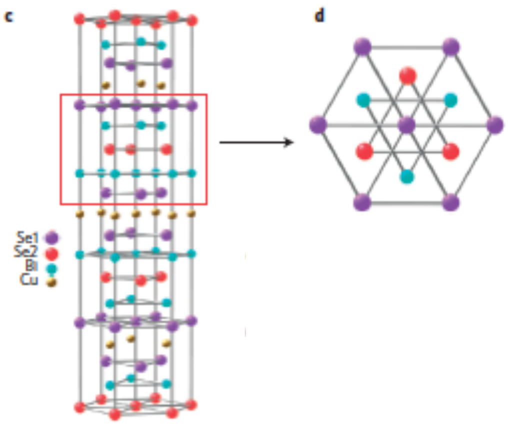
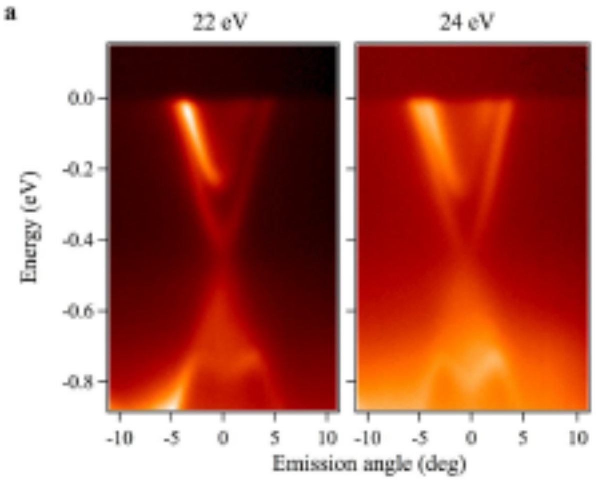
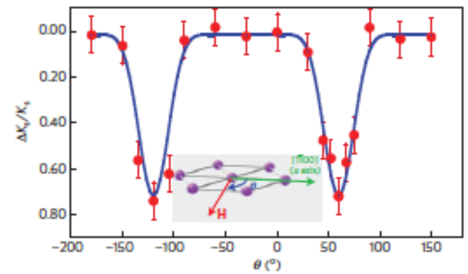
A doped topological insulator: odd-parity superconductivity in $Cu_xBi_2Se_3$

Y. S. Hor, et al. Phys. Rev. Lett. 104, 057001 (2010).
M. Kriener, et al., Phys. Rev. Lett. **106**, 127004 (2011).





rotational symmetry breaking



K. Matano, et al.
Nature Physics 12, 852 (2016).

Classification of superconducting states
L. Fu and E. Berg, Phys. Rev. Lett. **105**,4 097001 (2010).

$$\mathbf{d}_{\mathbf{k}} = \Delta^x \left(\hat{\mathbf{x}} k_z - \eta \hat{\mathbf{z}} k_x\right) + \Delta^y \left(\hat{\mathbf{y}} k_z - \eta \hat{\mathbf{z}} k_y\right) \Longrightarrow E_u$$

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the symmetry group (trigonal) = $D_{3d} \otimes U(1)$

