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Electric control of spin in monolayer WSe2 field effect transistors LEI ZHANG, KUI GONG, DONGPING LIU, McGill University, LEI LIU, YU ZHU, Nanoacademic Technologies Inc., YONGHONG ZHAO, HONG GUO, McGill University, MCGILL UNIVERSITY TEAM, NANOACADEMIC TECHNOLOGIES INC. COLLABORATION — We report a first principles theoretical investigation of quantum transport in monolayer WSe2 field effect transistor (FET). Due to a strong spin-orbit interaction (SOI) and the atomic structure of the two-dimensional (2D) lattice, monolayer WSe2 has an interesting electronic structure that exhibits Zeeman-like up-down spin texture near the K and K' points of the Brillouin zone. In a FET, the gate electric field induces an extra, externally tunable SOI that re-orients the spins into a Rashba-like texture thereby realizing electric control of the spin. Quantum transport is modulated by the spin texture, namely by if the spin orientation of the carrier after the gated channel region, matches or missmatches that of the FET drain electrode. The carrier current in the FET is labelled both the spin index and the valley index, realizing spintronics and valleytronics in the same device.

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