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X-rays and Magnetism – A Perfect Match

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Abstract Body: Today's fundamental and applied magnetism research is particularly focused on magnetic materials that are suitable as magnetic sensors, spin valves, spin transistors or magnetic media consisting of complex magnetic multilayer structures. Scientific investigations in this area are concerned with the origin of magnetic coupling, spin transport across interfaces, magnetic properties of magnetic oxides and the complex magnetic structures which evolve when different kind of magnets for example antiferromagnets (AF) and ferromagnets (FM) are brought into contact. Dichroism x-ray absorption spectroscopy (XAS) using synchrotron radiation represents a unique tool to understand complex nanomagnetic samples. The power of XAS is that it provides a possibility to address individual magnetic properties of different elements in a sample and a way to distinguish between different magnetic order like AF and FM order at the same time. It can furthermore be used to study the magnetism of buried interfaces, diluted magnetic systems like FM semiconductors or other exotic new magnets. The pulsed nature of the synchrotron as x-ray source allows for studying the time dependent behavior of a sample with a temporal resolution of a few tens of picoseconds. Dichroism soft x-ray absorption spectroscopy can furthermore be used to obtain spatially resolved information with less than 50nm lateral resolution in a modern full field or scanning x-ray microscopes.

In this contribution we will present recent examples of experiments that highlight the ability of x-rays to shine light questions at the forefront of magnetism research, like the magnetization reversal of small GMR nanoelements, the elusive ferromagnetism of carbon, and magnetic order at AF/FM interfaces.

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