Terahertz Photonic Devices Employing Functional Nanostructures

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The terahertz (THz) spectral range (0.1-10 THz, 3mm-30μm) has significant scientific and technological significance, as it overlaps with various fundamental excitations in different matters, including phonons, magnons, plasmons, and molecular vibrations. It also provides much wider bandwidth than all the bandwidths currently used for wireless communications. Therefore, the THz spectral range is suitable for a broad range of spectroscopy, sensing, imaging and communication technologies and applications.

However, photonic devices operating in the THz spectral range (especially above 1THz) lack diversity and technological maturity, mainly due to lack of materials with attractive properties. Recently, graphene has emerged as a versatile material for photonics applications, including in the THz range, especially because it can support highly confined and long-lived THz surface plasmon polaritons. In this talk, I will present our efforts in developing several types of THz photonic devices incorporating functional graphene (plasmonic) nanostructures. These graphene nanostructures, being much smaller than the typical THz wavelength, play crucial roles in realizing the functionalities of the THz modulators, photodetectors and molecular sensors to be discussed.