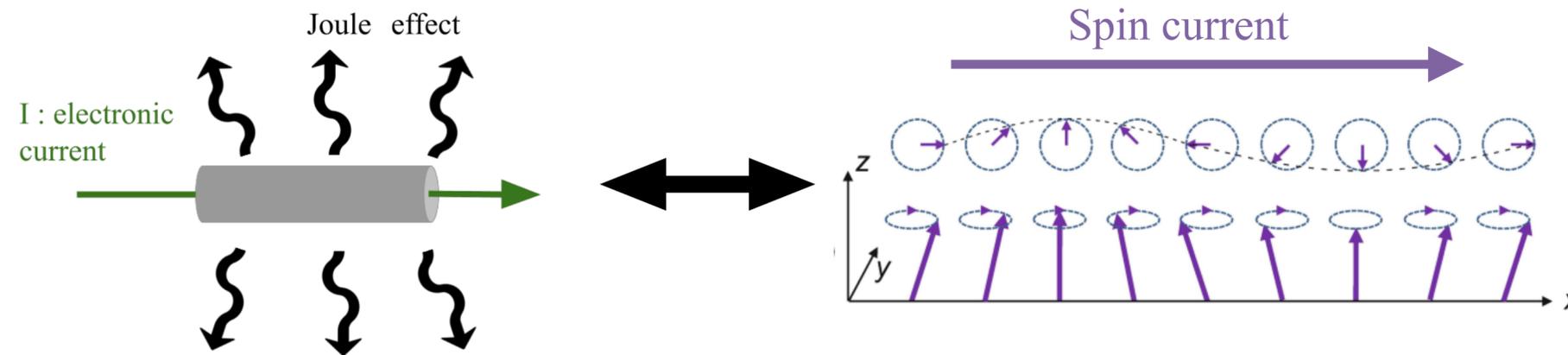


Multi-magnon excitations in LaFeO_3 : a polarisation analysis using RIXS

Nora LAHMITI, 2nd year PhD student - Research Team : **MIMABADI** at IMPMC & **NQMag** at INSP
 PhD Supervisors : Heba Elnaggar (IMPMC), Marcel Hennes (INSP), Amélie Juhin (IMPMC)

Information processing with electronic currents leads to **Joule losses.**



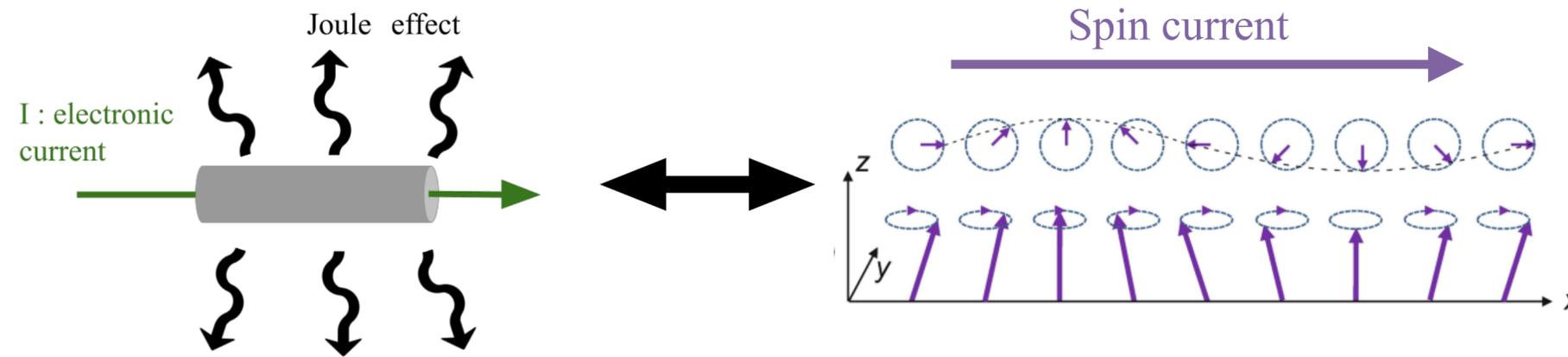
Magnons: Quanta of spin excitations in a magnetic material

—> *Magnon/Spin Wave to process information and avoid Joule effect*

Multi-magnon excitations in LaFeO_3 : a polarisation analysis using RIXS

Nora LAHMITI, 2nd year PhD student - Research Team : MIMABADI at IMPMC & NQMag at INSP
 PhD Supervisors : Heba Elnaggar (IMPMC), Marcel Hennes (INSP), Amélie Juhin (IMPMC)

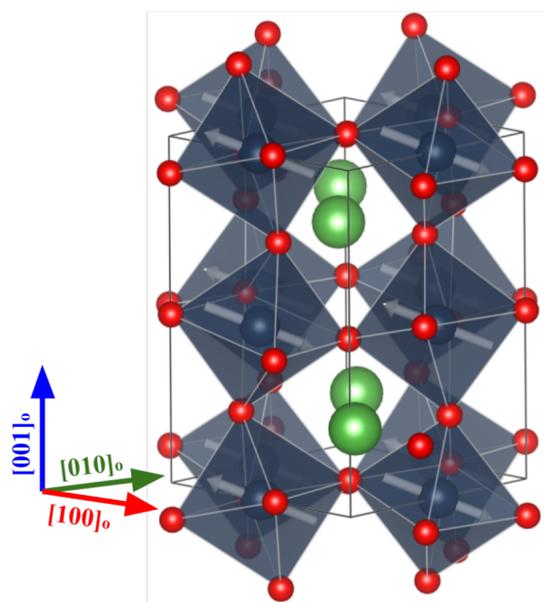
Information processing with electronic currents leads to **Joule losses**.



