Critical Properties of Superconducting Quantum Phase Transition in Disordered Dirac Fermion Systems
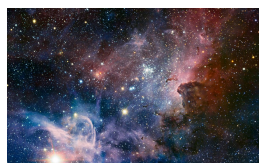
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$$S_B = \int d^D x \left(\sum_{i=1}^n i\bar{\psi}_i(\gamma_0 \partial_\tau + c_f \boldsymbol{\gamma} \cdot \boldsymbol{\nabla})\psi_i + (|\partial_\tau \phi|^2 + c_b^2 |\nabla \phi|^2) + r(x)|\phi|^2 \right.$$

$$\left. + \lambda^2 |\phi|^4 + h\left(\phi^* \sum_{i=1}^n (\psi_i^T i\sigma_2 \psi_i) + h.c.\right) \right)$$

Short-range correlated disorder

$$\langle \delta r(\boldsymbol{x})\delta r(\boldsymbol{y})\rangle = 4\Delta\delta(|\boldsymbol{x}-\boldsymbol{y}|)$$

Dimensions

$$d = 4 - \epsilon \qquad d_\tau = \epsilon_\tau$$

Not a Fixed Point