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Using quantum spin-phase to elucidate weakly coupled pair hopping rates in organic semiconductors WILLIAM BAKER, University of Utah, DANE MCCAMEY, TOM KEEVERS, University of Sydney, JOHN LUPTON, University of Regensburg, CHRISTOPH BOEHME, University of Utah, UTAH SPIN ELECTRONICS GROUP COLLABORATION, LUPTON GROUP COLLABORATION, SYNDEY QUANTUM PHYSICS GROUP COLLABORATION — We have carried out electrically detected spin echo experiments on recombining electron-hole pairs (polaron pairs)[1] in MEH-PPV organic light emitting diodes at different temperatures and device currents. We find long spin-phase relaxation times [$T_2 = 324(18)$ ns] at room temperature and less than twice this value [$T_2 = 611(39)$ ns] at $T = 10$K. Next to this very weak temperature dependency, we also observe nearly no dependency of T_2 on the free carrier density in the material. We attribute this coherence decay behavior to charge carrier hopping transitions between localization sites which are exposed to differing hyperfine fields. Although the nuclear spin relaxation times in our material are much longer than the time scale of our experiments, the stochastic movement through this random environment leads to a time dependent fluctuating field causing an irreversible phase loss. We have simulated the echo experiments with this hopping process incorporated, and find good agreement with experimental data. The results of our study contrast free polaron transport processes which show an Arrhenius-type activation in time-of-flight experiments.

[1]McCamey, D. R. *et al.*, *Nat Mater* **7**, 728 (2008).

[X] Prefer Oral Session
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