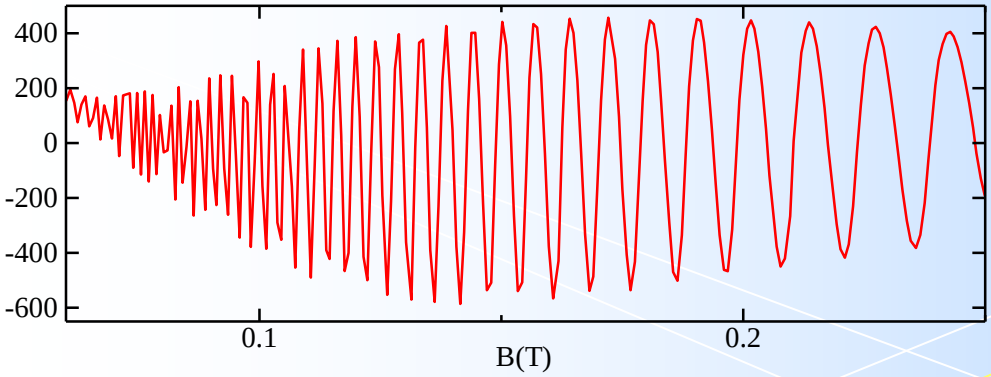


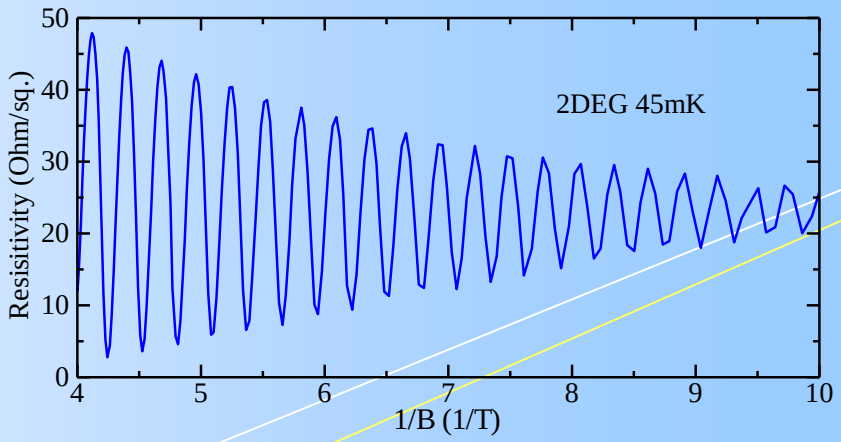


A. Yacoby et al.
PRB **53**, 9583 ('96).

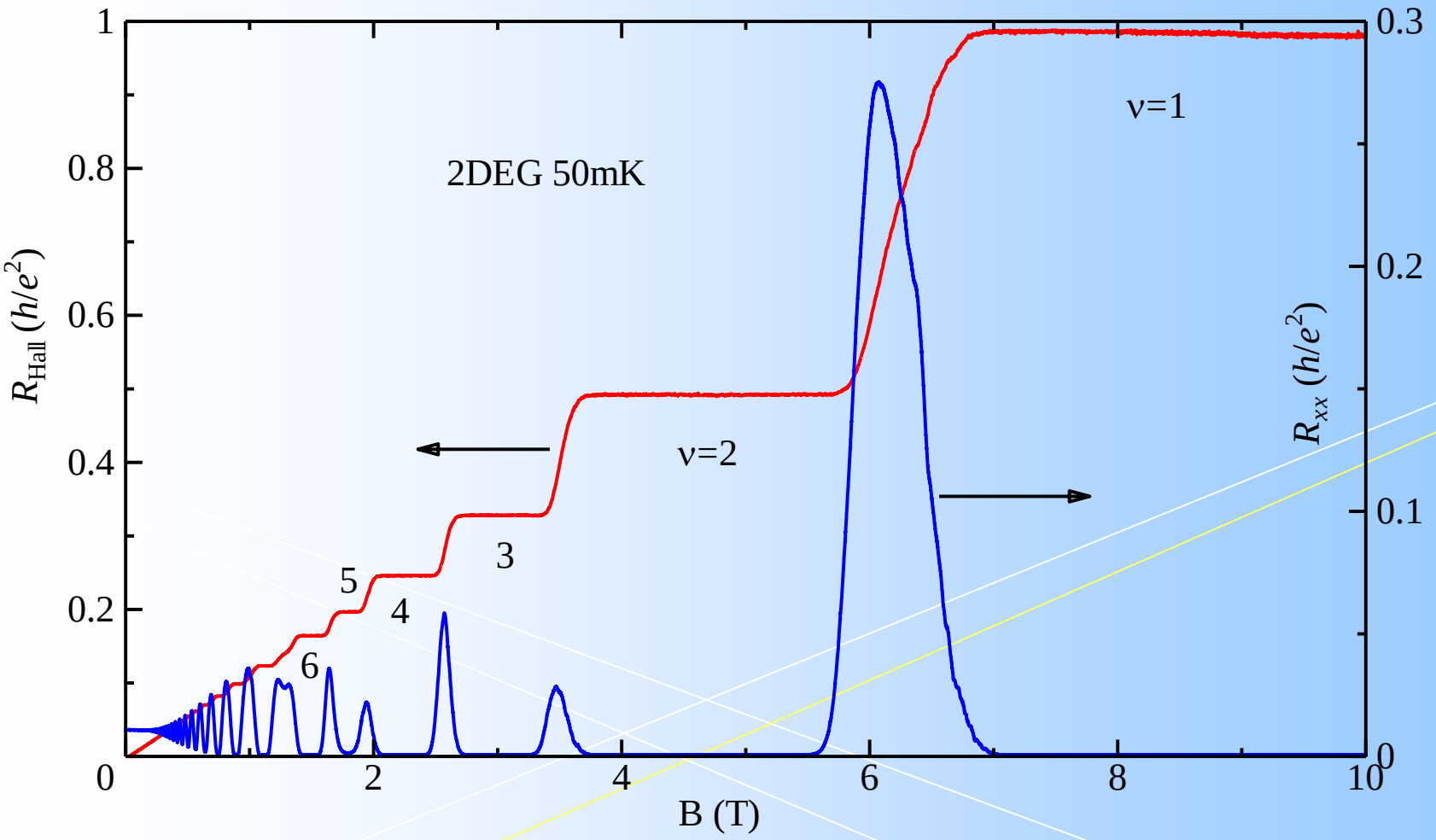
