

Tera-Days: Attività INFN e prospettive per la radiazione THz e le sue applicazioni



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THz response of innovative materials and metamaterials, metadevices and metasurfaces

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Terahertz Time Domain Spectroscopy (THz-TDS) is a powerful tool for investigating the electrodynamic response of any kind of material and/or metamaterial.

Using THz radiation (0.3-10 THz) one can retrieve in direct way essential information on material properties such as the refractive index and conductivity. These quantities are both described in terms of the complex dielectric function that TDS can provide through the coherent investigation of the modulus and phase of the transmitted signal.

In contrast with natural materials, metamaterials (MM) have a response tailored by the geometrical features and periodicity of the unit cell (meta-atom). The structure and specific features of the sub-wavelength elements and their coupling type and strength define their electromagnetic properties and functionalities. Metamaterials are commonly employed to design novel electro-optical devices with well-defined transmission/reflection signatures.

We will present here a brief overview on the on-going activities at the University of Naples "Federico II" using TDS in the range 0.1-4 THz.

We will first show, using a mean field theory, the capability of this technique into extracting electrodynamic information (through a mean field theory) of samples in thin film or bulk form, including polymeric nanocomposites.

On the metamaterial side, we will present results obtained on a number of passive and active metadevices and metasurfaces (i.e., planar metamaterials), aimed at exploiting exotic properties such as negative refraction, sub-diffraction imaging, enhanced transmission, cloaking, diffuse scattering, etc.

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