TUGRACO: Towards Ubiquitous GRAphene based RF COmmunications demonstrating and understanding graphene based plasmonic THz antenna potential and limitations

Main area: Prototypes
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Abstract

Nanotechnology is increasingly providing a plethora of new tools to design and manufacture miniaturized devices such as ubiquitous sensors, wearable electronics or pervasive computing systems. Such devices require wireless communications for information sharing and coordination. Unfortunately, reducing the size (and concomitantly cost) of such devices is severely restricted by the dimensions of metallic antennas. Graphene offers a radical alternative to downscale antennas by orders of magnitude thanks to its special dispersion relation and its ability to support surface-plasmon polaritons (SPP). Indeed, a graphene RF plasmonic micro-antenna with lateral dimensions of a few micrometers is predicted to resonate in the terahertz band (0.3-10THz) at a frequency up to two orders of magnitude lower and with a higher radiation efficiency with respect to metallic counterparts. In consequence, graphene micro-antennas provide a huge integration potential for future miniaturized wireless systems and represents an enabling technology for the future dominant ICT applications envisioned by e.g. Internet of Things.
In this project we will: i) present an experimental prototype demonstration, which shows and assesses the practical operation of a graphenna. Here, photoconductive emitters based on THz graphennas will be demonstrated with operation frequencies between 0.2 and 3 THz. A target reduction of antenna length by at least a factor of 10 is envisaged. The analysis includes scalability of the concept towards lower µ-wave frequencies. ii) A detailed quantitative evaluation of the potential and limiting performance factors of graphennas under realistic technologically achievable parameters will be developed. iii) A fundamental understanding of the microscopic origin of these limitations will be achieved, in order to guide graphene material optimization in the context of this (and other THz) applications.

Consortium

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