Phase I NSF CCI: Center for Molecular Spintronics (CHE-0943975)

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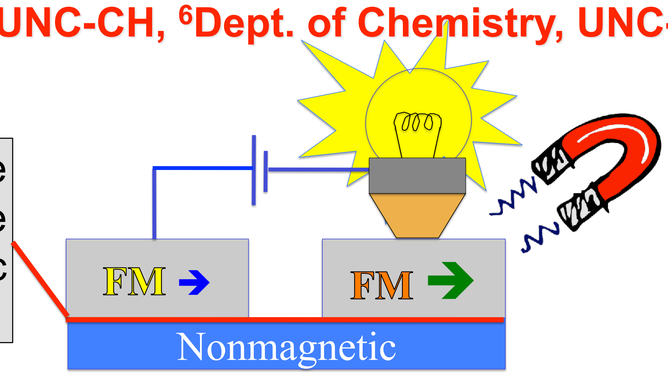
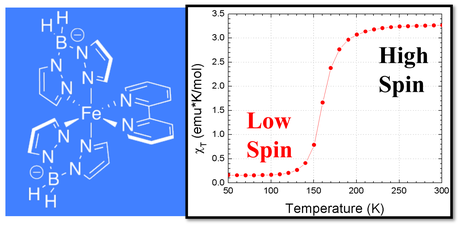
Center Focus: the CMS is exploring the utility of switchable/bistable paramagnetic molecules as interfacial "spin filters" to enhance and to gate injection and detection of spin polarized electrons from/to magnetic electrodes.



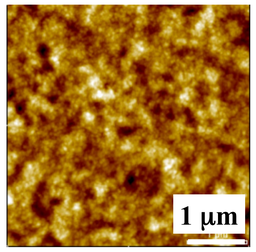
Cartoon of a spin valve: Current flows between magnetic electrodes only when magnetic moments are alighned parallel

- **Iron spin crossover compounds form stable films by evaporation**
- **Transport measurements across the spin crossover transition show a change in conductance in agreement with calculations**
- ***High-spin Fe^{II} conducts better than low-spin Fe^{II}***

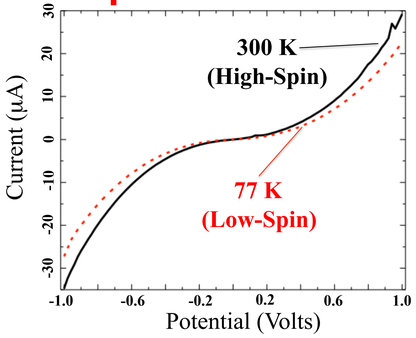
SQUID Magnetometry



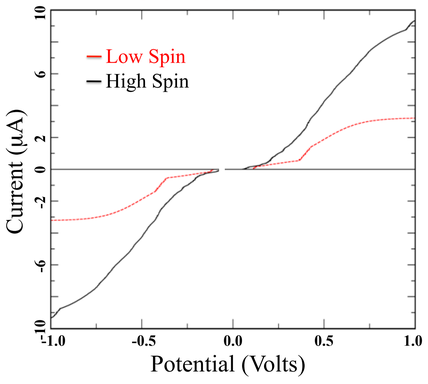
AFM of 60 nm Film:

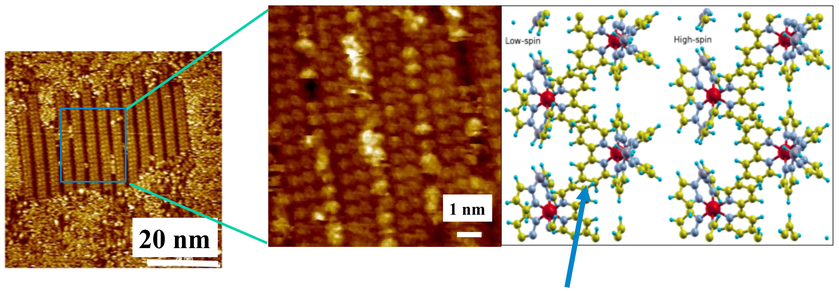


Experimental I-V:



Theoretical I-V:



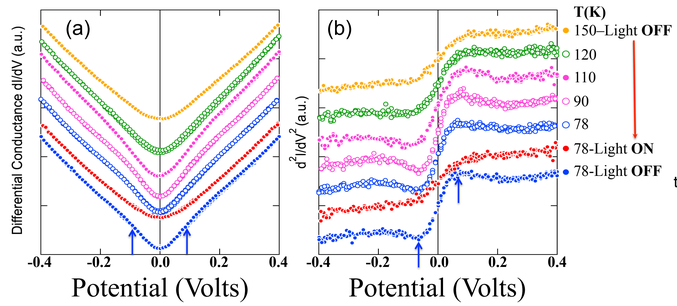


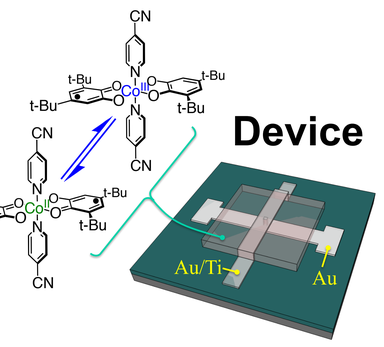
STM Images of the first two layers on Au(111)

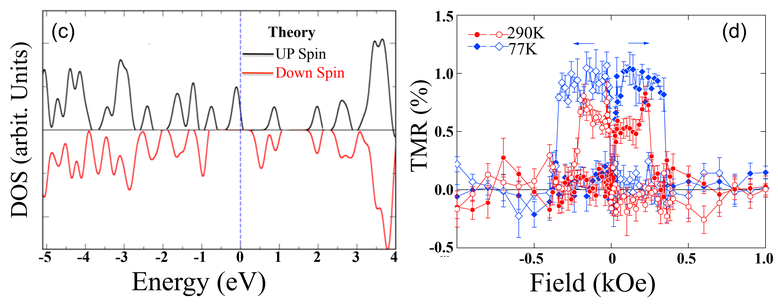
Dimerization by π interactions in monolayer similar to crystal structure

These results demonstrate that spin crossover complexes form the basis for a new type of molecular device as supported by theory.

- **Differential conductance exhibits 'resonances' below tautomeric transition**
- ***Low temperature resonances switched off by light***







- The resonances are peaks/dips in d^2I/dV^2 (↑) **and are switched-off by light (red traces in (a) and (b)), thus returning to the high temperature behavior** (orange traces at 150K). **(c)** Theoretical density of states plot that confirms the difference in minority and majority spin density conducive to the measured spin-valve effect. **(d)** Spin valve effect in permalloy/VT molecule/Co trilayer structure – tunneling magnetoresistance (TMR = $(R_{AP}-R_P)/R_P$) at two temperatures.

These results demonstrate that valence tautomers form the basis for a new type of molecular photoswitch device.