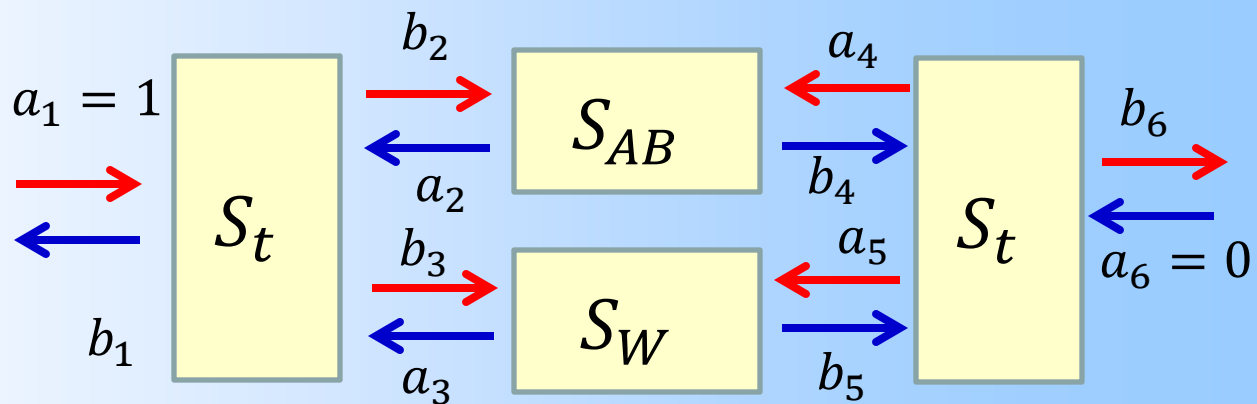
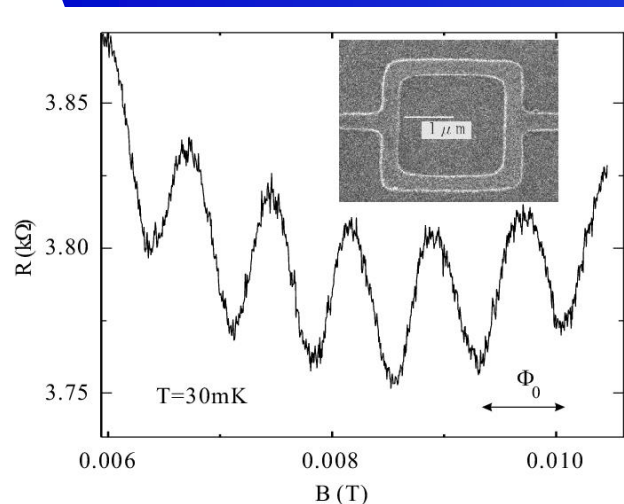


