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Spin-valley locking of the bulk transition-metal dichalocogenide superconductor $NbSe_2$ L. BAWDEN, Univ of St Andrews, S. COOIL, F. MAZZOLA, Norwegian Univ of Science Tech., J.M. RILEY, Univ of St Andrews Diamond Light Source, L. COLLINS-MCINTYRE, Univ of St Andrews, V. SUNKO, Univ of St Andrews Max Planck Inst. for Chemical Physics of Solids, J. WELLS, Norwegian Univ of Science Tech., G. BALAKRISHNAN, Univ of Warwick, S. BAHRAMY, Univ of Tokyo RIKEN, P.D.C. KING, Univ of St Andrews — 2H-$NbSe_2$ is a metallic transition metal dichalcogenide, which hosts instabilities to a charge density wave phase, and a superconducting phase at low temperatures [1]. To date, it has been assumed that these phases are largely unaffected by the spin degree of freedom. In contrast, from spin- and angle-resolved photoemission measurements, supported by first principles calculations, we reveal that the normal state Fermi surface hosts a complex spin texture. We uncover a rich spin-valley locking of the form also observed in the semiconducting materials of the same family [2], consistent with the recent observation of Ising pairing in the superconducting state of monolayer $NbSe_2$ [3]. We find that in the normal state of the bulk compound there is persistent spin polarisation which becomes intrinsically linked to the electronic dimensionality, showing a significant dependence on the out-of-plane momentum. This prompts a reinterpretation of the complex phases that emerge in this, and related materials. [1] Wilson JA et al, Phys. Rev. Lett. 32, 882 (1974). [2] Xiao D et al, Phys. Rev. Lett. 108, 196802 (2012); Xu X et al, Nature Phys. 10, 343350 (2014); Riley JM et al, Nature Phys. 10, 835 (2014). [3] Xi X et al, arXiv:1507.08731.

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