A journey across excitations in functional quantum materials using resonant inelastic x-ray scattering

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The past years have witnessed an increasing interest in the field of quantum materials (QM), not only thanks to their fascinating behaviour as a macroscopic manifestation of quantum mechanics, but also for the opportunities that these materials offer in terms of 'emergence' of functional properties (high-temperature superconductivity, quantum Hall effect, giant magnetoelectric effect, etc...). Understanding the physics behind quantum materials is thus a primary goal of condensed matter physics, both from a fundamental as well from an applied perspective, with the ultimate scope of gaining control of QMs towards the next generation of electronics.

In this talk, I will focus on soft Resonant Inelastic X-ray Scattering (RIXS) studies of spin excitations in QMs that are promising for low-power, energy efficient applications. In this regard, I will present an overview of recent results focusing on: *i)* the evolution of the spin dynamics as a function of thickness in magnetic thin films [1]; *ii)* the site-resolved electronic and magnetic structure of the skyrmion material Cu_2OSeO_3 [2].

References

[1] J. Pelliciari et al.; "Tuning spin excitations in magnetic films by confinement"; Nature Materials, 20, 188 (2021).
[2] Y. Gu et al.; "Site-resolved electronic and magnetic structure of the skyrmion material Cu_2OSeO_3", Commun. Physics 5, 156 (2022).