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Super tunneling and molecular wires

At low bias voltage and its HOMO-LUMO energy gap interval, the conductance of a molecular wire decays exponentially while increasing its length [1,2]. The same phenomenon occurs with a surface dangling bond atomic wire. The corresponding inverse decay length β of this through bond tunneling phenomenon ranges for example from β = 1.2 A^{-1} for an alkane molecular wire to about β = 0.3 A^{-1} for a medium large HOMO-LUMO gap χ conjugated molecular wire [3,4]. As a function of χ and of the effective mass m* of the tunneling electrons, β varies following an universal monotonic decay law as presented in Fig. 1 [3,4]. For a given χ, we will discuss (1) what prevents β to be exactly zero that is reaching a super tunneling transport regime [5], (2) how to approach a minimum β value by a good choice of the chemical composition of the molecular wire [6].

References

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Figures

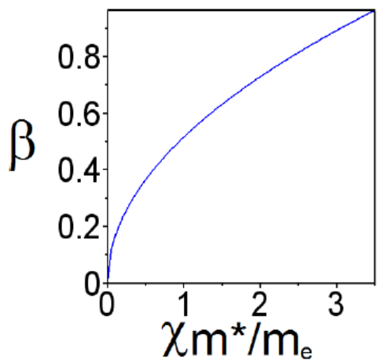

Figure 1: The universal β decay law in $A^{-1}$of the tunneling transport regime through an atomic scale wire as a function of its HOMO-LUMO gap χ in eV and of the effective mass m* of the corresponding tunneling electrons.