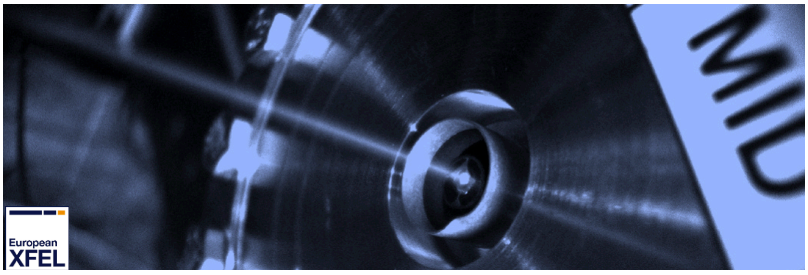

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Multi-scale approach of ultrafast photoinduced phase transitions in multi-functional materials exhibiting coupled electronic bistability and symmetry-breaking

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Modern ultrafast technologies have opened new perspectives in controlling bistable magnetic materials, where light can be used to switch between different phases and thus different properties [1]. Ultrafast photo-switching within bistability regimes indeed promises enhanced control of bistability down to ultrashort timescales.

Among the available bistable materials, Prussian Blue Analogues (PBAs) are cyano-bridged bimetallic compounds with a phase transition based on a charge transfer between two stable states of different spin [2]. Moreover, the electronic charge transfer is coupled to symmetry breaking and large volume change, leading to a wide bistability hysteresis [3].

Monitoring how electronic states and symmetry reorganize and couple to give rise to functions is a real challenge. We will illustrate this by showing how to follow the multiscale dynamics of the photoinduced phase transition within the thermal hysteresis of RbMnFe PBA micro-crystals [4,5]. This was made possible by developing a new streaming crystallography method for time-resolved X-ray diffraction studies of non-reversible phenomena [5].

These results open a broad field of dynamical studies for photo-switching in bistable materials through ultrafast crystallography and X-ray spectroscopies, with scientific opportunities to extend such studies towards very Hard XFEL Radiation.

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