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Gate Tunable Magneto-resistance of ultra-thin WTe_2 devices¹ JIAN-HAO CHEN, XIN LIU, CHAO-YI CAI, ZHIRAN ZHANG, SHIBING TIAN, HONG LU, SHUANG JIA, International Center for Quantum Materials, Peking University, and Collaborative Innovation Center of Quantum Matter, Beijing 100871, China, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science, 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan — We have carried out magneto-transport experiment on ultra-thin WTe₂ field effect transistors that are far away from charge neutrality (in the heavily electron-doped regime). We found that the magnetoresistance (MR) of the samples is tunable by gate voltage, and the two-fluid model captured most of the physics in this regime phenomenogically. By tuning the 2D electron-hole imbalance from 8.2 10^{17} m-2 to 3.3 10^{17} m⁻², we were able to change the MR of the devices by 850%. The change of MR could be as large as 400,000% if the sample is tuned to neutrality when preserving the mobility observed in bulk samples. We also found that the change of MR of the ultra-thin WTe₂ is determined largely by a single parameter, namely, the difference between the number of electrons and holes. Our findings show the potential of ultra-thin WTe_2 as a variable magnetoresistance material in future applications such as magnetic field sensors, information storage and extraction, and galvanic isolators.

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