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Full-range Gate-controlled Terahertz Phase Modulation with Graphene Metasurfaces QIONG WU, ZIQI MIAO, XIN LI, DING KUN, QIONG HE, ZHENHUA AN, YUANBO ZHANG, LEI ZHOU, Fudan Univ, LEI ZHOU'S GROUP COLLABORATION, YUANBO ZHANG'S GROUP TEAM, ZHENHUA AN'S GROUP TEAM — Local phase control of electromagnetic wave is the basis of a diverse set of applications such as hologram imaging, polarization manipulations and wave-front controls. Here, we demonstrate full-range THz phase modulation realized on a metasurface featuring magnetic resonators that are coupled with graphene as a tunable loss. A gate bias applied through ion liquid tunes graphene's optical conductivity, turns the coupled system from an under-damped resonator to an over-damped one, and induces dramatic modulation in the phase of the reflected wave. Our one-port resonator (i.e. resonator with only reflection channel) model reveals the underlying mechanism of our extreme phase modulation, and points to general guidelines for achieving large, tunable phase modulation in THz regime. A gate-tunable polarizer will be presented as an early demonstration of the capability of our graphene metasurfaces.

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