Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Negative Electronic Compressibility and Tuneable Spin Splitting in WSe_2 J.M. RILEY, Univ of St Andrews and Diamond Light Source, W. MEEVASANA, Suranaree Univ of Tech, L. BAWDEN, Univ of St Andrews, M. ASAKAWA, Tokyo Inst of Tech, T. TAKAYAMA, Univ of Tokyo, T. EKNAPAKUL, Suranaree Univ of Tech, T.K. KIM, M. HOESCH, Diamond Light Source, S.-K. MO, Advanced Light Source, H. TAKAGI, Univ of Tokyo, T. SASAGAWA, Tokyo Inst of Tech, M.S. BAHRAMY, Univ of Tokyo and RIKEN, P.D.C. KING, Univ of St Andrews — Recently, semiconducting transition metal dichalcogenides have gained attention for their extraordinarily large exciton-binding energies [1,2] and locking of the spin with valley and layer pseudospins [3,4]. Through sub-monolayer deposition of alkali metals onto the surface of WSe_2, analogous to the gating in a field-effect transistor, we create a 2DEG at the sample surface with tuneable carrier concentration [5]. Counter-intuitively, we find that the addition of carriers induces a reduction of the chemical potential in the near-surface. We attribute this to negative electronic compressibility [6] where strong Coulomb effects lead to the lowering of the chemical potential with band filling, which we find persists to remarkably high electron densities. Simultaneously, we show this is accompanied by a giant tuneable spin-splitting of the valence band states and a reduction of the quasiparticle band gap. [1] Ugeda, *et al., Nature Mat.* **13** (2014) 1091 [2] Ye *et al.*, *Nature* **513** (2014) 214 [3] Xu *et al., Nature Phys.* **10** (2014) 343 [4] Riley *et al., Nature Phys.* **10** (2014) 835 [5] Riley *et al.* doi:10.1038/nnano.2015.217 [6] Eisenstein *et al. Phys. Rev. Lett.* **68** (1992) 674

Jonathon Riley
Univ of St Andrews

Date submitted: 04 Nov 2015 Electronic form version 1.4