

Photogenerated Electron Spin Qubit Pairs in Molecular Materials for Quantum Information Applications

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We will describe recent work from our laboratory that focuses on using photo-driven processes to generate entangled electron spins in molecular materials targeting applications in quantum computing, communications and sensing. We will describe how ultrafast photogeneration of electron-hole pairs within covalent electron donor-acceptor systems results in two entangled spins having sufficiently long coherence times to perform CNOT gate operations and to teleport a prepared quantum state on a third spin to one of the spins comprising the entangled pair. Also, we will show how chirality-induced spin selectivity (CISS) strongly influences the spin dynamics of photogenerated electron-hole pairs in donor-chiral bridge-acceptor molecules. Exploiting CISS affords the possibility of using chiral molecular building blocks to control electron spin states for quantum information applications.