# Physics of Semiconductors (12)

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

$$S_w = \begin{pmatrix} 0 & e^{i\theta_0} \\ e^{i\theta_0} & 0 \end{pmatrix}$$

Traversal phase

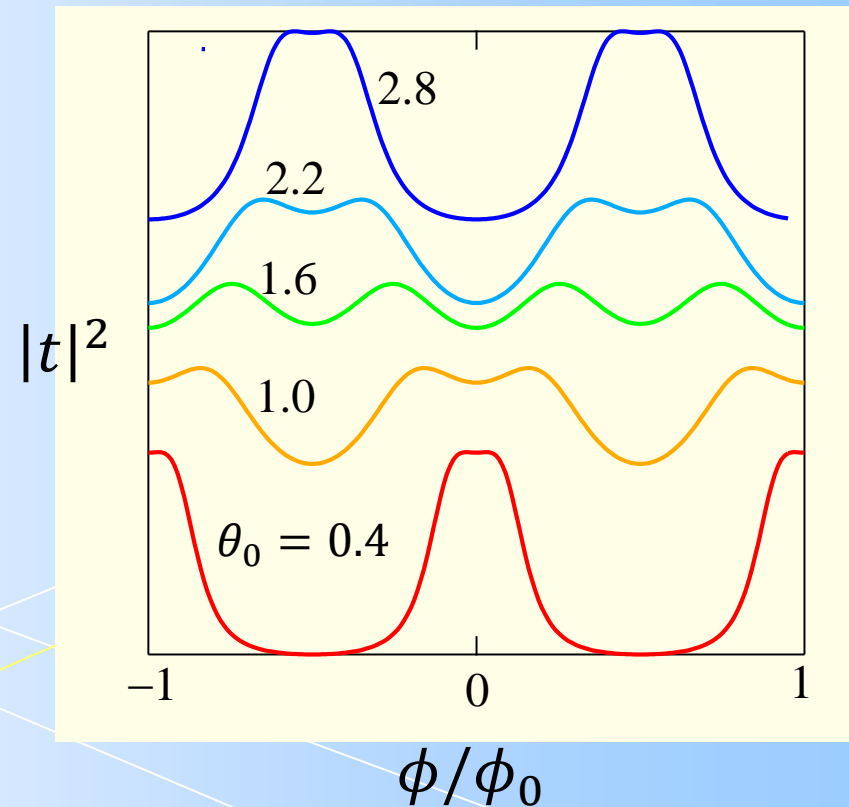
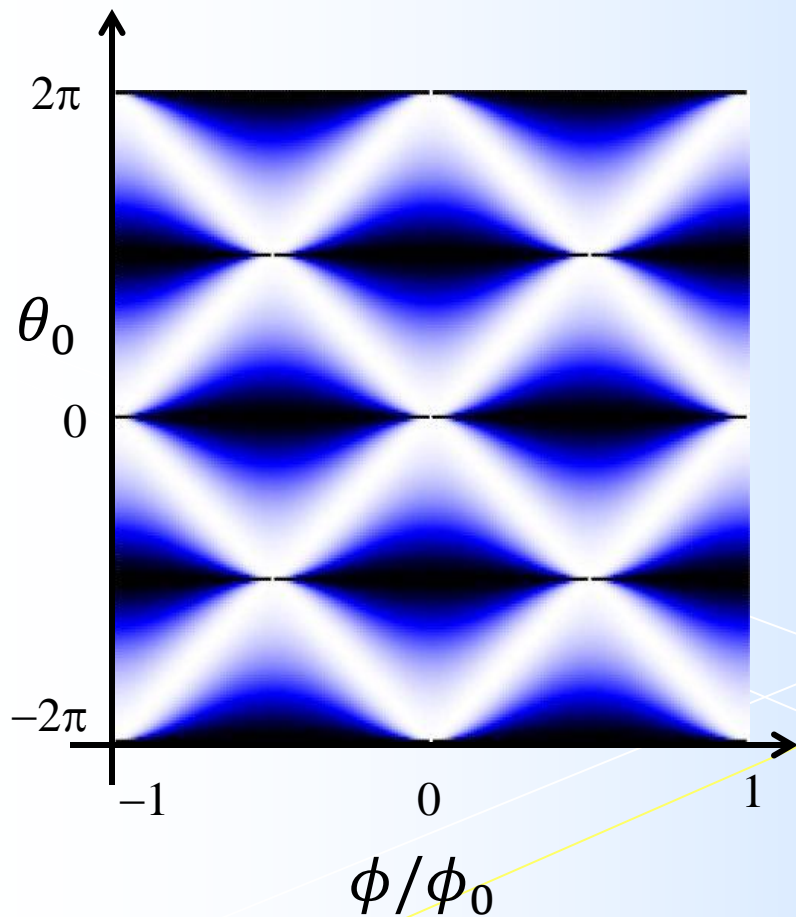
$$S_{AB} = \begin{pmatrix} 0 & e^{i\theta_{AB}} \\ e^{-i\theta_{AB}} & 0 \end{pmatrix}$$

