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The understanding of the magnetization dynamics of complex magnetic systems is the prerequisite for their controlled engineering, opening the door for the development of novel high-speed devices. A macroscopic understanding of the dynamic magnetization is commonly obtained through ferromagnetic resonance (FMR) measurements. Supported by micromagnetic simulations and theoretical modelling, some insight into their microscopic behavior is gained. X-ray detected ferromagnetic resonance (XFMR), on the other hand, provides a direct element-specific and time-resolved probe of the magnetization dynamics of technologically relevant layered spin valve and TMR structures [1,2]. Examples of XFMR measurements on such trilayer structures will be discussed.

To study the dynamics of topological magnetic systems, such as skyrmions, XFMR is unfortunately not suitable since the net magnetization probed by the x-ray beam vanishes. Magnetic skyrmions have shown a variety of novel features due to their unique topological nature, including new microwave excitation modes [3] such as clockwise and counterclockwise rotating, and breathing modes. Due to the periodic nature of the skyrmion lattice, resonant x-ray diffraction is very sensitive to probing this phase in, e.g., Cu2OSeO3 [4]. By combining resonant magnetic x-ray diffraction with FMR, diffractive FMR (DFMR) can give access to the real-space spin dynamics of a system. DFMR is a modal spectroscopy technique, potentially opening new pathways for the development of spintronic devices [5]. The technique will be introduced and discussed in the context of a cycloidal spin system.

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