GHz-THz Nonlinearities in Semiconductor Superlattices

M. F. Pereira

Department of Physics, Khalifa University of Science and Technology, Abu Dhabi 127788, UAE
mauro.pereira@ku.ac.ae

This talk starts with a short review of the state of the art in nonlinearities in the Gigahertz (GHz) to Terahertz range, followed by an outline of an hybrid approach combining Nonequilibrium Green's Functions and the Boltzmann equation for the nonlinear response of semiconductor superlattices. The nonlinearities are controllable in very good agreement with experiments [1-2].

The Terahertz-Mid Infrared (TERA-MIR) is relatively well understood [3-5] but more work is needed for the next step which is the GIGA-TERA-MIR extended range and a predictive numerical tool is discussed to design materials and devices for a large number of applications for the detection of substances which have strong GHz-THz resonances.

Recent results of control of GHz-THz nonlinearities under will be discussed in detail [6-9].

Possible projects for PhD students with full Fellowship at KU will be discussed. See a video of KU at Ref. [10].

[1] M.F. Pereira et al, Phys. Rev. B 96, 045306 (2017).
[2] M.F. Pereira et al, J. Nanophoton 11 (4), 046022 (2017).
[3] M.F. Pereira, Opt Quant Electron 47, 815 (2015).
[4] M.F. Pereira, Applied Physics Letters 109, 222102 (2016).
[5] M.F. Pereira and I.A. Faragai, Optics Express 22 (3), 3439 (2014).
[6] A. Apostolakis and M.F. Pereira, AIP Advances 9, 015022 (2019).
[7] A. Apostolakis and M.F. Pereira, J. of Nanophotonics 13, 036017 (2019).
[8] A. Apostolakis and M.F. Pereira, Nanophotonics (2020)
[9] M.F. Pereira et al, Sci Rep 10, 15950 (2020).
[10] https://www.youtube.com/watch?v=rpGdQapbRd8&t=27s