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

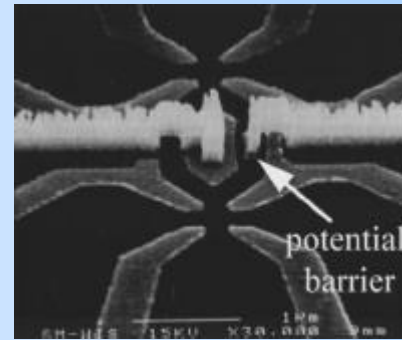
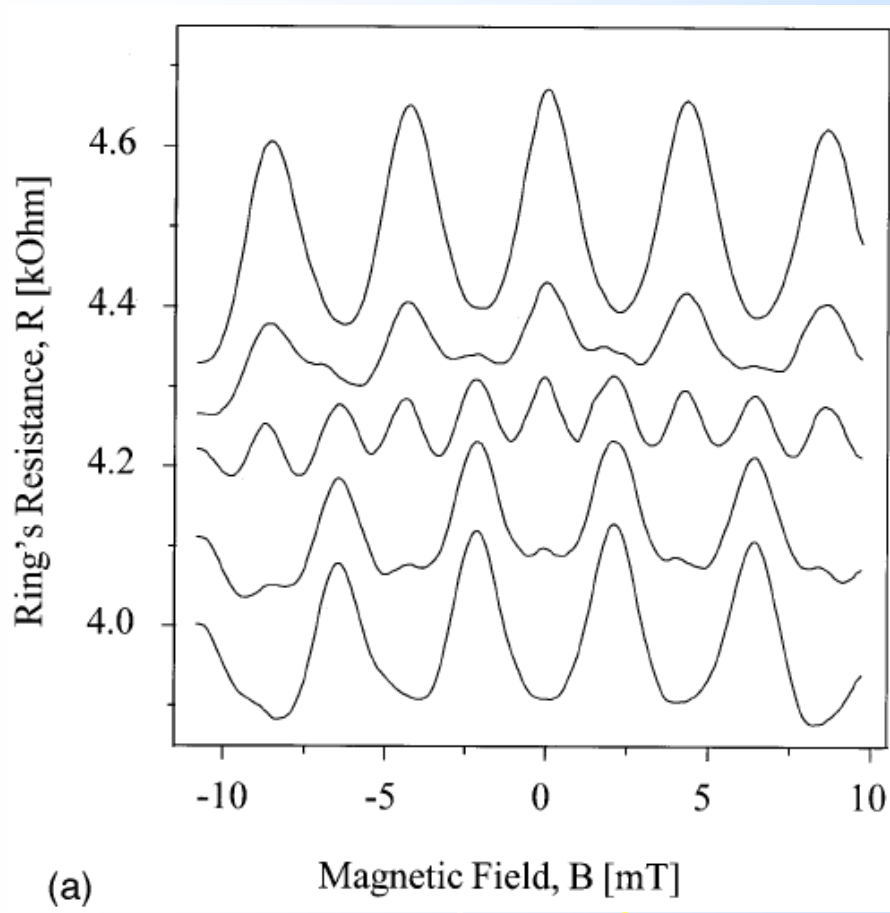
Aharonov-Bohm phase

