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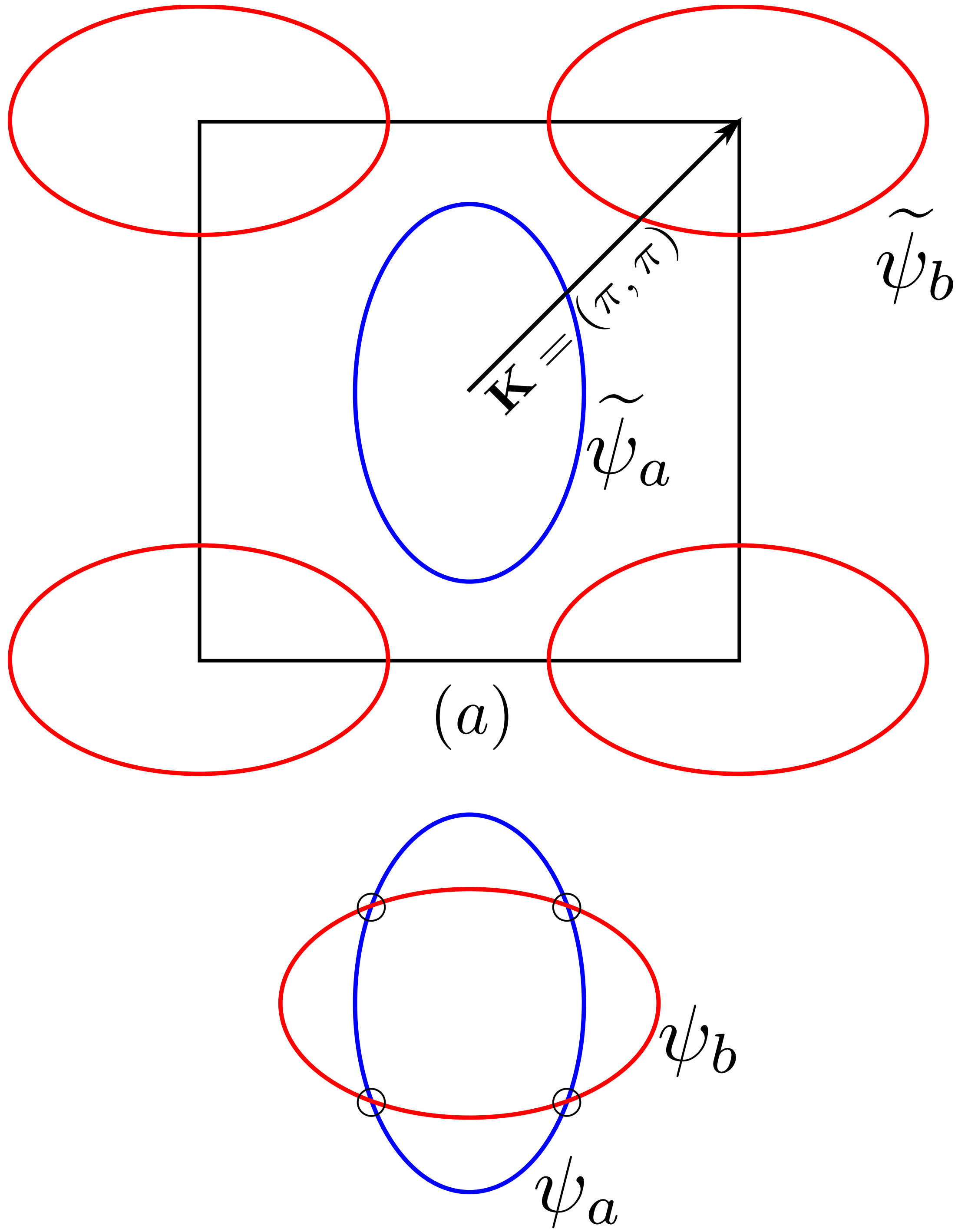

