TERA-MIR RADIATION: MATERIALS, GENERATION, DETECTION AND APPLICATIONS III

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In this talk, I start by summarizing the main goals and recent achievements of COST ACTION MP1204 [1], whose main objectives are to advance novel materials, concepts and device designs for generating and detecting THz and Mid Infrared radiation using semiconductor, superconductor, metamaterials and lasers and to beneficially exploit their common aspects within a synergetic approach. We use the unique networking and capacity-building capabilities provided by the COST framework to unify these two spectral domains from their common aspects of sources, detectors, materials and applications. We are creating a platform to investigate interdisciplinary topics in Physics, Electrical Engineering and Technology, Applied Chemistry, Materials Sciences and Biology and Radio Astronomy. The main emphasis is on new fundamental material properties, concepts and device designs that are likely to open the way to new products or to the exploitation of new technologies in the fields of sensing, healthcare, biology, and industrial applications. End users are: research centres, academic, well-established and start-up Companies and hospitals.

Results are presented along our main lines of research: *Intersubband materials and devices with applications to fingerprint spectroscopy; Metamaterials, photonic crystals and new functionalities; Nonlinearities and interaction of radiation with matter including biomaterials; Generation and Detection based on Nitrides and Bismides.*

Next I summarize research results in which I have been directly involved including: *valence band THz polaritons and antipolaritons* [2,3], *a microscopic approach to dilute semiconductor optics* [4], *simulations of quantum cascade lasers* and *THz generation by frequency multiplication in semiconductor superlattices and a numerical study of high impedance T-match antennas for THz photomixers* [5], harmonic generation in superlattices and quantum cascade laser simulations. The theoretical results outlined are intended to stimulate further cooperation between theory and experimental teams.

[1] M.F. Pereira, Opt Quant Electron 47, 815–820 (2015).
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[3] I.A. Faragai and M.F. Pereira, Opt Quant Electron 47, 937–943 (2015).
[4] C.I. Oriaku and M.F. Pereira, Opt Quant Electron 47, 829–834 (2015).
[5] L. Juul, M. Mikulics, M. F. Pereira and M. Marso, Opt Quant Electron 47, 913–922 (2015).