

# Critical Fluctuation enhanced geometrical phenomena

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## Geometrical Structure

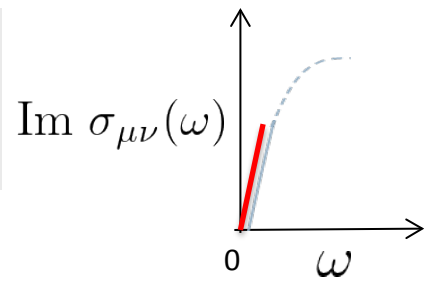
the Berry curvature of the bands → Anomalous Hall Effect etc.

What about optical response?

in an effective 2 bands model

**the metric of the bands → scattering-independent optical response**

$$\lim_{\omega \rightarrow 0} \frac{\text{Im } \sigma_{\mu\nu}(\omega)}{\omega} = (\tau \text{ dependent term}) + (\text{metric origin* term})$$



$\tau$  : relaxation time

\* Integration of “metric/band gap”

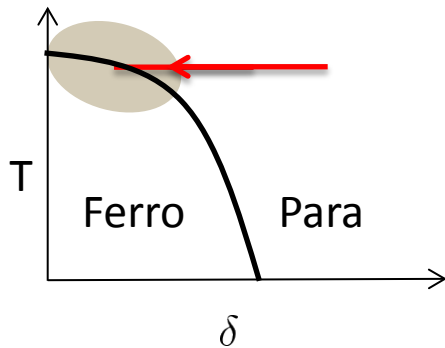
$$\lim_{\omega \rightarrow 0} \frac{\text{Im } \sigma_{\mu\nu}(\omega)}{\omega} = (\mathcal{T} \text{ dependent term}) + (\text{metric origin term})$$

$$|\langle \psi(\mathbf{k}) | \psi(\mathbf{k} + d\mathbf{k}) \rangle|^2 = 1 - g_{\mu\nu} dk_{\mu} dk_{\nu} \dots$$

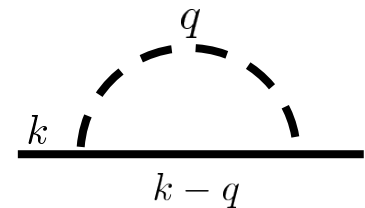
Fubini Study metric

Many body effect?

Itinerant magnet



Coupling to magnetic fluctuation



Model: spin orbit coupling system

$$H = (-\lambda k_y, \lambda k_x, \Delta) \cdot \sigma$$



$$H \rightarrow H^* \quad \text{Renormalized band}$$

metric in the renormalized band is enhanced near the critical line