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Photo-induced Modulation Doping in Graphene/Boron nitride Heterostructures[1] JAIRO VELASCO JR., LONG JU, EDWIN HWANG, SALMAN KAHN, CASEY NOSIGLIA, HSIN-ZON TSAI, Deptartment of Physics, Universtiy of California, Berkeley, WEI YANG, GUANGYU ZHANG, Bejing National Laboratory for Condendsed Matter Physics and Institute of Physics, TAKASHI TANIGUCHI, KENJI WATANABE, Advanced National Laboratory, National Institute for Materials Science, YUANBO ZHANG, Department of Physics, Fudan University, MICHAEL CROMMIE, ALEX ZETTL, FENG WANG, Deptartment of Physics, Universtiy of California, Berkeley — Van der Waals heterostructures (VDH) provide an exciting new platform for materials engineering, where a variety of layered materials with different electrical, optical and mechanical responses can be stacked together to enable new physics and novel functionalities. We report an emerging optoelectronic phenomenon (i.e. photo-induced modulation doping) in the graphene-boron nitride VDH (G/BN heterostructure). We find it enables flexible and repeatable writing and erasing of charge doping in graphene with optical light. We show that the photo-induced modulation doping maintains the remarkable carrier mobility of the G/BN heterostructure, and it can be used to generate spatially varying doping profiles like pn junctions. Our work contributes towards understanding light matter interactions in VDHs, and introduces a simple technique for creating inhomogeneous doping in high mobility graphene devices.

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