Thermal stability of epitaxial Fe/GaAs thin films for spintronic applications

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Pure Iron (Fe) is a material that have remarkable properties: large magnetization, large spin-polarization and small magnetic losses [1]. Recent advances in material science have made it possible to obtain it the form of epitaxial thin films [2] which makes it attractive for applications in the fields of spintronic and magnonics.

At the Dioscuri Centre for spin caloritronics and magnonics, we want to use high quality epitaxial Fe/GaAs films we grow in-house to probe exotic magnetic phenomena: quench switching [3] and spin wave Doppler shift [4]. Before doing that, we first need to know how stable they are under drastic changes of temperature as those used in nano fabrication and experimental conditions we perform. We will expose the films and their nanostructures to large gradients of temperature, and we will determine the resulting changes in their magnetic properties. To characterize these changes, we will measure magnetic hysteresis and magnetization dynamics by SQUID magnetometry and ferromagnetic resonance, respectively.

A successful project can lead into a bachelor's or master's thesis in spintronics/magnonics revolving around the patterning of nanostructures and the study of quench switching or spin wave Doppler shift.

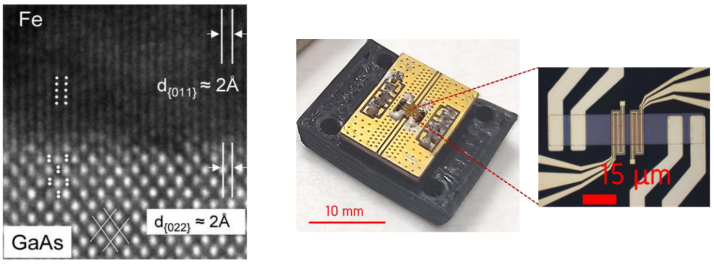

Figure 1: (Left) Epitaxial Fe/GaAs interface [2] (Right) Sample holder and spin waveDoppler shift nanofabricateddevice

Main tasks

- Designingand performingtemperaturegradient experiments in films and nanostructures.
- Hands-on characterization experiments:magnetometryand ferromagneticresonance.
- Collecting andanalyzing experimental data.
- Preparing areport on the results.

Requirements

- Basic manual skills for sample preparation

- Basic knowledge of magnetism(Bachelor level)
- Working knowledge of English

What we offer

- Flexible working hours by agreement
- Student assistant position (DPP contract)
- Opportunity to work in an international research team
- Hands-on experience withstate-of-the-art magnetic characterization
- Possibility to extend the project into a bachelor's or master's thesisfor motivated student

References

[1] Solano et al.Phys. Rev. Materials 6, 124409, (2022)

[2] Herfort, et al. International Journal of Materials Research, vol. 97, no. 7, 2006, pp. 1026-1036.

[3] Olejnik et al.Phys. Rev. B 112, 144401, (2025)

[4] Solano et al.arXiv:2412.20531