LIESST above T_{LIESST} on $Fe(phen)_2(NCS)_2$: a balance between relaxation time and fluence.

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The $Fe(phen)_2(NCS)_2$ spin crossover molecule is a textbook photo-switchable system. At very low temperature, the molecule is switched by light from the Low Spin (LS) to a meta-stable High spin (HS) state, this is the Light Induced Excited Spin State Trapping or LIESST. This state remains stable until a limit temperature known as T_{LIESST} [1]. The LIESST effect has been intensively studied since its discovery in the 80s [2]. Below T_{LIESST}, phenomena such as Light Induced Thermal Hysteresis (LITH) [3] or Light Induced Optical Hysteresis (LIOH) [4] were also investigated. Above T_{LIESST}, the fast relaxation rate precludes investigating LIESST with conventionnal technique and it is recquired to use ultra-fast pump probe techniques [5].

We report here, the observation of the LIESST effect above T_{LIESST} in a photo-stationnary state (see Fig. 1). We used Micro Raman spectroscopy with 633nm wavelength. Thanks to the microscope objectives, the focal spot of the laser is very small on the crystal ($< 4\ \mu m$) and is allowing a very high laser fluence. In this compound the photo switching is very efficient at 633nm and the fluence is sufficient to balance the relaxation rate of the meta-stable High spin state. This competition between LIESST and relaxation rate can be described by a very simple kinetic model that will be discussed during the presentation. The results show that micro-Raman spectroscopy, sensitive to the spin state, allows for observing LIESST well above T_{LIESST} and monitoring fast relaxation through laser fluence modulation.

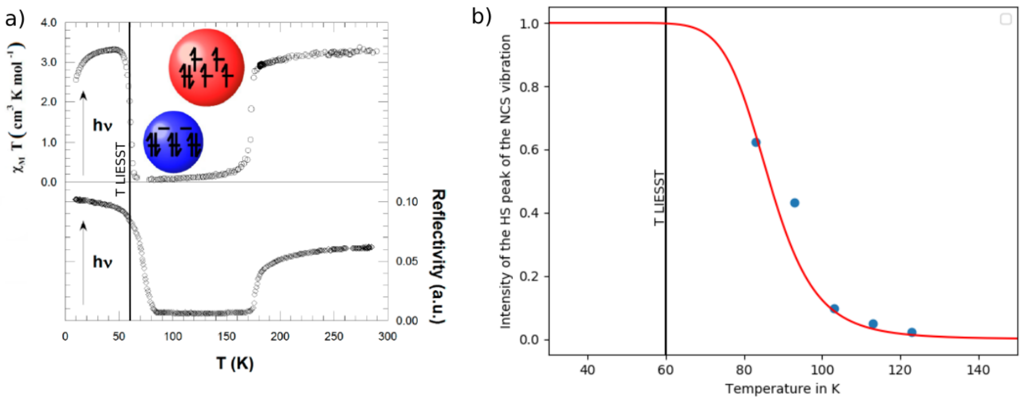

Figure 1: a) LIESST Effect in the $Fe(phen)_2(NCS)_2$ measured with SQUID (upper figure) and optical reflectivity (down figure). The solid line represents T_{LIESST}. Figure taken from [6]. b) Dots are representing the experimental intensity of a Raman High Spin mode in function of the temperature. The solid line represents the model that we derived to explain the phenomena, this line is not a fit but just the raw model taking into account the experimental conditions.

References

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