Shubnikov-de Haas Oscillation







Integer quantum Hall effect

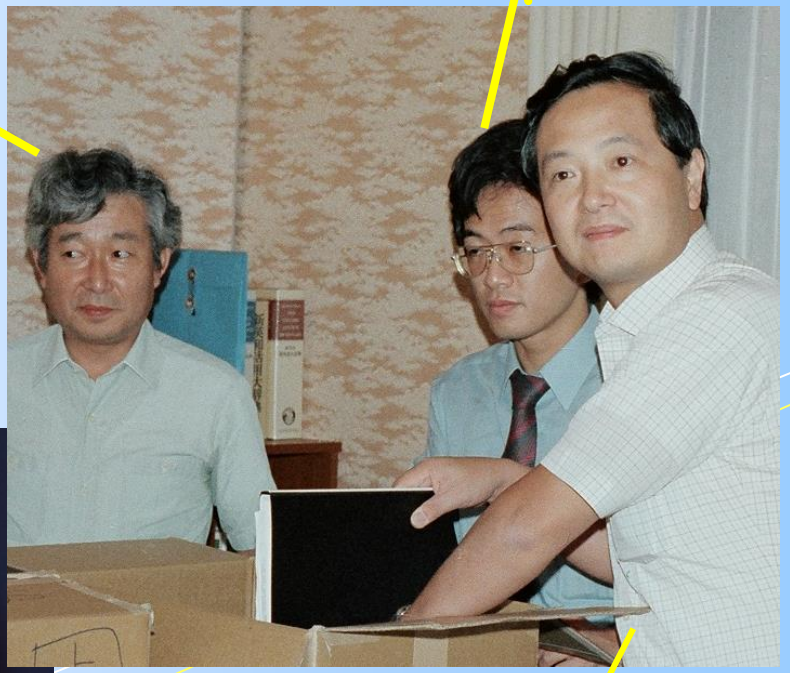


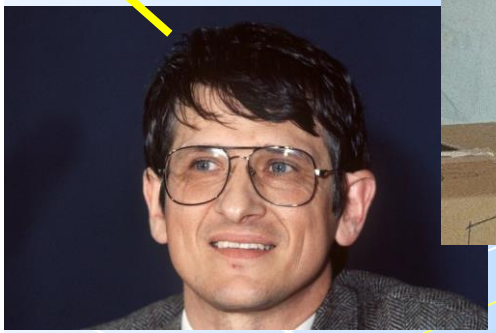
