Department for nanostructured materials | Institut Jožef Stefan, Ljubljana

Open PhD position:

STEM ptychography investigation of magnetic nanostructures

Electron ptychography is a technique to numerically, pixel by pixel, reconstruct the phase from a phase-contrast electron-microscopy image, which exploits the interference phenomena in diffraction patterns during scanning transmission electron microscopy (STEM). This has been possible by a recent development of probe-corrected electron beam combined with a direct electron detector, which has significantly extended the capabilities of STEM mode of operation.

Besides atomic-scale image reconstruction, STEM in the differential-phase-contrast (DPC) mode is a technique for probing magnetization profiles in materials at the nano-scale level. Essentially, it is based on a measurement of the electron-beam deflection due to the Lorentz force (Lorentz STEM) resulting from the internal electromagnetic fields within the investigated material. However, an exact interpretation, required to obtain quantitive results from the measured data is complex, and it includes a description of the phenomena within the frame of quantum mechanics (Aharonov-Bohm effect) as well as the application of the ptychography- a computational method for generating images from interference patterns.

The objective of the Ph.D. training is to develop a whole procedure for the analysis of spin textures in magnetic materials. The research will involve experimental work on a microscope, quantum-mechanical calculations of the measurable observables, and numerical image processing. The motivation is to make a gradual process from a qualitative to a quantitative analysis of magnetic domains in ferromagnetic materials to a detection of more exotic states, like magnetic skyrmions, which are all important for future technologies.

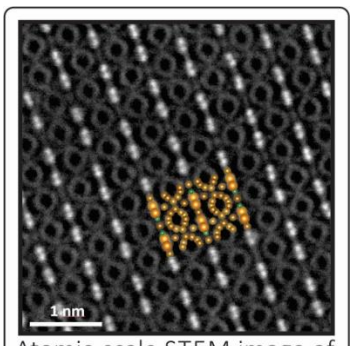
The work will take place at the Department for Nanostructured Materials, at the Jožef Stefan Institute, Ljubljana, Slovenia and under the supervision of prof. dr. Sašo Šturm. A four-year PhD position is a fully-funded by the Slovenian Research Agency, starting in October 2021.

Minimum requirements for application:
- MSc in either physics, mathematics, material science, geology, chemistry, or chemical engineering.
- Grade point average above 8
(exams and lab classes excluding the undergraduate thesis).
- Age up to 28 years and fluent in spoken and written English.

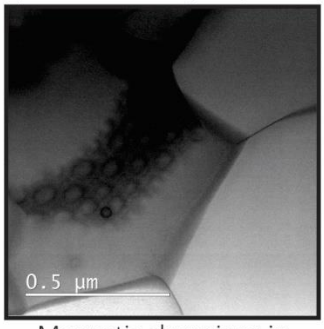
Criteria for assessment of candidates:
- grade point average in all courses,
- awards or prizes received,
- participation in research work,
- scientific articles published,
- assessment of an interview with the candidate.

Web page: https://nano.ijs.si/

Interested candidates must submit the required documentation as described in the links below by 2nd of July 2021:
- Call for Tenders applicable to young researcher candidates with selected mentors in 2021 (English)
- Javni razpis za kandidate za mlade raziskovalce pri izbranih mentorjih v letu 2021 (SLO)



Atomic-scale STEM image of permanent magnet phase



Magnetic skyrmions in permanent magnet grains?

Ljubljana, 10th of June 2021