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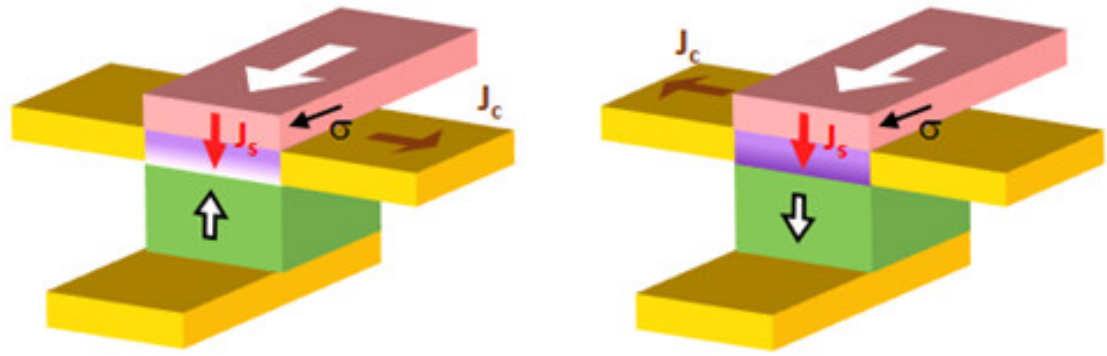

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Ferroelectric control of Rashba states: towards non-volatile spintronics driven by ferroelectricity

2pm - 3pm (Salle 1180, bâtiment E2, Salle des séminaires)

After 50 years of exponential increase in computing efficiency, the technology of today's electronics is approaching its physical limits, with feature sizes of just a few nm. New schemes must be devised to contain the ever-increasing power consumption of information and communication systems, which requires the introduction of non-traditional materials and new state variables. As recently highlighted, the remanence associated with collective switching in ferroic systems is appealing to reduce power consumption [1]. A particularly promising approach is spintronics, which relies on ferromagnets to provide non-volatility and to generate and detect spin currents. However, magnetization reversal by spin transfer torques is a power-consuming process. This is driving research on multiferroics to achieve a low-power electric-field control of magnetization, but practical materials are scarce and magnetoelectric switching remains difficult to control. In this talk, we will propose an alternative strategy to achieve low-power spin detection and generation in non-magnetic systems combining ferroelectricity and Rashba spin-orbit coupling [2]. We will focus first on oxide-based 2-dimensional electron gases (2DEGs) based on ferroelectric SrTiO 3 and show how both spin-charge and charge-spin conversion can be controlled by ferroelectricity [3]. While these results were obtained at low temperature, we will describe our current efforts to realize ferroelectric 2DEGs with high Curie temperature, and present room-temperature operation with the ferroelectric Rashba semiconductor GeTe [4]. These observations open the way to the electric-field control of spin currents and to ultralow-power spintronics, in which non-volatility would be provided by ferroelectricity rather than by ferromagnetism.

References

[1] Manipatruni, S. et al. Nature Phys 14, 338 (2018). [2]. Varignon, J. et al. Nature Phys 14, 322 (2018). [3]. Noël, P. et al. Nature 580, 483 (2020). [4]. Varotto, S. et al. Nat Electron 4, 740 (2021).