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Surface Plasmon Instability Leading to Emission of Radiation in Hybrid Semiconductors GODFREY GUMBS, Hunter College, CUNY and Donostia International Physics Center (DIPC),, ANDRII IUROV, University of New Mexico and Hunter College, CUNY, DANHONG HUANG, Air Force Research Laboratory, Space Vehicles Directorate, WEI PAN, Sandia National Laboratory — An energy conversion approach from a dc electric field to a terahertz wave based on a new generation of hybrid semiconductors by combining two-dimensional (2D) crystalline layers and a thick conducting material is proposed with possible applications as a source of coherent radiation. The hybrid nano-structure may consist of a single or pair of sheets of graphene, silicene or a 2D electron gas as would occur at a semiconductor hetero-interface. When an electric current is passed through a layer, we discover that the low-frequency plasmons may become unstable beyond a critical wave vector q_c. However, there is no instability for a single driven layer far from the conductor and the instability of an isolated pair of 2D layers occurs only at ultra long wavelengths. To bring in frequency agility for this spontaneous radiation, we manipulate the surface-plasmon induced instability, which leads to the emission of radiation (spiler), to occur at shorter wavelengths by choosing the conductor electron density, layer separation, distances of layers from the conductor surface and the driving-current strength. Applications of terahertz radiation from spiler for chemical analysis, security scanning, medical imaging and telecommunications are expected.

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