# "Phase rigidity" in AB ring

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

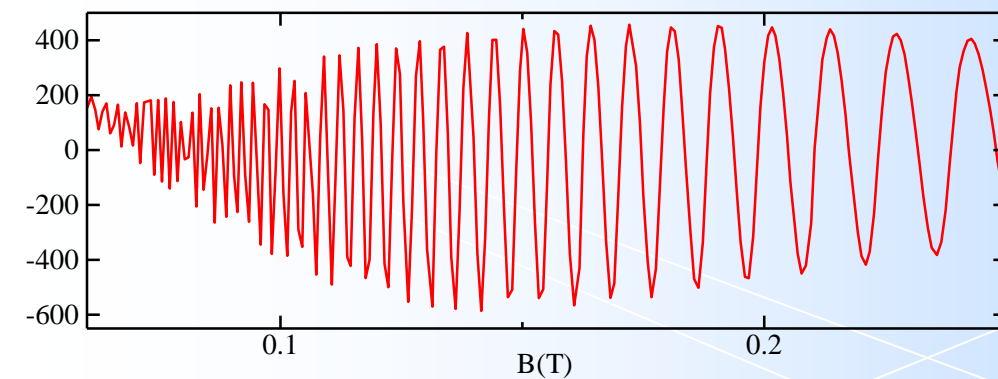
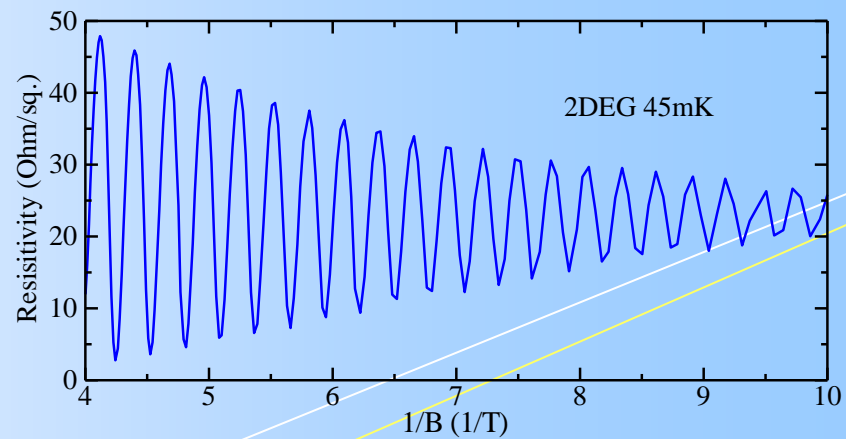
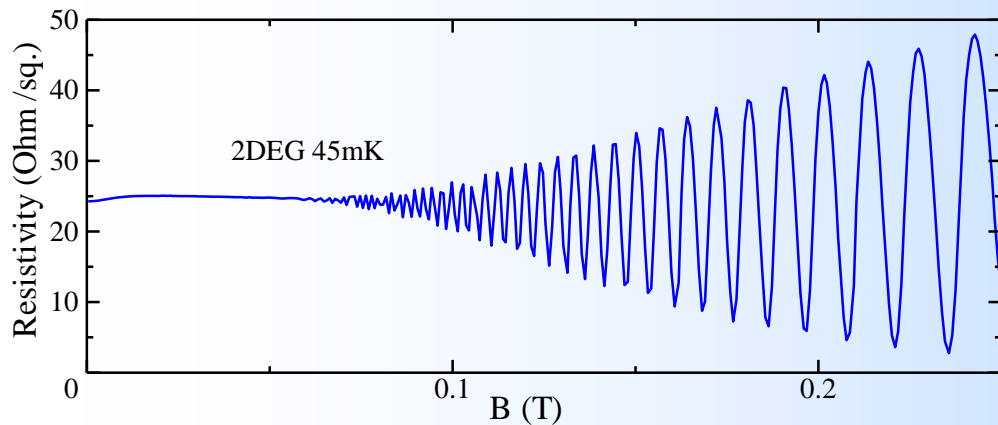


