Magnetic Excitations in Functional Oxide Thin Films:

Beyond Single Magnons

Laboratory : IMPMC - INSP
Address : Sorbonne Université, 4 place Jussieu, 75005 Paris
Offer : Fully funded PhD position

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Context:

Magnons are the fundamental units of magnetic oscillations within magnetic materials and represent a change of 1 unit of spin angular momentum[1]. When a magnon propagates through a magnetic medium, no electrical charge transport is involved and hence no electrical losses take place. This is the keyadvantage of using magnons as information carriers in devices. Prior research has centered around magnons with energies in the GHz range. However, another class of magnons with substantially higher energies, in the THz regime, has only begun to be explored[2]. The magnon frequency has an important impact on the performance of magnon-based devices because the larger the excitation frequency, the "faster" the magnons can be. This means that the use of high frequency magnons would provide a great opportunity for the design of ultrafast devices. Nevertheless, a fundamental understanding of the attainable magnon frequencies, their interaction with other degrees of freedom (such as lattice and orbit) and their dynamics is so far missing.

We have recently discovered a novel cascade of high energy-magnons, the multi-magnons[3], propagating 2, 3, 4 and 5x the energy and the spin angular momentum of conventional single-magnons[4]. Our goal is to investigate the microscopic interactions dictating the properties of these high energy multi-magnons within thin films of magnetic perovskites using X-ray spectroscopy.

[1] Bloch, F. (1930). *Z. Physik* 61, 206. [DOI: BF01339661], [2] Zakeri, K. (2018). *Phys. C : Supercond. Appl.* 549, 164. [DOI : 10.1016], [3] Elnaggar, H. et al. (2023). *Nat. Commun*. 14, 2749. [DOI : 10.1038], [4] Samuelsen, E et al. (1970). *Phys. Stat. Sol.* 42, 241. [DOI : XXXX].

Job Description:

This full-time funded position offers students an excellent opportunity to delve into the field of magnonics and gain deep fundamental knowledge of magnetic processes. The project combines 65% experimental and 35% theoretical work including performing part of the experiments at large scale facilities in the UK, USA, Japan and Taiwan. The tentative starting date is **01.10.2024**. Applications are accepted until **22.04.2024**.

Your Profile:

You should have a recent Master's degree (or be close to its completion) in Physics, Material Science, or related disciplines from an internationally recognized university. We are looking for candidates who are self-driven highly motivated, creative, and excited to work in interdisciplinary teams. Although we welcome candidates with diverse backgrounds, having prior experience in: (1) Synchrotron facilities and/or (2) Growth techniques such as pulsed laser deposition and/or (3) Ligand field multiplet theory calculations are a big plus.

Curious? So are we.

We look forward to receiving your online application. Please send the following information in a single merged PDF document, titled with your last name and initials as well as the application date (for example: 20231201_SmithJT_application) in the following order:

1. Cover letter with a description of your research achievements and research interests
2. Detailed CV
3. Transcripts of all degrees (English)
4. Names and contact information of at least 2 references
5. Optionally, representative published research work (Papers, thesis if possible).

Please apply by sending an e-mail to both addresses specified with the subject: IMAT_Applicant_Surname.

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