Projet SUD: Spintronique à une dimension

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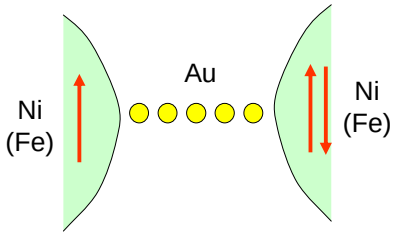
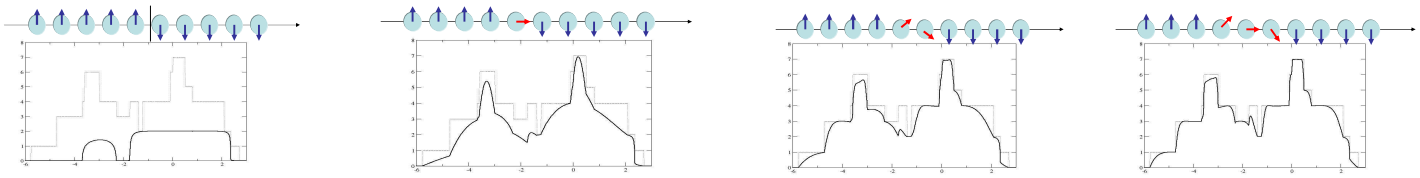
Goal: *The project aims at understanding magnetoresistance properties of one dimensional systems of ultimate small size, for which new physical phenomena can be expected. The properties of magnetic atomic chains are investigated and one-dimensional 'spin valves', where two ferromagnetic electrodes are separated by an atomic chain made of gold or platinum, will be realised and studied. The project started in February 2009.*



Theory

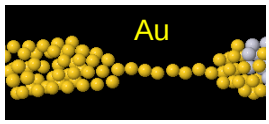
Electronic transport (CEA Saclay/SPCSI) : 1D spin valves: «ballistic» GMR??
First step: Calculation of the resistance of a Domain Wall in a pure atomic chain : transmission coeficient vs energy for the different DW shapes:



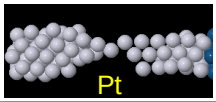
→ Low domain wall resistance in the ballistic regime

Molecular dynamics (CINAM): what happens when Au and Pt are being streched?

→ Au forms facets {111} at the surface, then helical structures, then stripes and eventually atomic wires before breaking.

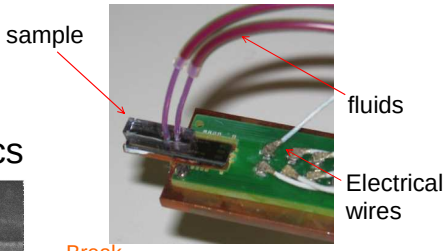


→ Pt keeps a very compact structure, then forms stripes but no wires

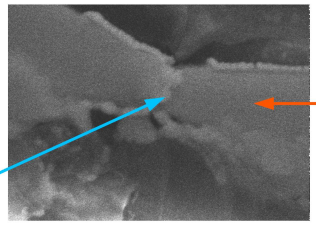


Experimental

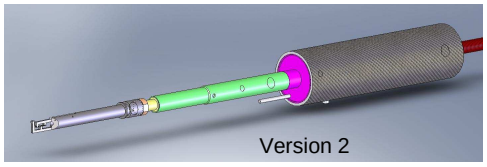
1) Electrodeposition in a break junction (IPCMS + CEA Saclay)
Electrodeposition with real-time transport measurements: microfluidics



First tests to produce an atomic contact with electrodes of a different material, electrodeposition of Pt in a Au break junction:



2) Observation in real time of the atomic structures in a TEM
→ development of a sample holder in order to break junctions in a TEM with real-time electrical measurements (LPS + CEA Saclay):



Future work:

Theory: magnetoresistance in a realistic GMR geometry: combination of transport and molecular dynamics

Experimental: sample holders ready for first transport measurements + imaging at the atomic level