# Experiment on phase rigidity

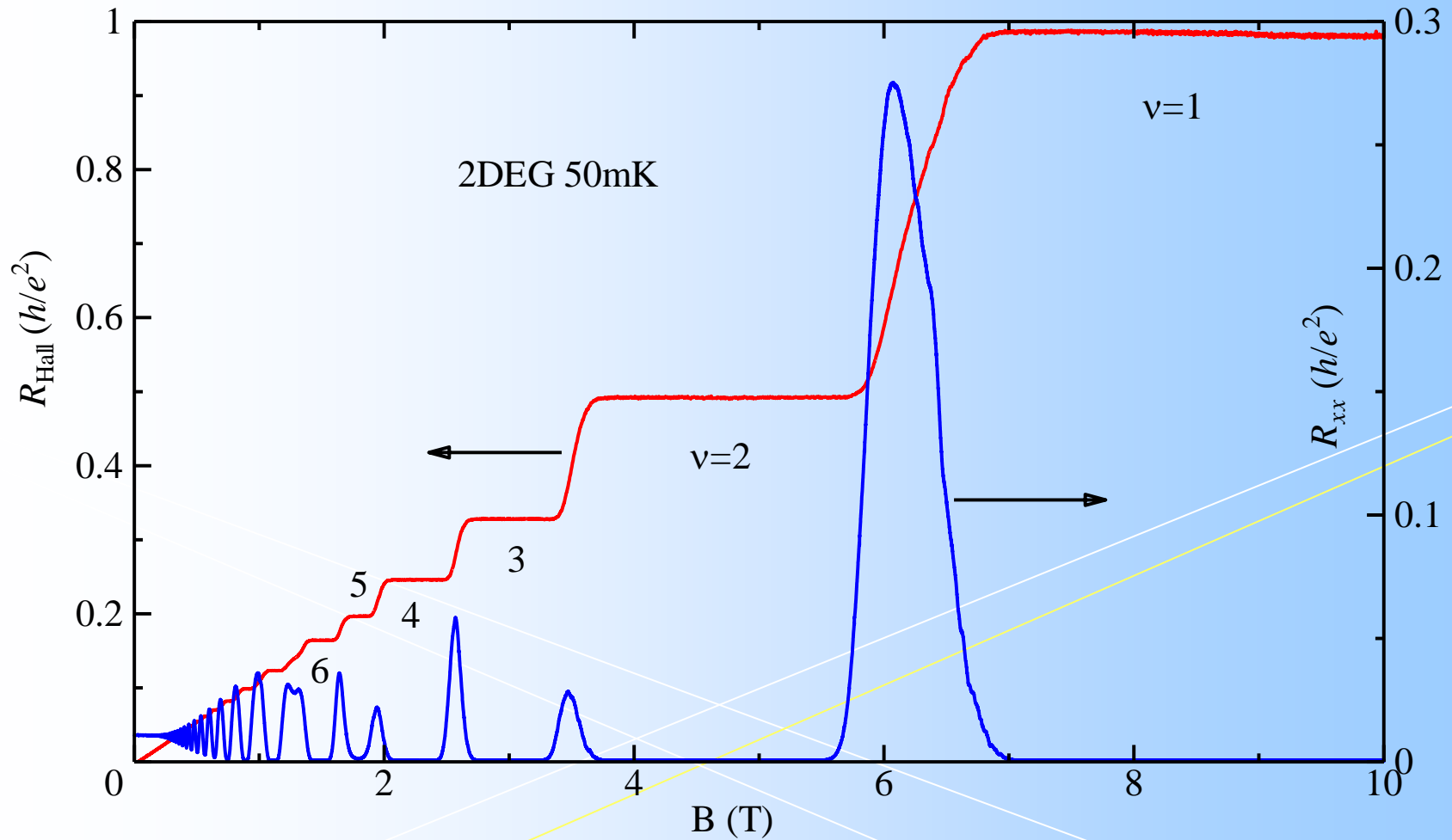


A. Yacoby et al.  
PRB **53**, 9583 ('96).

# Shubnikov-de Haas Oscillation



# Integer quantum Hall effect



# Discovery of quantum Hall effect



Klaus von Klitzing



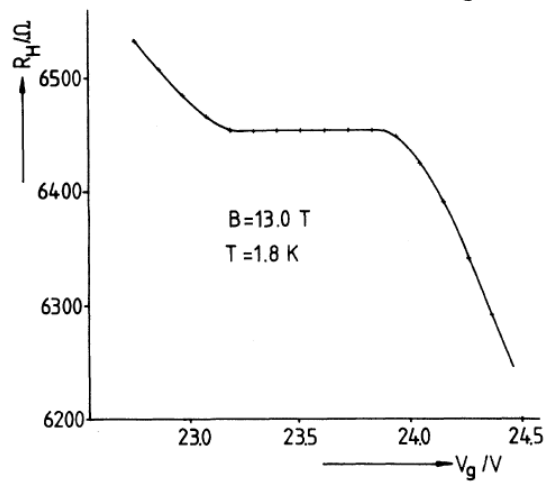
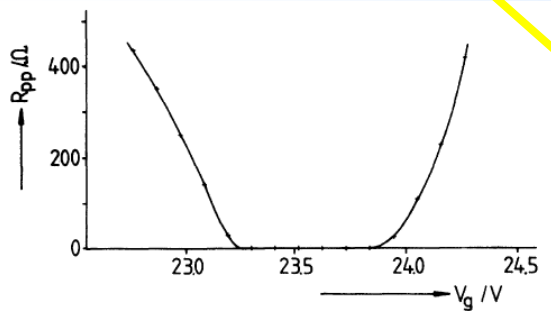
Shinji Kawaji



