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Prediction of large linear-in-k spin splitting for holes in the 2D GaAs/AlAs system[1] JUN-WEI LUO, ALEX ZUNGER, National Renewable Energy Laboratory, ATHANASIOS N. CHANTIS, Los Alamos National Laboratory, MARK VAN SCHILFGAARDE, Arizona State University, GABRIEL BESTER, Max Planck Institute for Solid State Research — The spin-orbit interaction generally leads to spin splitting (SS) of electron and hole energy states in solids, a splitting that is characterized by a scaling with the wavevector **k**. Whereas for *3D bulk zincblende* solids the electron (heavy hole) SS exhibits a cubic (linear) scaling with k, in *2D quantum-wells* the electron (heavy hole) SS is currently believed to have a mostly linear (cubic) scaling. Such expectations are based on using a small 3D envelope function basis set to describe 2D physics. By treating instead the 2D system explicitly in a multi-band many-body approach we discover a large linear scaling of hole states in 2D. This scaling emerges from hole bands coupling that would be unsuspected by the standard model that judges coupling by energy proximity. This discovery of a linear Dresselhaus k-scaling for holes in 2D implies a different understanding of hole-physics in low-dimensions.

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