$$E_u \otimes E_u = A_{1g} \oplus A_{2g} \oplus E_g$$

time reversal symmetry

nematic superconductivity

$$\varphi = i\left(\Delta_x^* \Delta_y - \Delta_y^* \Delta_x\right)$$

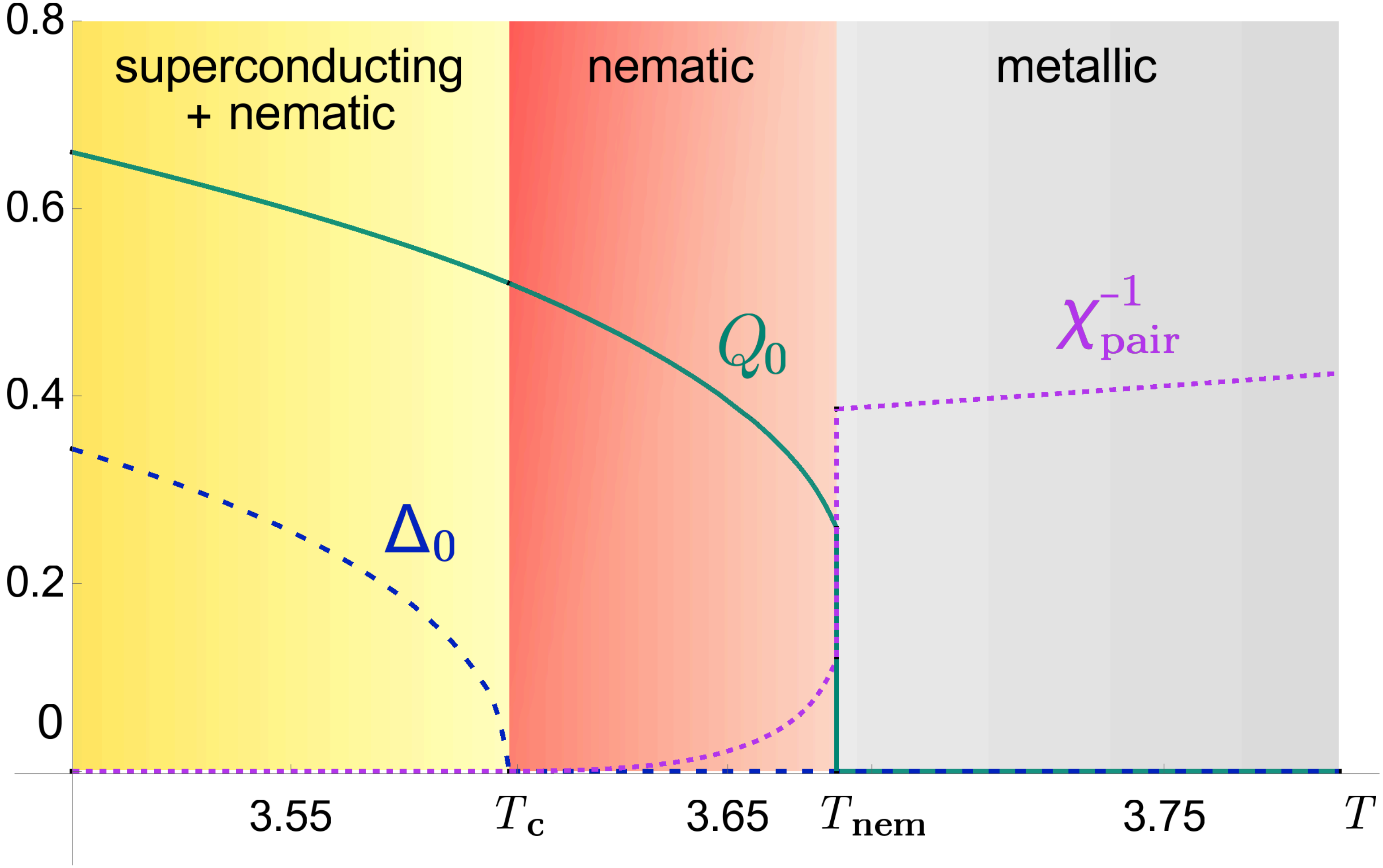
$$\hat{Q} = \begin{pmatrix} q_1 & q_2 \\ q_2 & -q_1 \end{pmatrix}$$

$$q_1 = \Delta_x^* \Delta_x - \Delta_y^* \Delta_y$$

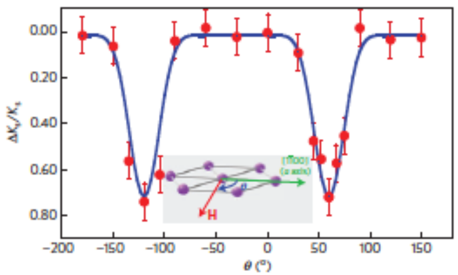
$$q_2 = \Delta_x^* \Delta_y + \Delta_y^* \Delta_x$$

T_c with nematic order strongly enhanced

enhanced pairing susceptibility



$$f = \frac{r}{2}\left(q_1^2 + q_2^2\right) - \frac{g}{3} q_1 \left(q_1^2 - 3 q_2^2\right) + \frac{u}{4}\left(q_1^2 + q_2^2\right)^2$$



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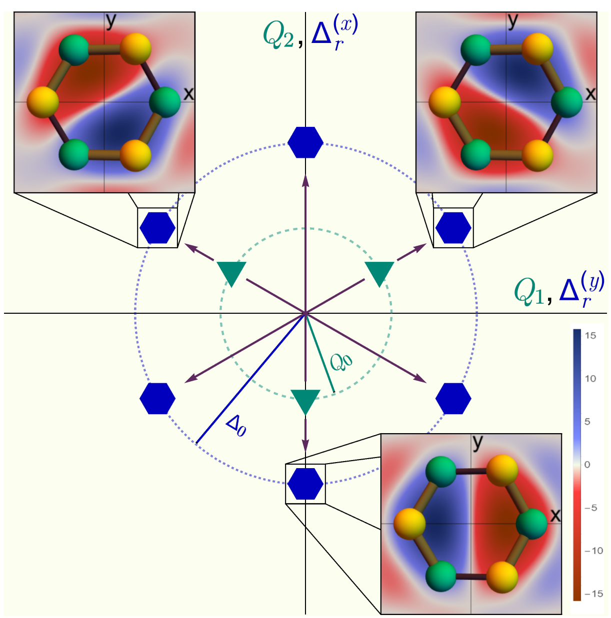
three degenerate solutions that break rotation invariance
→ three state Potts model



anisotropic Aslamasov-Larkin
fluctuation conductivity

$$\sigma_{\alpha\beta} \propto \frac{e^2\, a_\alpha a_\beta}{a_x a_y a_z} \times$$