Discovery of quantum Hall effect

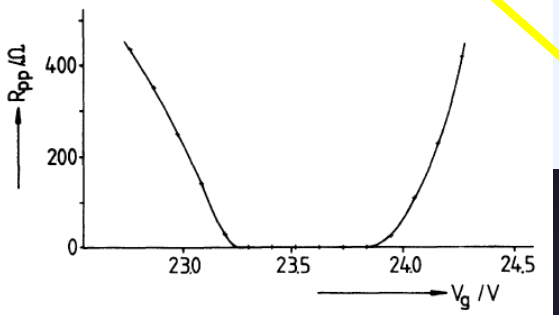
Klaus von Klitzing

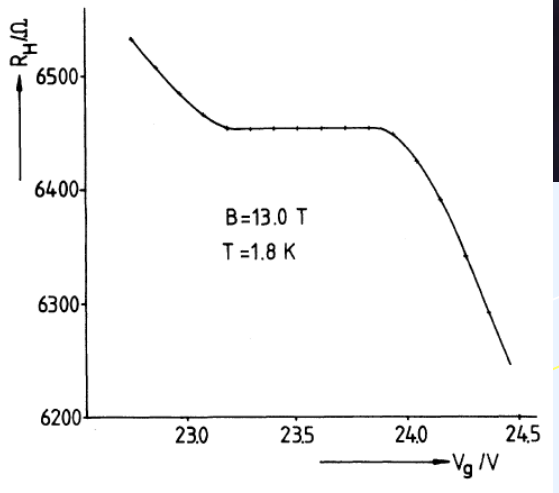
Shinji Kawaji

