



Institut für Physik  
Institut für Chemie und Biotechnik



## INSTITUTSKOLLOQUIUM

Gemeinsames Kolloquium der Physik und Chemie

Am Dienstag, dem 31. Januar 2023, spricht um 17:15 Uhr im  
Faraday-Hörsaal,

**Frau Dr. Nadine Hauptmann**

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Nijmegen, The Netherlands*

zum Thema:

**„WHAT CAN ATOMIC FORCE MICROSCOPY CONTRIBUTE TO  
UNDERSTAND ATOMIC-SCALE MAGNETISM?“**

### Abstract:

Non-collinear magnetic structures, such as skyrmions and spin spirals, are hot candidates for nano-scale magnetic storage, and are stabilized by an interplay between competing exchange interactions. In order to understand and predict the formation of these structures, it is inevitable to quantify the different magnetic exchange interactions at the atomic scale. Spin-polarized scanning tunneling microscopy has achieved great success in investigating the magnetization of non-collinear magnetic structures at surfaces, but faces limitations in being able to directly detect the underlying exchange forces, as well delineate between structural and electronic contributions to the spin-polarized density of states. More than 10 years ago, a force-based method to directly probe the magnetic exchange interaction between a magnetic tip a magnetic surface structure has been presented (magnetic exchange force microscopy). However, this method has been scarcely applied to quantify magnetic exchange forces of non-collinear magnetic structures so far.

In my talk, I will discuss what the combination of spin-polarized scanning tunneling microscopy together with magnetic exchange force microscopy (for short called SPEX) can help to sense and quantify magnetic exchange interactions at the atomic scale. I will discuss how SPEX can contribute to independently measure the geometric, electronic and magnetic structure at the atomic scale and to quantify different magnetic exchange force regimes. I will show that SPEX can resolve the magnetic noncollinearity of the antiferromagnetic spin spiral in a monolayer Mn/W(110). Using distance-dependent spectroscopy together with first-principles calculations, the interplay between different magnetic exchange interactions, i.e. antiferromagnetic and Zener-type ferromagnetic exchange mechanism, can be quantified.

Wir laden Sie zu diesem Kolloquium herzlich ein!

Die Hochschullehrer der Institute für Physik und Chemie