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Edge states and electric field effects of zigzag silicene, germanenen and stanene nanoribbons with edge hydrogen terminations AYAMI HATTORI, Nagoya Universiy, YUKIO TANAKA COLLABORATION, MASAAKI ARAIDAI COLLABORATION — Silicene, germanene and stanene are novel two dimensional graphene-like materials composed of silicon, germanium and tin atoms. In these materials, quantum spin Hall effects can be observed at experimentally accessible temperature since they have larger spin-orbit coupling than graphene [1]. These materials prefer to construct sp^3-like hybridized orbitals rather than sp^2 ones [2,3]. Since the structures are crucial for these materials, not only π but also σ orbitals influence seriously on the energy spectra of edge states [4]. We study edge states controlled by an electric field perpendicular to the zigzag silicene, germanene and stanene nanoribbons (ZSiNRs, ZGeNRs and ZSnNRs) based on a multi-orbital tight-binding model. We show the edge states of ZSiNRs and ZGeNRs remain in the bulk energy gap even if above the critical electric field. However we discuss only ZSnNRs are promising materials of topological quantum field effect transistor from our light calculations. [1] C. -C. Liu, et al., Phys. Rev. Lett. 107, 076802 (2011). [2] K. Takeda and K. Shiraishi, Phys. Rev. B, 50, 14916 (1994). [3] S. Cahangirov, et al., Phys. Rev. Lett. 102, 236804 (2009). [4] A. Hattori, et al., arXiv: 1604.04717 (2016).

Ayami Hattori
Nagoya Universiy

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