Spin Spirals in Mn/W(110) as Seen via X-Ray Absorption Spectroscopy: Complementarity with STM

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Abstract. The non-collinear magnetic state of epitaxial Mn monolayers on tungsten (110) crystal surfaces is investigated by means of soft X-ray absorption spectroscopy, to complement earlier spin-polarized scanning tunneling microscopy (STM) experiments. X-ray absorption spectra (XAS), X-ray linear dichroism (XLD) and field-induced X-ray magnetic circular dichroism (XMCD) spectra were measured in the temperature range from 8 to 300 K and compared to results of fully-relativistic ab initio calculations. We show that antiferromagnetic (AFM) helical and cycloidal spirals give rise to significantly different Mn L23-edge XLD signals, enabling thus to distinguish between them. It follows from our results that the magnetic ground state of a Mn monolayer on W(110) is an AFM cycloidal spin spiral. Based on temperature-dependent XAS, XLD and field-induced XMCD spectra we deduce that magnetic properties of the Mn monolayer on W(110) vary with temperature, but this variation lacks a clear indication of a phase transition in the investigated temperature range up to 300 K. The observed trends may result from the fact that, in contrast to the STM, X-ray absorption provides an instantaneous view on the magnetic properties averaged over a set of Mn islands with a variety of sizes and shapes.