Graphene-based devices for Terahertz photonics

Alessandro Tredicucci
NEST, CNR – Istituto Nanoscienze and Scuola Normale Superiore
Piazza San Silvestro 12, 56127 Pisa
Email: a.tredicucci@sns.it

Graphene, a single-layer of carbon atoms arranged in a two-dimensional honeycomb lattice is nowadays attracting considerable attention for a variety of photonic applications, including fast photodetectors, transparent electrodes in displays and photovoltaic modules, and saturable absorbers. Owing to its high carrier mobility, gapless spectrum, and frequency-independent absorption coefficient, it has been precognized as a very promising element for the development of detectors and modulators operating in the Terahertz (THz) region of the electromagnetic spectrum (wavelengths in the hundred μm range), which is still severely lacking in terms of solid-state devices. Here I will illustrate the realization of THz detectors based on antenna-coupled single-layer and bilayer graphene field-effect transistors (FETs), and discuss the development and applications of electrically switchable metamaterial devices. Finally, prospects for the use of graphene in a new generation of THz sources will be analyzed.


Alessandro Tredicucci

Research Director at NEST, CNR – NANO, is well known for his work on THz photonic devices based on intersubband transitions (sources) and field effect nanotransistors (detectors). He also pioneered studies on the modification and control of light interaction with intersubband transitions in structures with strong photon confinement. He has co-authored more than 200 publications with a total of about 6900 citations (h-index 43), holds 15 international patents, and has given 76 invited talks at conferences. He was the Chair of the 2007 edition (13th) of MSS (Genova, July 15-20, 2007) and the Chair of ITQW for the 11th edition (Sardinia, Italy, September 11-17, 2011). Among his awards, the 2013 Nick Holonyak Jr. award of the Optical Society of America, and the 2003 S. Panizza award of the Italian Physical Society. He is presently Coordinator of the ERC advanced grant "SoulMan" of the European Commission (2013-2019).