Towards free-standing garnet membranes for next-generation of RF and optical devices

Scientific Context

Garnet oxides are a versatile class of functional materials exhibiting a wide range of physical properties, including magnetic, optical, magneto-optical, and spin-related functionalities. Their combination of excellent functional properties and high crystalline quality makes them promising materials for applications in spintronics, magnonics, photonics, and hybrid devices.

The properties of epitaxial garnet thin films are strongly influenced by their crystalline structure, strain state, thickness, and interaction with the underlying substrate. However, the use of a substrate imposes constraints on the integration of these materials with other platforms (such as optical isolators, and optomagnonics devices) and limits the possibility of independently controlling the mechanical and strain state of the active layer. **Free-standing membranes offer an attractive alternative**, as they could enable the transfer of high-quality crystalline garnet layers onto arbitrary substrates and provide new opportunities for strain engineering, heterostructure and device integration.

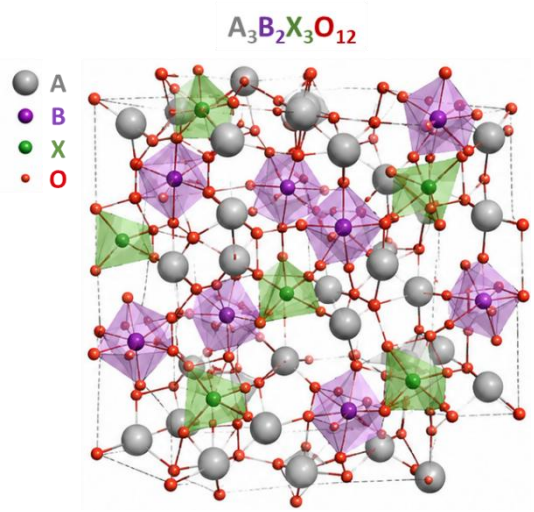


Figure 1. Schematic representation of the garnet crystal structure projected along the (111) direction.

The aim of this internship is to explore the feasibility of fabricating **free-standing garnet membranes** from epitaxial thin films. The project will investigate whether high-quality garnet layers can be released from their growth substrates while preserving their structural and functional properties (optics and spin-dynamics), paving the way towards their integration into new material platforms and device architectures.

Work program & skills acquired during internship

The student will grow and optimize garnet thin films and sacrificial layers of selected compositions using **Pulsed Laser Deposition (PLD)** technique on suitable substrates. The candidate will also perform comprehensive structural and magnetic characterization of the thin films through **X-Ray reflectivity (XRR), X-Ray diffraction (XRD), Reciprocal Space Map technique (RSM), Atomic Force Microscopy (AFM), Ferromagnetic Resonance (FMR) and magneto-optical Kerr effect** measurements. Different release strategies and transfer procedures will then be explored. Following release, the structural integrity and physical properties of the free-standing garnet membranes will be evaluated and compared with those of the as-grown films. Experience with thin-film **growth techniques** and **structural and magnetic characterization techniques** will be considered an asset, along with strong **experimental skills, data analysis capabilities, and the ability** to work effectively in an interdisciplinary environment bridging **academic research and industrial innovation**.

Work environment

You will be working under the supervision of: **Lucía Iglesias (CNRS), Luigi Matera (Thales) and Romain Lebrun (Thales)**.

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Requested background: **Master 2**
Duration: **6 months**
Start period: **Feb 2027**
Possibility of the PhD thesis: **YES**