Yasuhiro Iye





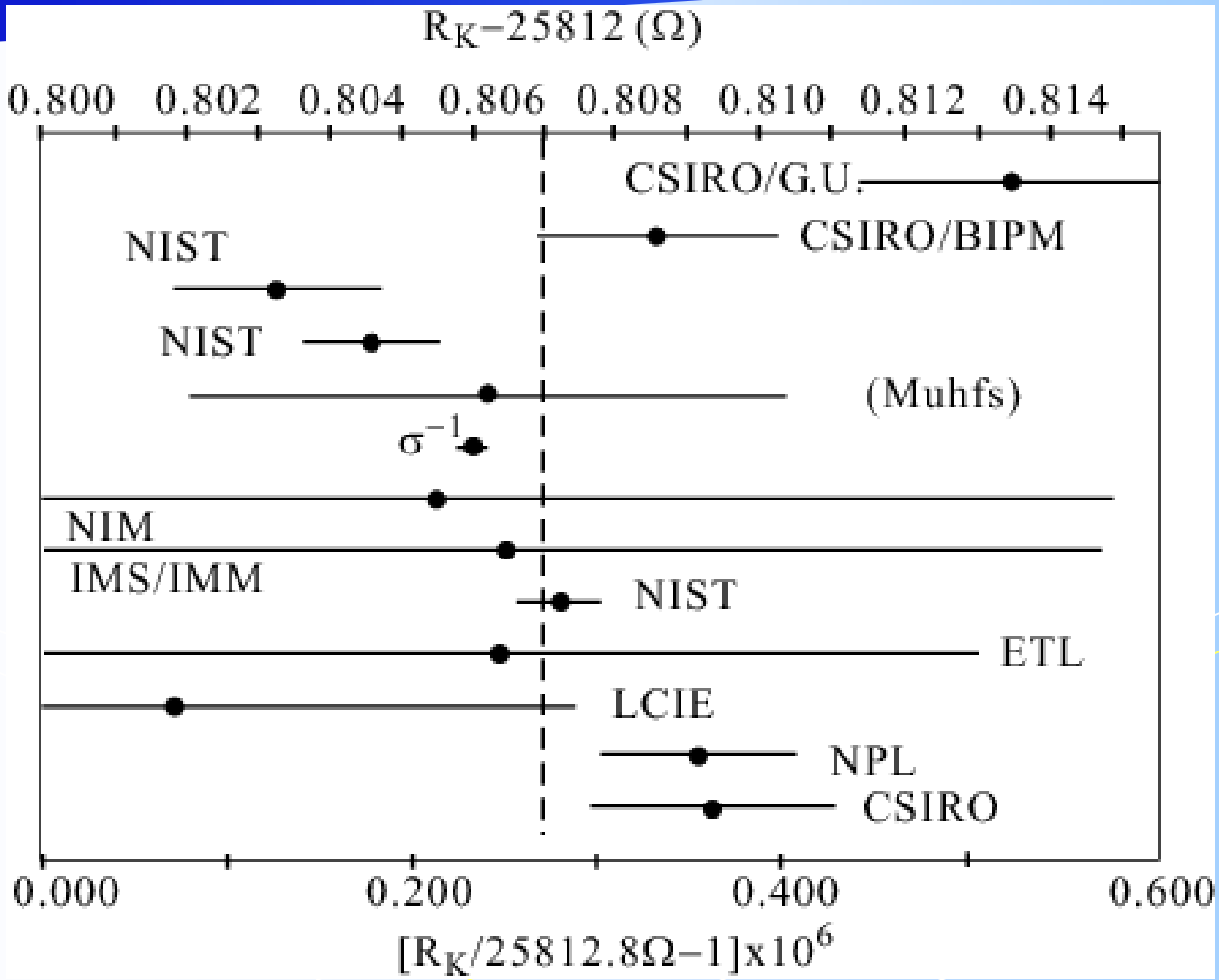




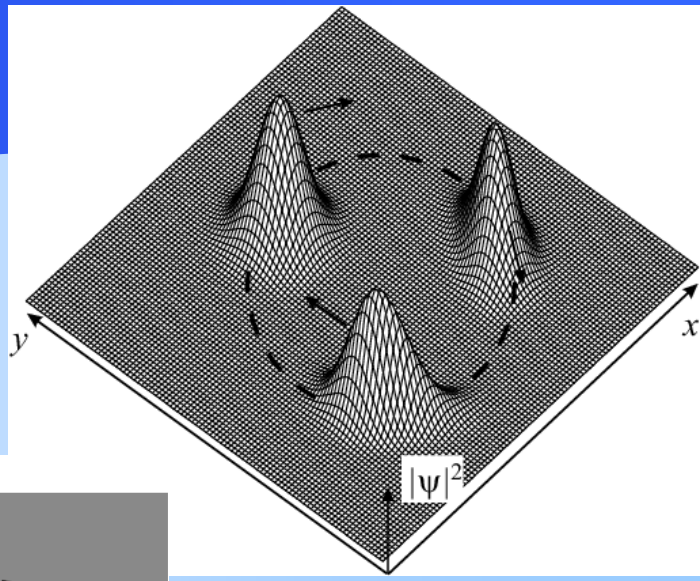
Tsuneya Ando

Phys. Rev. Lett. **45**, 494 (1980)

