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All-Electrical Spin Field Effect Transistor in van der Waals Heterostructures at Room Temperature ANDR DANKERT, SAROJ DASH, Chalmers Univ of Tech — Spintronics aims to exploit the spin degree of freedom in solid state devices for data storage and information processing. Its fundamental concepts (creation, manipulation and detection of spin polarization) have been demonstrated in semiconductors and spin transistor structures using electrical and optical methods. However, an unsolved challenge is the realization of all-electrical methods to control the spin polarization in a transistor manner at ambient temperatures. Here we combine graphene and molybdenum disulfide (MoS_2) in a van der Waals heterostructure to realize a spin field-effect transistor (spin-FET) at room temperature. These two-dimensional crystals offer a unique platform due to their contrasting properties, such as weak spin-orbit coupling (SOC) in graphene and strong SOC in MoS_2. The gate-tuning of the Schottky barrier at the MoS_2/graphene interface and MoS_2 channel yields spins to interact with high SOC material and allows us to control the spin polarization and lifetime. This all-electrical spin-FET at room temperature is a substantial step in the field of spintronics and opens a new platform for testing a plethora of exotic physical phenomena, which can be key building blocks in future device architectures.

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