The Model
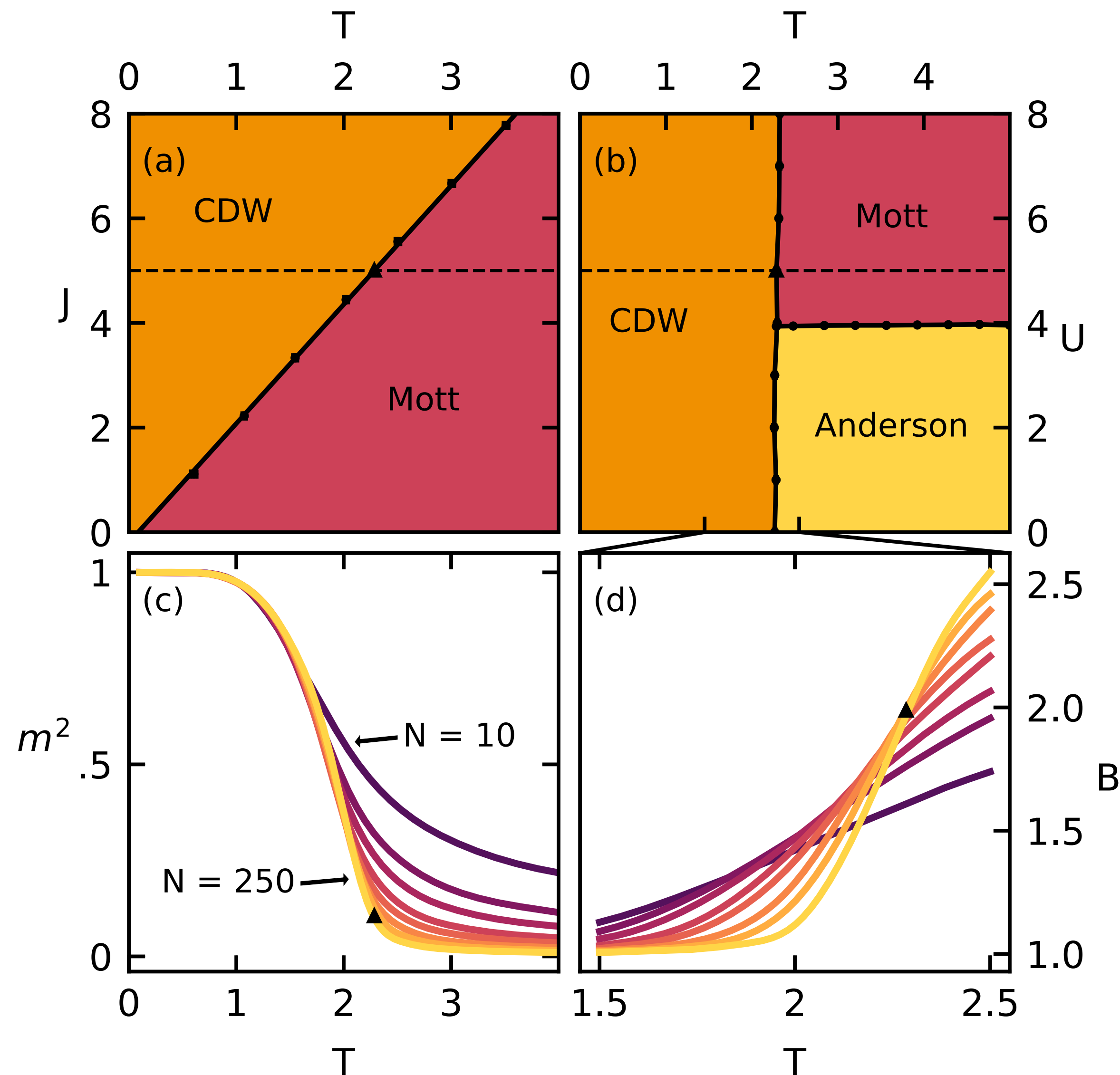
$$H_{\text{FK}} = -t \sum_i c_i^\dagger c_{i+1} + c_{i+1}^\dagger c_i \qquad \text{Fermion hopping}$$

$$+ U \sum_i S_i \left(c_i^\dagger c_i - \frac{1}{2} \right) \qquad \text{Fermion-Spin Coupling}$$

$$+ 4\kappa J \sum_{i,j}^{N} \frac{(-1)^{|i-j|}}{|i-j|^\alpha} S_i S_j \qquad \text{Long Range } (\alpha < 2) \text{ Spin-Spin Coupling}$$

Results: Thermodynamics

- m^2 : Staggered magnetisation order parameter.

- J : Spin-Spin Interaction

- U: Spin-Fermion Interaction

🟠 Charge Density Wave (CDW)

🔴 Mott Insulator, Gapped

🟡 Anderson Insulator, Gapless