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Prediction of extremely long mobile electron spin lifetimes at room temperature in low-Z wurtzite semiconductor quantum wells NICHOLAS HARMON, WILLIAM PUTIKKA, The Ohio State University, ROBERT JOYNT, University of Wisconsin — Many proposed spintronics devices require mobile electrons at room temperature with very long spin lifetimes. One route to achieving this is to use quantum wells with tunable spin-orbit (SO) parameters. Research has focused on materials with the zincblende structure such as GaAs, which however, do not have long spin lifetimes at room temperature. We show that low-Z materials with the wurtzite structure are much better suited for spintronics applications. Their hexagonal symmetry implies that SO couplings can be completely canceled over a very wide range of electron momenta at zero temperature. Low-Z materials possess smaller SO couplings resulting in long spin lifetimes at room temperature. This leads to predictions of spin lifetimes exceeding 2 ms at helium temperatures in wurtzite AlN and, most relevant to spintronic devices, spin lifetimes up to 0.5 μs are predicted for tuned AlN wells at room temperature.

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