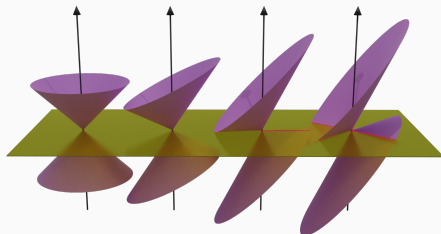


Master thesis presentation

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Background

Conformal anomaly in massless QED

The massless Dirac equation

$$\bar{\psi} i \not{\partial} \psi = 0. \quad (1)$$

Conformal anomaly in small perturbation limit

$$g^{\mu\nu} = \eta^{\mu\nu} + \delta g^{\mu\nu}. \quad (2)$$

The Dirac cone Hamiltonian

$$H_D = v_F s \boldsymbol{p} \boldsymbol{\sigma}. \quad (3)$$

Our work

Linear response and Luttinger's method

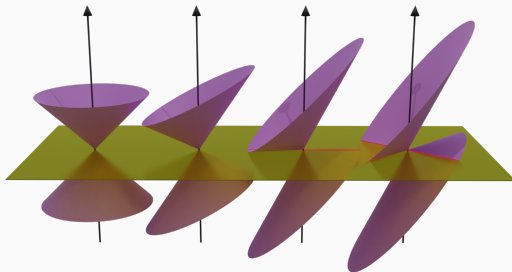
Temperature perturbation ∇T and gravitational potential ψ

$$\nabla\psi + \frac{\nabla T}{T} = 0. \quad (4)$$

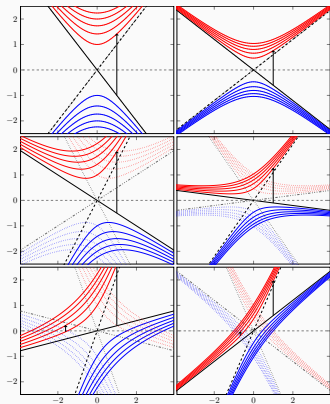
Linear response (Kubo)

$$\begin{aligned} \langle J \rangle(t, \mathbf{r}) = & i v_F \int dt' d\mathbf{r}' \int_{-\infty}^{t'} dt'' \Theta(t - t') \\ & \times \langle [\mathbf{J}^i(t, \mathbf{r}), T^{j0}(t'', \mathbf{r}')] \rangle \frac{\partial_j T(t', \mathbf{r}')}{T(t', \mathbf{r}')} \end{aligned} \quad (5)$$

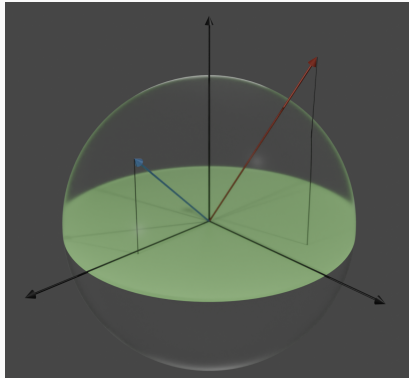
Type-I and Type-II



Landau levels



Type-I and Type-II



Proposition

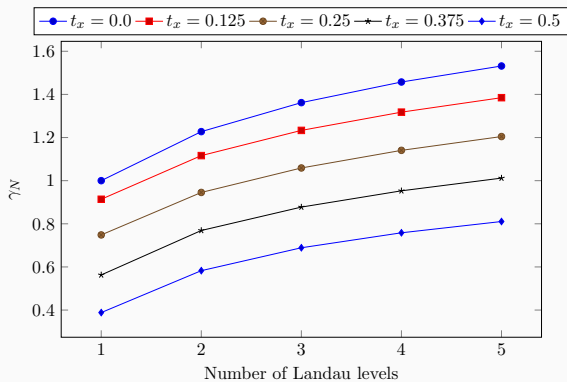
The modulus of the *tilt vector* \mathbf{t} separates Type-I from Type-II, with Type-II having $t > 1$.

Collapse of LLs for perpendicular tilt.

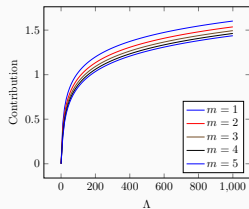
Result

The response can be directly tuned by the tilt parameter t .

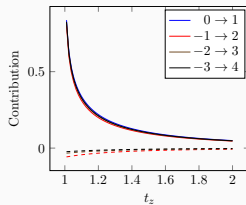
Perpendicular tilt



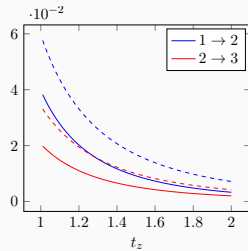
Parallel tilt



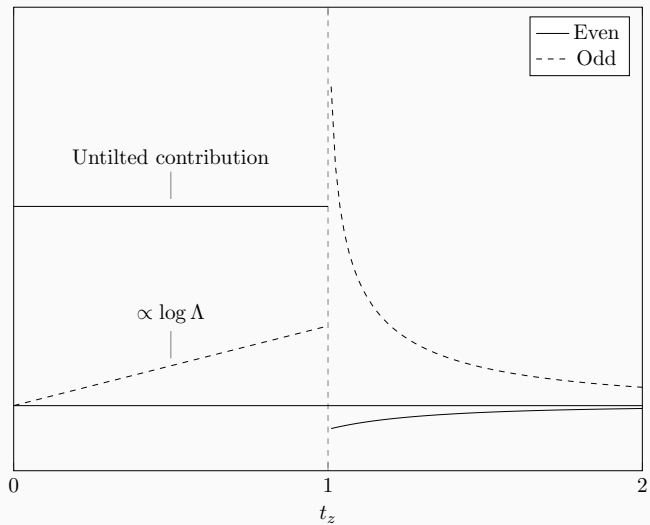
(a) Type-I



(b) Type-II inter band



(c) Type-II intraband



Thank you!

