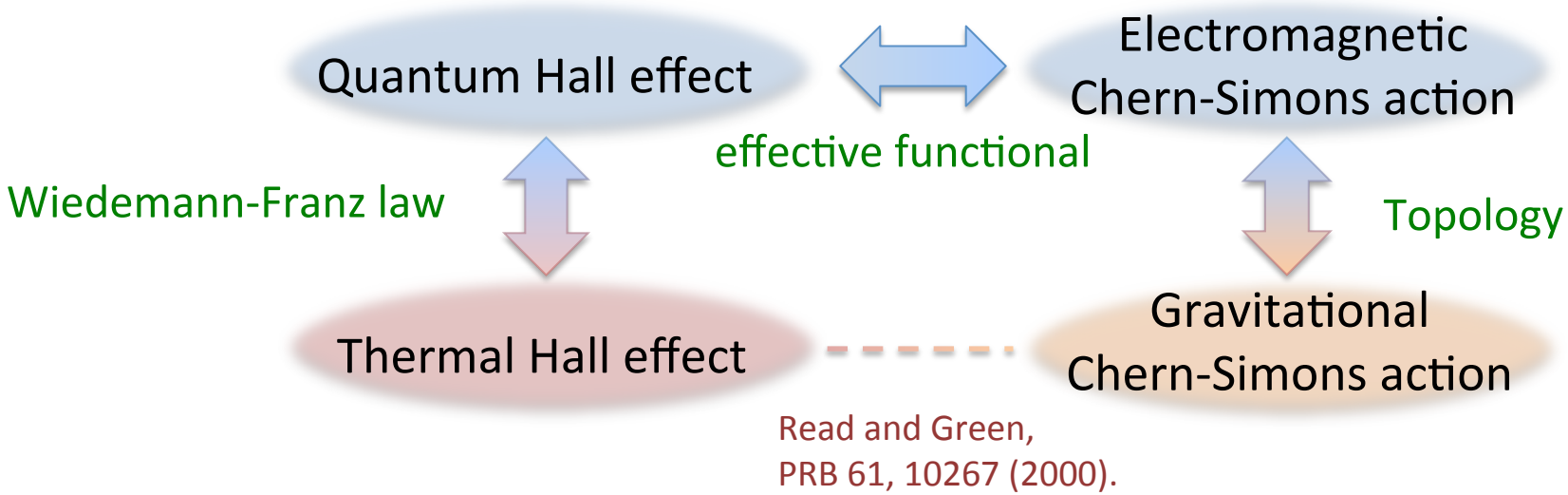
PS-B7 Microscopic theory of the thermal response of topological superconductors

Ryota Nakai[1], Shinsei Ryu[2], and Kentaro Nomura[3]

[1]*WPI-Advanced Institute for Materials Research (WPI-AIMR), Tohoku University*
[2]*Department of Physics, University of Illinois*
[3]*Institute for Materials Research, Tohoku University*



◆ Gravitational Chern-Simons theory

$$S_{\text{eff}}^{\text{G}} = \frac{C}{96\pi}\int dt d^2x\, \epsilon^{\mu\nu\rho}\text{tr}\left(\omega_\mu\partial_\nu\omega_\rho + \frac{2}{3}\omega_\mu\omega_\nu\omega_\rho\right)$$

Thermal current flows only along the boundary.
[M. Stone, PRB 85, 184503 (2012)]

◆ Phenomenological theory

$$F_{\text{eff}} = \int d^2x \frac{2\kappa_H T}{v^2}\phi\Omega$$

K. Nomura et al., PRL 108, 026802 (2012).

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Dirac fermion + gravitational field

$$H = \int d^2x \sqrt{g}\, \psi^\dagger \left[-ive^j{}_\alpha \gamma^0 \gamma^\alpha \overleftrightarrow{\partial_j} + m\gamma^0 \right] \psi$$

$$F_{\text{eff}} = \frac{\kappa_H T}{2v} \int_D d^2x\, \epsilon^{jk} \partial_j h h_{k0} \qquad \kappa_H = \text{sgn}(m) \frac{\pi T}{12}$$

1) Gravitational potential + rotation

$$g_{\mu\nu} = \begin{pmatrix} 1+2\phi & \Omega y/v & -\Omega x/v \\ \Omega y/v & -1+2\phi & 0 \\ -\Omega x/v & 0 & -1+2\phi \end{pmatrix}$$

Phenomenological effective free energy

$$F_{\text{eff}} = \int d^2x \frac{2\kappa_H T}{v^2} \phi\Omega$$

2) Gravitational potential (+ Luttinger's relation)

$$g_{\mu\nu} = \begin{pmatrix} 1+2\phi & 0 & 0 \\ 0 & -1+2\phi & 0 \\ 0 & 0 & -1+2\phi \end{pmatrix}$$

Quantized thermal Hall current

$$j_T^k = \kappa_H \epsilon^{kl} \partial_l T$$