

Block II

What the complete Hamiltonian is saying

The full $H = H_{\text{mol}} + H_L + H_R + H_T$ describes: a chain of sites, each carrying a spin-1/2 degree of freedom (the spinor φ_n from §3 §56), connected by hopping and spin-orbit coupling (latter derived from §3 §72 via $V_n^{(s)}$), with molecular vibrations coupled to the electrons, and the whole system open at both ends to electron reservoirs.

The geometry enters entirely through $V_n^{(s)}$. Since $V_n^{(s)} = \hat{d}_{m_1, s} \times \hat{d}_{m_2, s}$ is a cross product of bond directions, it is zero for straight chains, planar for zig-zag, and 3D for helices. Only the helix has a longitudinal component of $V_n^{(s)}$, and it is only this that can drive spin-polarization along the transport direction. This is the physical root of why CISS is a chiral effect, grounded in §3 §72's derivation of spin-orbit coupling from the relativistic motion ~~of~~ of an electron in a confining potential.