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NANOSPIN: COMBINING THE MAGNETIC AND ELECTRIC PROPERTIES OF FERROMAGNETIC SEMICONDUCTORS INTO FUNCTIONAL DEVICES.

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NANOSPIN is a European Commission projected bringing together 8 academic and industrial partners with a strong background in spintronic materials and devices. The project aims at the development of novel multifunctional spintronic nanoscale devices whose mode of operation is designed to take optimum advantage of the specific magneto electric properties of ferromagnetic semiconductors. The devices combine non-volatility, low current consumption, high switching speed and excellent scalability. The project addresses a number of interlinked novel device concepts for the magnetic writing of information, including current induced switching and current induced domain wall motion, combined with novel readout concepts based on tunneling anisotropic magneto resistance and double barrier structures.

Since the project is strongly device oriented, we use the well established and well understood ferromagnetic semiconductor (Ga,Mn)As as a vehicle material. This allows us to focus on device action, rather than on materials issues. While this implies that the prototype devices necessarily operate at low temperatures only, the concepts developed should directly apply to any p-type ferromagnetic semiconductor. The project thus complements ongoing materials research on room temperature ferromagnetic semiconductors. Direct involvement of several industrial and semi-industrial partners permits a constant evaluation of the potential of the developed devices for industrial applicability and commercialization for post CMOS applications.

In this presentation, I will briefly summarize how NANOSPIN aims to harness the interplay between magnetic and transport properties of strongly spin-orbit couple system in order to achieve these novel devices. In particular, I will describe the very sophisticated transport and magnetic anisotropies present in these materials, and show some they lead to the fundamentally novel transport behavior which we aim to convert into device functionalities.