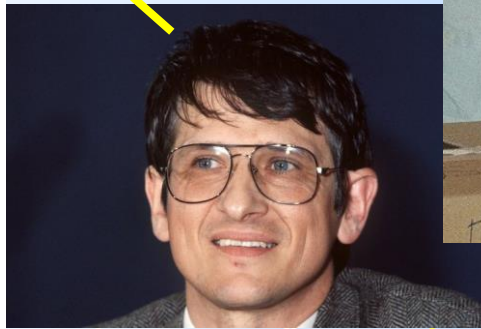
Yasuhiro Iye



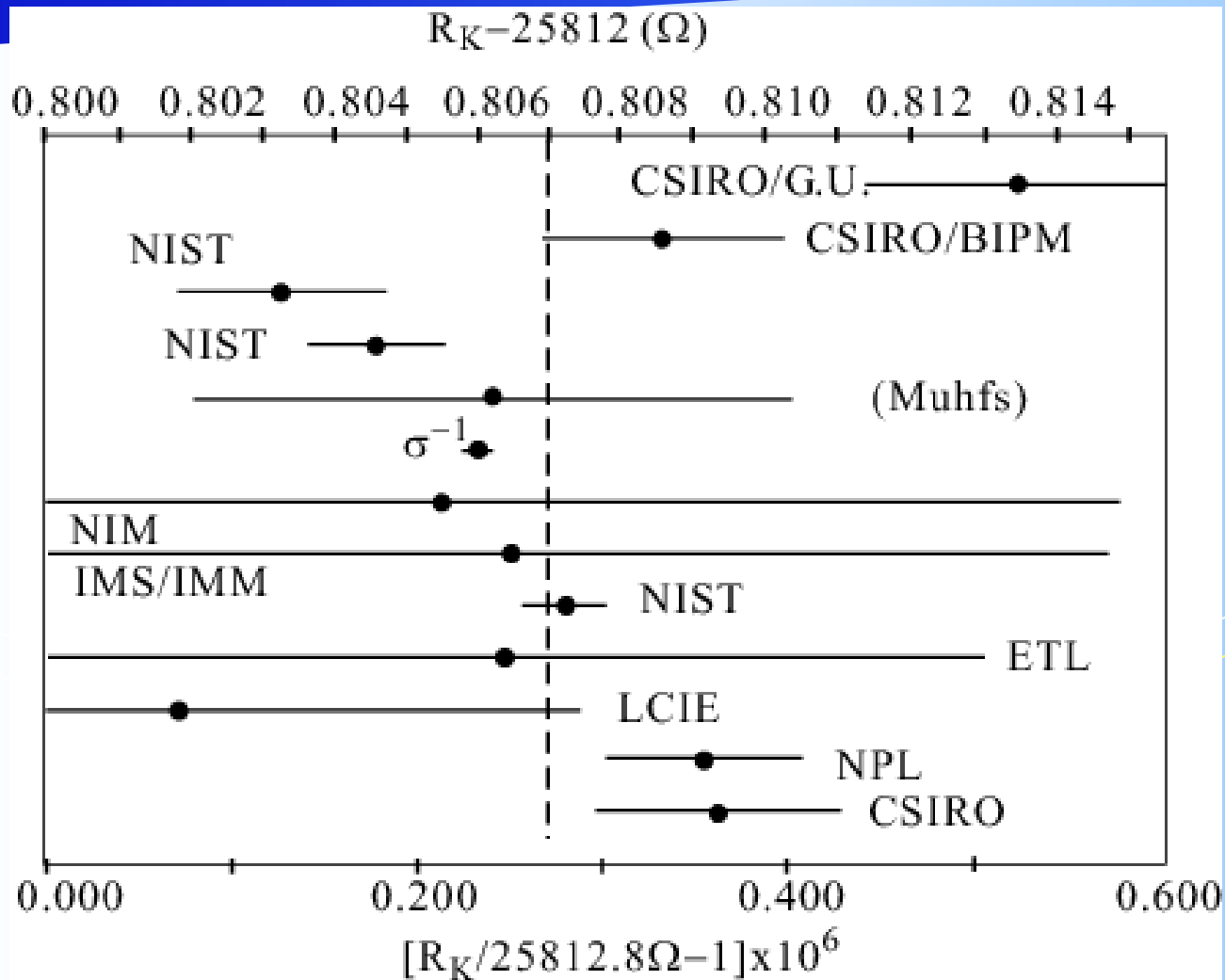
Tsuneya Ando



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

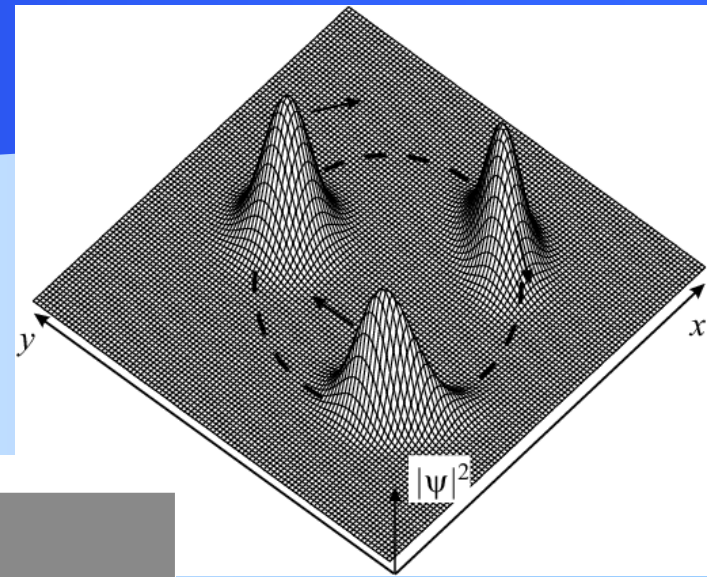


# Standard of resistance

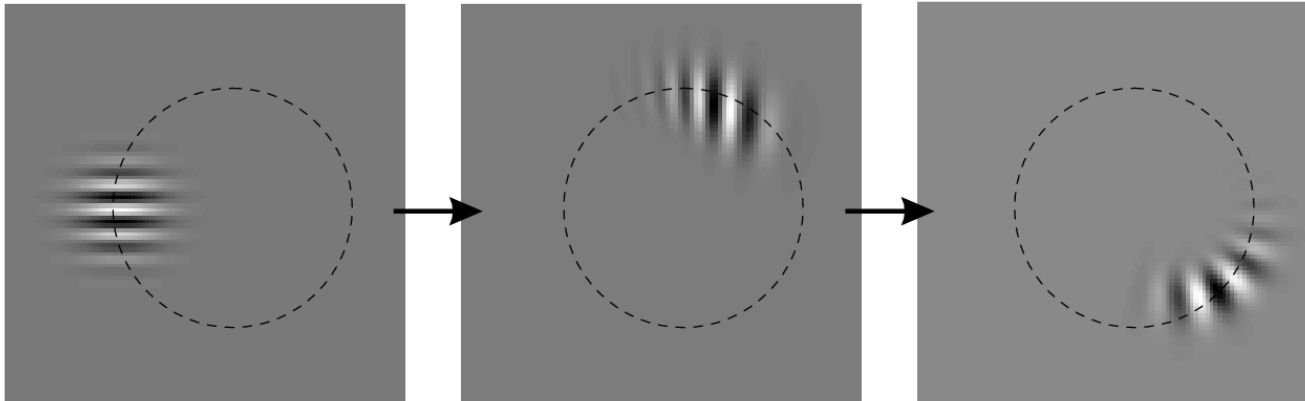




# Cyclotron motion and gauge selection

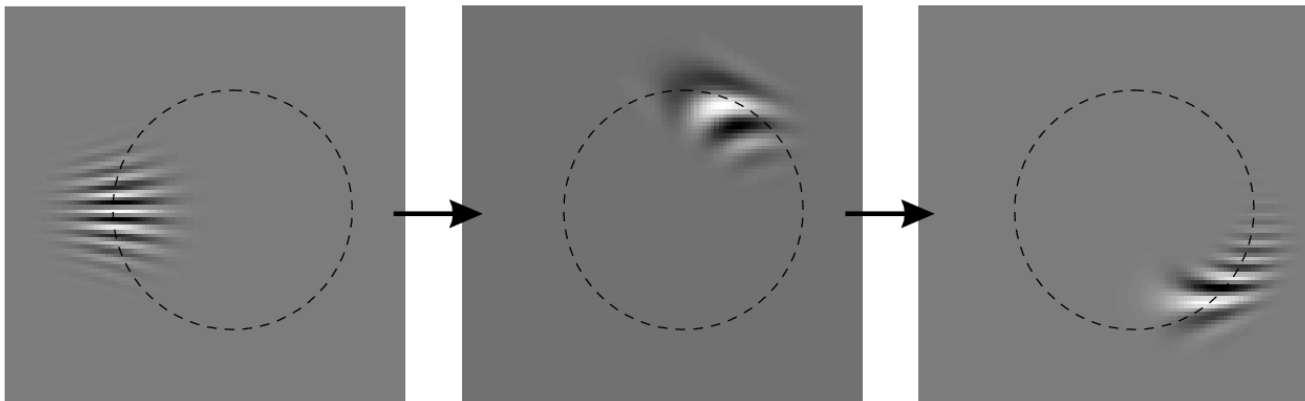


対称ゲージ



Symmetry gauge

ランダウゲージ



Landau gauge

# 物性研究所市民講演会

5.2.1980 BIRTHDAY OF QHE  
