

FRIDAY, AUGUST 16, 2024

11:00 AM IN CLB 102



ULTRAFAST SPIN AND ORBITAL CURRENTS PROBED BY THZ-TDS SPECTROSCOPY

ABSTRACT

The conversion of non-equilibrium angular momentum into charge current and vice versa, in the static and dynamic regime of electrical injection, is at the heart of today's spintronic and orbitronic devices. With this in mind, terahertz time-domain spectroscopy (THz-TDS) has established itself as a benchmark non-destructive optical technique, using several concepts from magnetism, spintronics and photonics, capable of probing these fundamental principles. In particular, spin-charge conversion (SCC) in magnetic heterostructures excited by a femtosecond laser pulse can generate ultrafast spin currents giving rise to a high-efficiency, wide-bandwidth terahertz emission with a magnetically controllable polarization state. The origin of this THz emission has been attributed to the generation of a spin-polarized current and a subsequent transient charge current. Two main SCC mechanisms are generally involved: the inverse spin Hall effect (ISHE) and the inverse Rashba-Edelstein effect (IREE). In this general seminar, Prof. Henri Jaffrès will discuss, along with the main relevant concepts, our major results obtained recently concerning the generation of ultrafast spin currents giving rise to SCC at the surface of quantum materials as played out by topological insulator surface states (TSS); as well as more recent experiments showing the occurrence of the generation and transport of electron orbitals followed by a transient charge current and the subsequent THz-emissivity effect.

BIOGRAPHY

Prof. Henri Jaffrès (52 years old) is a senior research director at CNRS, centre National de la recherche Scientifique, at the Laboratoire Albert Fert (LAF) at the Université Paris-Saclay and professor at the Ecole Polytechnique, Palaiseau, France since 2017. He is an international leader in the field of spin-injection in metals, hybrid metal/semiconductor and topological insulator devices. He is co-leader of the ultrafast spintronics and spintronics THz team at LAF. He has worked in spintronics, orbitronics and spinorbitronics for more than 20 years with a more recent focus on ultrafast spin-charge conversion phenomena at active spintronics interfaces in the frame of (French) national ANR France 2030 and European projects in the frame of Horizon-Europe framework (Pathfinder). Since 2001, he has been the author or co-author of more than 150 publications on spin-injection devices, spin-LEDs and Spin-VCSELs and various spin-charge conversion phenomena mainly in APS, AIP and Nature journals.

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