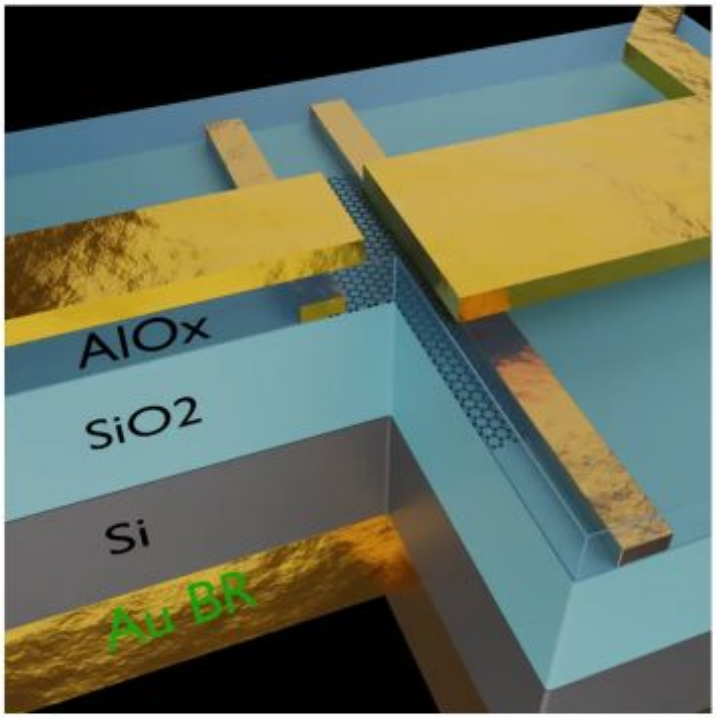

Proof of Concept Grant

ERC funding to develop a Terahertz graphene receiver for wireless communications

January 27, 2023

The European Research Council, in its efforts to help ERC grant-holders to bridge the gap between their research and the earliest stage of a marketable innovation, created the Proof of Concept (PoC) funding scheme for researchers who have already been awarded an ERC grant. The grants are part of the EU's research and innovation program, Horizon Europe. Not only does this program help ERC grantees to bridge the gap between the results of their pioneering research and the early phases of its commercialisation, the program complements the efforts of ICFO's Knowledge and Technology Transfer Unit (KTT), which proactively searches for ways to translate newly generated knowledge into new technologies.

ICREA Prof at **ICFO Dr Frank Koppens**, leader of the Quantum Nano-Optoelectronics research group, has been awarded his fourth PoC to date, the thirteenth award of this kind for ICFO in the past ten years, for the project titled **TERACOMM**. This project aims to develop

a terahertz graphene receiver for wireless communications.

6th generation (6G) mobile broadband communications will transform the communications industry, leading to high speed networks capable of linking integrated communication, sensing, and computing capabilities to fuse the physical, biological, and cyber worlds. However, 6G infrastructure will require a significant increase in data transfer rate (>10 times larger than current standards), ultra-low power consumption (<1pj/bit), and high reliability. 5G technology, originally designed for data rates up to 20 Gbps, cannot fulfil these requirements.

The sub-THz spectrum (~100GHz-300GHz) could provide the required capacity for 6G short-range wireless links. On the other hand, Multiple-Input-Multiple-Output (MIMO) systems, consisting of multiple transmitting/receiving antennas, are a key element of 5G tech, dramatically increasing the spectral efficiency of the wireless link, multiplying the data transfer rate of the single TX/RX antenna system by the number of implemented channels. Developing a technology that can combine the advantages of the sub-THz spectrum and MIMO systems could yield short-range 6G wireless connectivity, significantly enhancing data rates, power consumption, and reliability.

ICFO's patented Antenna-integrated-Graphene-THz-Detector (AGTD) technology, providing ultrabroadband frequency operation, high speed (potentially >100GHz), high sensitivity, small footprint and low power consumption, represents an ideal solution able to meet all the requirements for the realization of a MIMO system operating at unprecedented frequencies. TERACOMM envisions the realization and the demonstration of the receiver module of a graphene-based wireless MIMO system able to reach data rates >100Gbps for short range applications. Industrial links, protection of intellectual property, and commercial exploitation will lie at the heart of the project from the outset, in order to maximize the potential for this technology to realize a significant social and economic impact.