Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Electron Spin Relaxation in a Transition-Metal Dichalcogenide Quantum Dot ALEXANDER PEARCE, GUIDO BURKARD, University of Konstanz — We study the relaxation of a single electron spin in a circular quantum dot in a transition-metal dichalcogenide monolayer. These materials provide an interesting and promising arena for quantum dot nano-structures due to combination of spin-valley physics and strong spin-orbit coupling. First we will discuss which bound state solutions in different B-field regimes can be used as the basis for qubits, at low B-fields combined spin-valley Kramers qubits and at large B-fields spin qubits. Then we will discuss the relaxation of a single electron spin mediated by electron-phonon interaction via various different relaxation channels. Rashba spin-orbit admixture mechanisms allow for relaxation by in-plane phonons arising either from the deformation potential or by piezoelectric coupling, additionally direct spin-phonon mechanisms involving out-of-plane phonons allow for relaxation. We find that the relaxation rates scale as $\propto B^5$ and $\propto B^3$ for in-plane phonons coupling via deformation potential and piezoelectric coupling respectively, while relaxation due to the direct spin-phonon coupling scales as $\propto B^2$. In the low B-field regime we also discuss the role of impurity mediated spin relaxation which will arise in disordered quantum dots.

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Date submitted: 06 Oct 2016

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