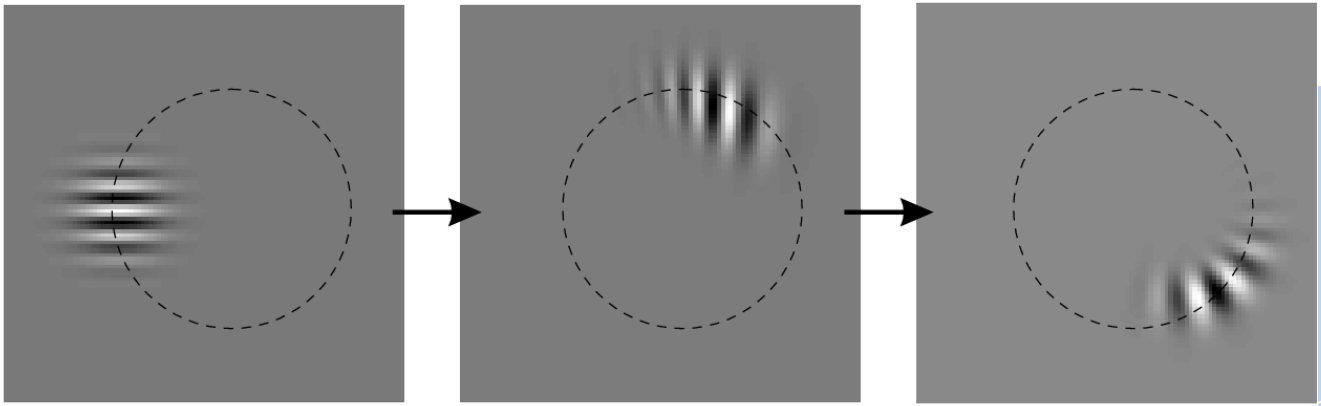
Standard of resistance



Cyclotron motion and gauge selection

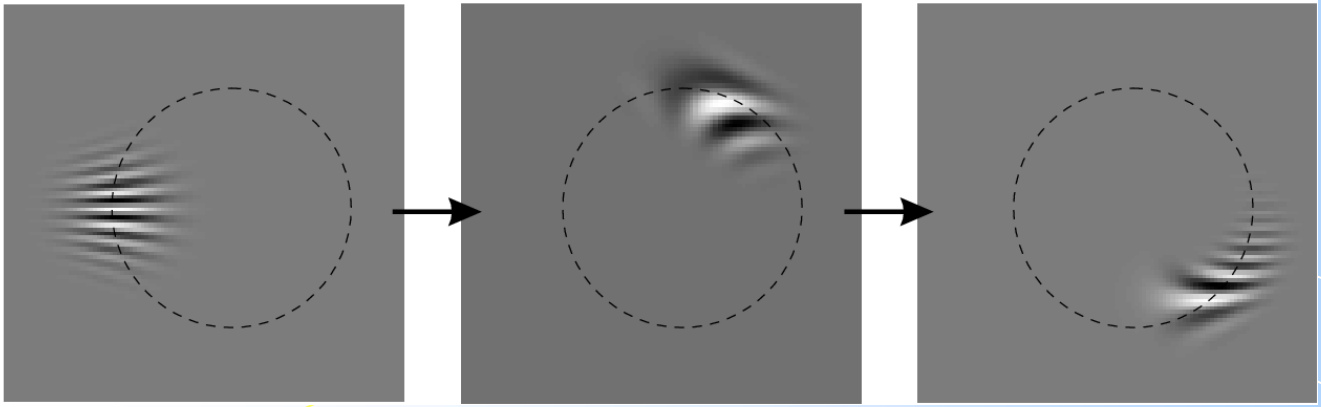


対称ゲージ



Symmetry gauge

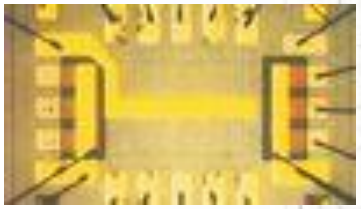
