University of Pavia

Ph.D. School of Electrical and Electronics Engineering and Computer Science

SEMINAR

Terahertz photonics and its applications

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Aula Seminari (Ex Dip. di Elettronica), D floor

Via Ferrata 5, Pavia

Abstract: Originally employed in the astronomy and laser-fusion communities to investigate cosmic far-infrared radiation and plasma diagnostics, respectively, Terahertz (THz) radiation corresponds to the portion of the electromagnetic spectrum below the optical and above the microwave domains (between 0.1 - 10 THz, 3 mm - 30 μm wavelength). Since the first demonstration of THz time-domain spectroscopy in the late 1980s, THz photonics has received increasing attention for scientific and industrial applications as more efficient THz sources, detectors, and supporting devices have been made available over the years. The technology has shown its potential for a vast variety of fields such as imaging, chemical and biological sensing, medical diagnosis, environmental monitoring, communications, as well as security and quality-control applications. Indeed, THz radiation can "see through" many materials such as: plastics, paper, cardboard, semiconductor wafers, and fabrics, thus enabling, e.g., testing of their quality (e.g., homogeneity, stress cracks, inclusions, and voids). Moreover, unlike X-rays, THz radiation exhibits low photon energy (~meV instead of ~keV) and thus does not cause deleterious effects in sensitive materials and biological tissues. Finally, THz spectroscopy is an effective technique for sensing low-frequency modes (e.g., collective vibrations, phonons, magnons, intra-excitonic transitions) of a variety of materials, which in turn allows the identification of many chemical compounds as well as more fundamental investigations. As reported by the National Academies, electronics and optics are merging together to open a new "Tera-Era". Therefore, due to its unique location in the electromagnetic spectrum and its yet to be fully exploited potential, THz photonics will represent one of the most exciting research areas in future science and technology.

Bio: Riccardo Piccoli received his Bachelor (2009), Master (2011), and PhD (2014) Degrees in Electronic Engineering from University of Pavia (Italy) on the design and characterization of laser sources under the supervision of Prof. A. Agnesi and Prof. G. Reali. He also spent a period abroad at Swansea University (Wales, UK) under the supervision of Prof. S. Taccheo, where he studied Photodarkening effect in Yb-doped fibers as a part of the European project LIFT. Since February 2015, he joined INRS-EMT as Postdoctoral Research Fellow under the supervision of Prof. R. Morandotti and Prof. L. Razzari. He is currently investigating different fields such as terahertz technology (ultra-broadband detectors, waveguides, multidimensional imaging), metamaterials and plasmonic nanostructures from visible to THz, as well as pulse compression techniques in gas-filled hollow-core fibers. These projects are carried out in the framework of international collaborations with prestigious institutions such as IIT (Italy), KAUST (Saudi Arabia), MIT (USA), École Polytechnique (France), Fraunhofer Institute (Germany), and CREOL (USA). To date, Dr. Piccoli has published 14 research papers in high-IF peer-reviewed international journals (such as *Nature Communications*, *Optica*, and *Laser & Photonics Reviews*) and more than 40 conference contributions and seminar talks.

Organizer

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Seminar in English

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