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Potential for spin-based information processing in a thin-film molecular semiconductor MARC WARNER, Harvard University, SALAHUD DIN, Imperial College London, IGOR TUPITSYN, University of British Columbia, GAVIN MORLEY, University of Warwick, MARSHALL STONEHAM, University College London, JULES GARDENER, RMD Inc, ZHENLIN WU, Imperial College London, ANDREW FISHER, University College London, SANDRINE HEUTZ, Imperial College London, CHRISTOPHER KAY, GABRIEL AEPPLI, University College London — Organic semiconductors are studied intensively for applications in electronics and optics, and even spin-based information technology, or spintronics. Fundamental quantities in spintronics are the population relaxation time (T_1) and the phase memory time (T_2): T_1 measures the lifetime of a classical bit, in this case embodied by a spin oriented either parallel or antiparallel to an external magnetic field, and T_2 measures the corresponding lifetime of a quantum bit, encoded in the phase of the quantum state. Here we establish that these times are surprisingly long for a common, low-cost and chemically modifiable organic semiconductor, the blue pigment copper phthalocyanine, in easily processed thin-film form of the type used for device fabrication. At 5 K, a temperature reachable using inexpensive closed-cycle refrigerators, T_1 and T_2 are respectively 59 ms and 2.6 ms, and at 80 K, which is just above the boiling point of liquid nitrogen, they are respectively 10 ms and 1 ms, demonstrating that the performance of thin-film copper phthalocyanine is superior to that of single-molecule magnets over the same temperature range.

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