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Novel frequency conversion devices and optoelectronic devices based on 2D materials

Beiju Huang¹, Chuantong Cheng¹, Xurui Mao¹ and Hongda Chen^{1,2}

¹Chinese Academy of Sciences, China

²University of Chinese Academy of Sciences, China

Graphene and other two-dimensional (2D) materials have captured extensive research interests due to its outstanding electronic, optical, mechanical, and thermal properties. Here, we will show several novel frequency conversion devices and optoelectronic devices based on 2D materials. We achieved two kinds of novel frequency mixer based on graphene photodetectors. One can mix optical signal and electronic signal directly and the other one can mix two optical signals directly. With ambipolar graphene, we achieved frequency tripler and frequency quadrupler. We also integrated graphene photodetectors onto silicon integrated circuit chips to achieve a prototype monolithic optoelectronic integrated optical receiver. These novel RF devices and optoelectronic devices based on 2D materials achieved in our group show unique properties as comparing with traditional bulk semiconductor material.

bjhuang@semi.ac.cn