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Direct observation of spin-valley-layer locking in centrosymmetric bulk WSe_2 by spin- and angle-resolved photoemission

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Methods to generate spin-polarized electronic states in non-magnetic solids are strongly desired to enable all-electrical manipulation of electron spins for new quantum devices. This is generally accepted to require breaking global structural inversion symmetry. In contrast, I will report our observation from spin- and angle-resolved photoemission spectroscopy of spin-polarized bulk states in the centrosymmetric transition-metal dichalcogenide 2H-WSe_2 [1]. Mediated by a lack of inversion symmetry in constituent Se-W-Se monolayers of the bulk crystal where the electronic states are localized, we show how enormous spin splittings up to $\sim$0.5 eV result, with a spin texture that is strongly modulated in both real and momentum space. Through this, our study provides direct experimental evidence for a putative locking of the spin with the layer and valley pseudospins in transition-metal dichalcogenides, of key importance for using these compounds in proposed valleytronic devices.

[1] J.M. Riley *et al.*, Nature Phys. **10** (2014) 835