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GHz - THz plasmonic circuits using low dimensional electronic systems[1]

DONHEE HAM, Harvard University

Nature offers a broad variety of plasma systems consisting of electrons unbound from atoms, e.g.; astrophysical plasmas in intergalactic, interstellar, and stellar media; the Earth's ionosphere; and solid-state plasma, the free electrons in metals and semiconductors, only to name a few. A key feature of many plasma systems is collective motions of electrons; as the electron density profile is perturbed from equilibrium, Coulomb restoring forces (and sometimes quantum pressure in dense plasma) arise to power these collective motions, usually in the form of bulk electron density oscillations or electron density waves. Solid-state plasmas are particularly interesting, as the fabrication technologies available for solid-state materials allow us to alter the boundaries and interfaces of the plasma media in various ways to engineer the collective motion. A notable example is the surface plasmons, which have been a source of many breakthroughs in photonics. I will talk about a set of our recent developments where the plasmons are brought down to the electronics-regime (GHz$\sim$THz) and manipulated to produce a range of functionalities, while offering unique advantages to electronics over their purely electromagnetic counterparts. (Co-workers) William Andress (Harvard), Hosang Yoon (Harvard), Kitty Yeung (Harvard), Ling Qin (Harvard), Ken West (Princeton), and Loren Pfeiffer (Princeton).

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