

Abstract Submitted
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Spin-Boson Theory of Organic Magnetoresistance CHANG-QIN

WU, Department of Physics, Fudan University, Shanghai 200433 — The discovery of room-temperature, low-field magnetoresistance (MR) in organic light-emitting devices was one of major achievements of spintronics in the last decade. Compared to its inorganic counterpart, a sizable organic MR (OMR) is relatively easy to be obtained, showing extensive potential in magnetically controlled applications. Yet, after years of intense research, a comprehensive understanding of this magnetic field effect out of these nonmagnetic materials is still lacking. In this work, we present a spin-boson theory for magnetotransport in organic semiconducting materials, on the basis of a coupling between charge carriers' spin and a local bosonic environment, which is shown to be an irreducible ingredient in understanding of the anomalous OMR. Among those compose this environment triplet excitons play a basic role. The incoherent hopping rate between molecules is calculated to give out the basic behavior of OMR. The underlying mechanism is revealed from the calculation of entanglement, represented by the von Neumann entropy, between the carrier's spin and bosons. We also obtain the dependence of OMR on both of the bias voltage and the spin-boson coupling. The results obtained from the theory are in good agreement with experiments.

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