(at 2 a.m.)

Resistance at B=0  
Resistance at B=19.8 T

Hallresistance



GATEVOLTAGE

Notes 4/5.2.1980

rotating sample holder

pin connections

$$E_H = R_H \cdot I = \frac{1}{n \cdot e} \cdot B \cdot \frac{I}{b}$$

$$u_H = \frac{B}{n \cdot e} \cdot I$$

$$u_H = \frac{2 \cdot \pi \cdot B \cdot I}{e \cdot e \cdot B} = \left( \frac{h}{e^2} \cdot I \right)$$

$$N = \frac{eB}{2\pi k} \quad (g_s \cdot g_v = 1)$$

$$\frac{e^2}{4\pi} \cdot \frac{1}{e^2} = \frac{25813 \Omega}{2}$$

notes of the phone call to PTB  
PTB 531/5729 (5.2.1980)  
Prof. U. Kne  
10<sup>-6</sup>  
6 · 10<sup>-2</sup> 1.29 07

25813 Ω : N	}	25813 → 25163.46
111 Ω parallel		12744.04
quantized resistances		6453.25 (411.27)
with and without the		226.63 (226.25)
input resistance of the x-y recorder		2151.68 (2146.47)



Prof. Dr. Klaus von Klitzing



2013.8.21 14:00-

量子世界のガリレオ 勝本信吾

降壁位置