ランダウゲージ

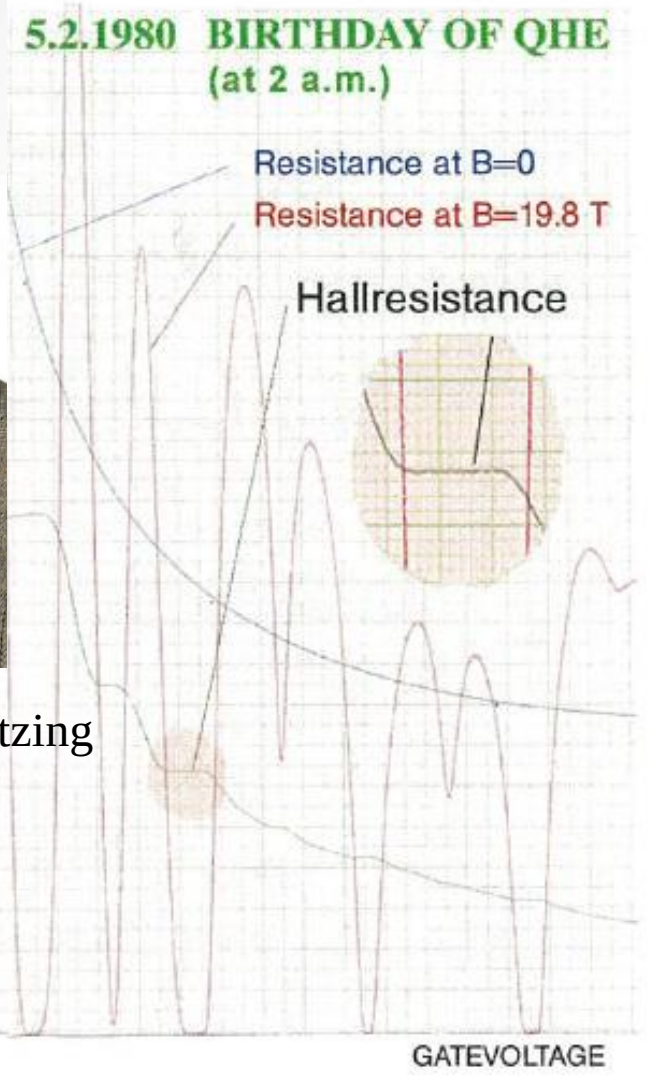


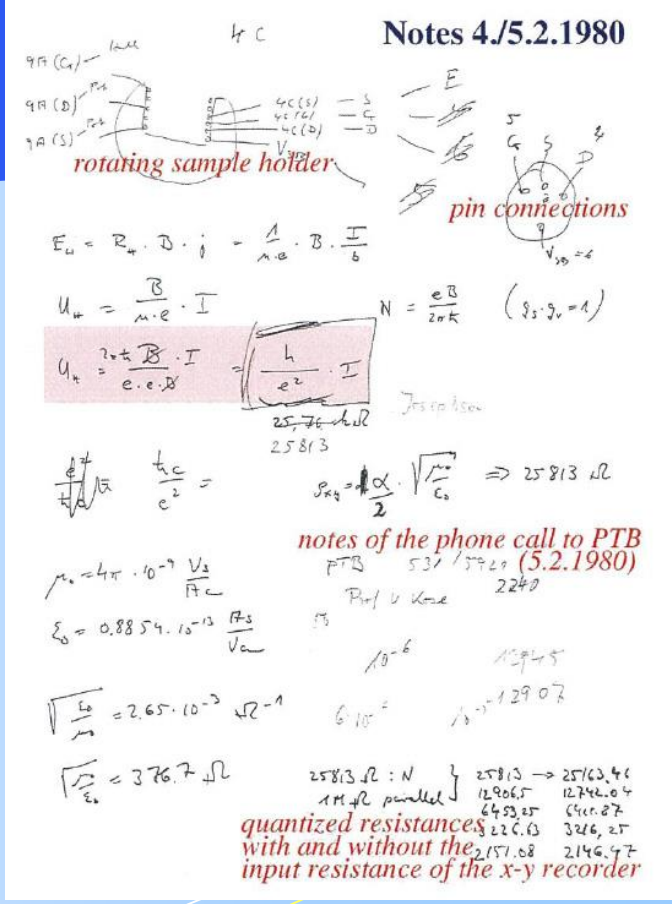
Landau gauge

物性研究所市民講演会

Prof. Dr. Klaus von Klitzing







2013.8.21 14:00-

量子世界のガリレオ 勝本信吾