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Spinorbitronics at interfaces for THz emission

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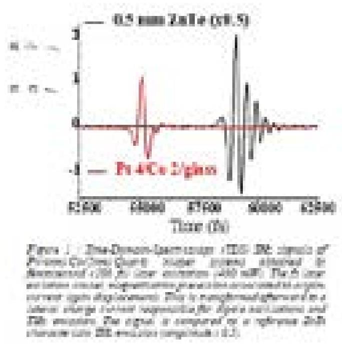
Spin-Hall Effects at short lengthscale in bulk heavy metals like Pt or W and spin-orbit related phenomena like Inverse-Edelstein Effect at interfaces are presently at the basis of new spintronics functionalities. Combined with RF-spin-pumping Ferromagnetic Resonance (FMR) pumping, spin-orbit give rise to AC and DC spin-to-charge current conversion. Those combined techniques enable to probe the interface quality and physical properties. In the same way, in an extented description out-of FMR resonance, it was recently reported that THz emission of relatively high power may be realized in the same kind of heterostructures composed of ferromagnetic (FM) and non-FM metal films via dynamical spin-to charge conversion and time-dependent spectroscopy (TDS). In that mind, we will present our last results of THz emission provided by optimized growth bilayers composed of a high-spin orbit material in contact with a ferromagnetic layerCo/Pt, NiFe/Au:W). Those bilayers state-to-the art model systems in experiments combining RF-spin pumping and spin-to-charge conversion by ISHE. Here, experiments consist in exciting magnetization and spin-currents within the FM layer via femtosecond laser excitation and measuring, in the picosecond timescale, the relaxation of the correlated spin and charge currents responsible for THz dipolar emission. The THz emission provided by these spintronics bilayers reaches the power of ZnTe semiconductor technology. We will display the first THz emission results obatined on -Sn/InSb topological insulators. Moreover, in order to study the SHE spin-current profiles and address their properties in those [Co,Ni]N/Pt and [Co,Ni]N/Au:W multilayers, we have analyzed their Anomalous Hall effect (AHE) signals showing up a characteristic AHE spin-inversion from Pt to Au:W samples. We analyze our results in the series of samples: the exact conductivity profile across the multilayers via the 'extended' Camley-Barnas approach and the spin current profile generated by spin-Hall effect. We will discuss the role of the generalized spin-mixing conductance on the spin-transport properties and spin-orbit torques.



Biography

Dr. Henri Jaffrès completed his Ph.D. at the Physics Department of the Institut National des Sciences Appliquées (INSA) - University Toulouse III, France, in 1999. Then he joined the Unité Mixte de Physique CNRS-Thales, Palaiseau, France as a postdoc (2000–2001) before joining the CNRS at the same institute. His work focuses on spintronics, spin injection, spin transport, and spin transfer in semiconductor spintronics devices with electrical and optical detection in III-V heterostructures, as well as spin-Hall effect and spin-pumping in group IV semiconductors.

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