$$\mathcal{L} = \psi^\dagger \left(\partial_\tau - \mu_0 + \begin{pmatrix} \xi_a & 0 \\ 0 & \xi_b \end{pmatrix} \right) \psi + \frac{1}{2} \nabla\phi_\mu \cdot \nabla\phi_\mu + \frac{\epsilon}{2} (\partial_\tau \phi_\mu)(\partial_\tau \phi_\mu) + \frac{u}{6} \left(\phi_\mu \phi_\mu - \frac{3}{g} \right)^2 + \lambda \psi^\dagger \phi_\mu \Gamma_\mu \psi.$$

$$\xi_a = -\frac{\partial_x^2}{2m_1} - \frac{\partial_y^2}{2m_2} + \dots \ , \quad \xi_b = -\frac{\partial_x^2}{2m_2} - \frac{\partial_y^2}{2m_1} + \dots$$

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- As long as $\chi_{\vec{J},\vec{P}} \neq 0$ (where $\vec{J}$ is the electrical current) the d.c. resistivity of the critical theory is exactly zero. This is the case even though the electron self energy can be highly singular and there are no fermionic quasiparticles (many well-known papers on non-Fermi liquid transport have incorrect statements on this point.)

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- We need to include additional (dangerously) irrelevant umklapp corrections to obtain a non-zero resistivity. Because these additional corrections are irrelevant, it is difficult to see how they can induce a linear-in-T resistivity.

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Theories of metallic states without quasiparticles in the presence of disorder

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- SYK models

arXiv:1705.00117

Title: A strongly correlated metal built from Sachdev-Ye-Kitaev models

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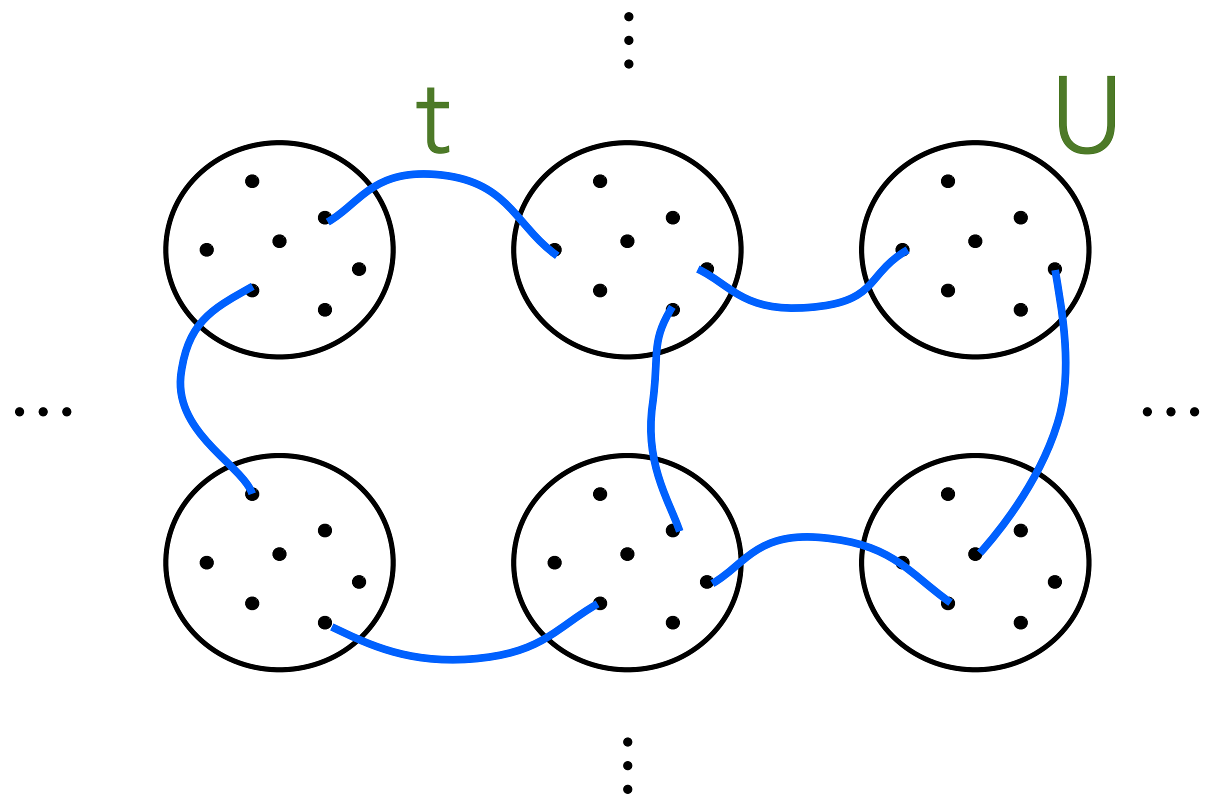

