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Magnetic x-ray spectroscopy of two-dimensional CrI₃ layers

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Abstract

The recently confirmed monolayer ferromagnet CrI₃ is a frisky example of a two-dimensional ferromagnetic material with great application potential in van der Waals heterostructures. Here we present a soft x-ray absorption spectroscopy study of the magnetic bulk properties of CrI₃, giving insight into the magnetic coupling scenario which is relevant for understanding its thickness-dependent magnetic properties. The experimental Cr $L_{2,3}$ x-ray magnetic circular dichroism spectra show a good agreement with calculated spectra for a hybridized ground state. In this high-spin Cr ground state the Cr-I bonds show a strongly covalent character. This is responsible for the strong superexchange interaction and increased spin-orbit coupling, resulting in the large magnetic anisotropy of the two-dimensionally layered CrI₃ crystal.

Keywords: Magnetic materials, Spectroscopy, X-ray techniques

1. Introduction

CrI₃ belongs to the family of van der Waals materials [1] that is characterized by stacked two-dimensional (2D) layers which are weakly bonded together

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