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GATE TUNABLE ANISOTROPY IN 2D GATE

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Anisotropy in crystals arises from different lattice periodicity along different crystallographic directions, and is usually more pronounced in two dimensional (2D) materials. Indeed, in the emerging 2D materials, optical and electrical anisotropy has been one of the recent research focuses [1]. However, key understandings of the in-plane anisotropic resistance in low-symmetry 2D materials, as well as demonstrations of model devices taking advantage of it, have proven difficult. Here, we show that, in few-layered semiconducting GaTe, electrical conductivity anisotropy between x and y directions of the 2D crystal can be gate tuned from several fold to over 10^3 [2]. This effect is further demonstrated to yield an anisotropic non-volatile memory behavior in ultra-thin GaTe, when equipped with an architecture of van der Waals floating gate (Figure 1).

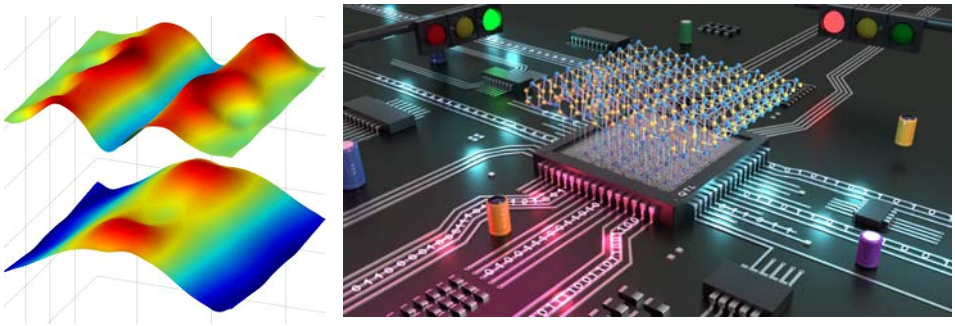

Figure 1. (left) Band profile of top valence and bottom conduction bands; (right) anisotropic non-volatile "traffic control" memory.

References

[1] Shengxi Huang, Yuki Tatsumi, Xi Ling, Huaihong Guo, Ziqiang Wang, Garrett Watson, Alexander A. Puretzky, David B. Geohegan, Jing Kong, Ju Li, Teng Yang, Riichiro Saito, and Mildred S. Dresselhaus, ACS Nano **10**, 8964 (2016).

[2] Hanwen Wang, Mao-Lin Chen, Mengjian Zhu, Yaning Wang, Baojuan Dong, Xingdan Sun, Xiaorong Zhang, Shimin Cao, Xiaoxi Li, Jianqi Huang, Lei Zhang, Weilai Liu, Dongming Sun, Yu Ye, Kepeng Song, Jianjian Wang, Yu Han, Teng Yang, Huaihong Guo, Chengbing Qin, Liantuan Xiao, Jing Zhang, Jianhao Chen, Zheng Han, Zhidong Zhang, Nature Comm. **10**, 2302 (2019).