$$H = \sum_x \sum_{i<j,k<l} U_{ijkl,x} c^\dagger_{ix} c^\dagger_{jx} c_{kx} c_{lx} + \sum_{\langle xx' \rangle} \sum_{i,j} t_{ij,xx'} c^\dagger_{i,x} c_{j,x'}$$

$$\overline{|U_{ijkl}|^2} = \frac{2U^2}{N^3} \qquad \overline{|t_{ij,x,x'}|^2} = t_0^2/N$$

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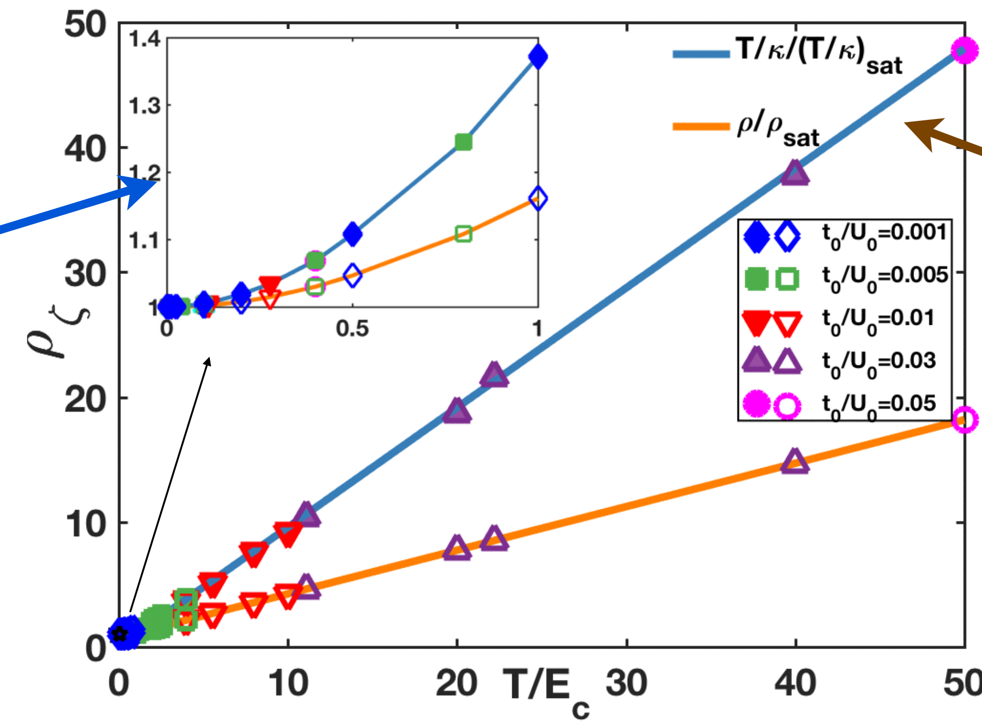
Fermi liquid
$R=R_0+AT^2$
for $T \ll E_c$



Linear in T for
$E_c \ll T \ll U$

Crossover from heavy FL to strange metal

- Small coherence scale $E_c=t^2/U$
- Heavy mass γ~m*/m ~ U/t
- Small QP weight Z ~ t/U
- Kadowaki-Woods A/γ^2 = constant
- Linear in T resistivity and T/κ
- Lorenz ratio crosses over from FL to NFL value