Magnons: Quanta of spin excitations in a magnetic material

—> *Magnon/Spin Wave to process information and avoid Joule effect*

LaFeO_3 : Material to probe magnons



Antiferromagnetic system

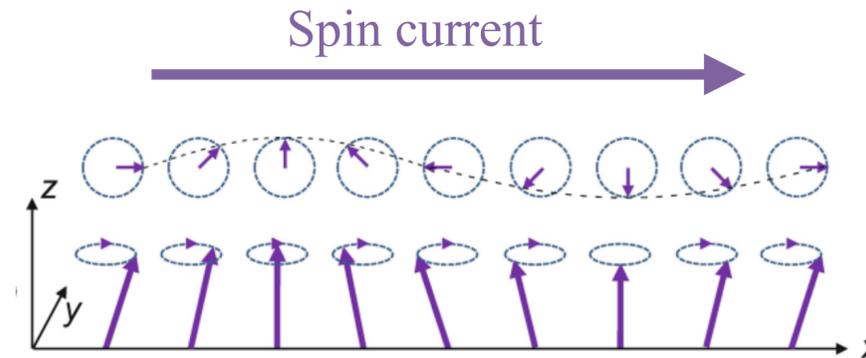
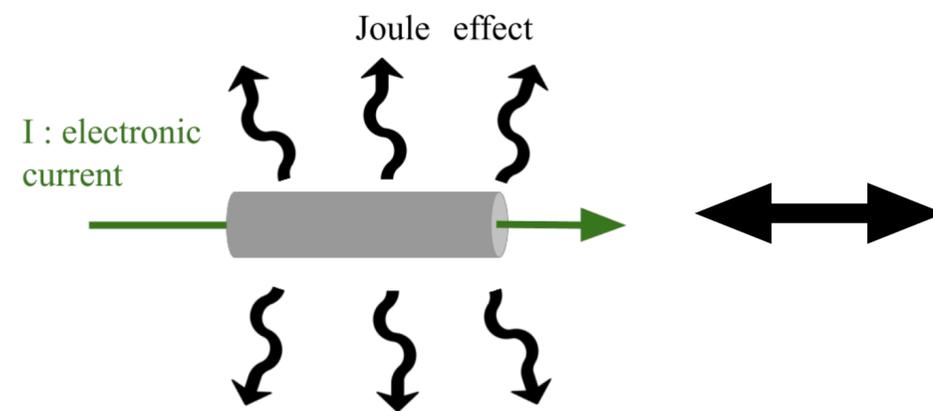
- $T_{\text{Neel}} \sim 740 \text{ K}$
- Thickness: 30 nm

- : Spin Orientation [3]
- : Iron (Fe)
- : Lanthanum (La)
- : Oxygen (O)

Multi-magnon excitations in LaFeO₃: a polarisation analysis using RIXS

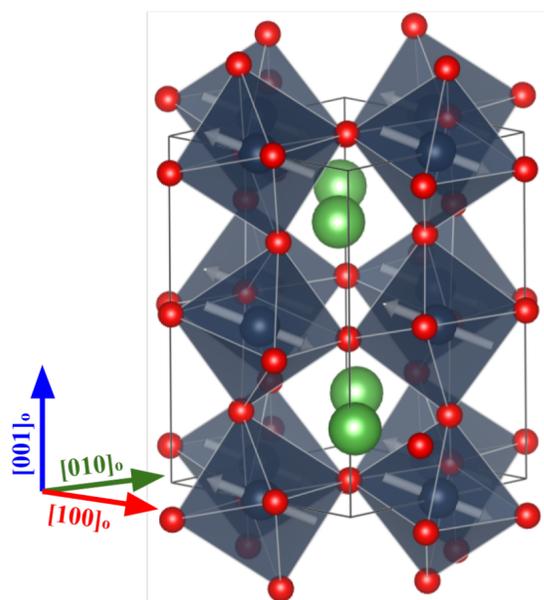
Nora LAHMITI, 2nd year PhD student - Research Team : MIMABADI at IMPMC & NQMag at INSP
 PhD Supervisors : Heba Elnaggar (IMPMC), Marcel Hennes (INSP), Amélie Juhin (IMPMC)

Information processing with electronic currents leads to **Joule losses**.



Magnons: Quanta of spin excitations in a magnetic material
 → *Magnon/Spin Wave to process information and avoid Joule effect*

LaFeO₃: Material to probe magnons

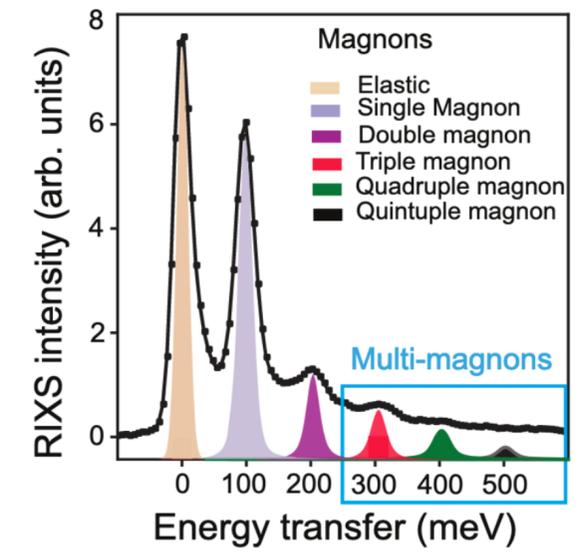
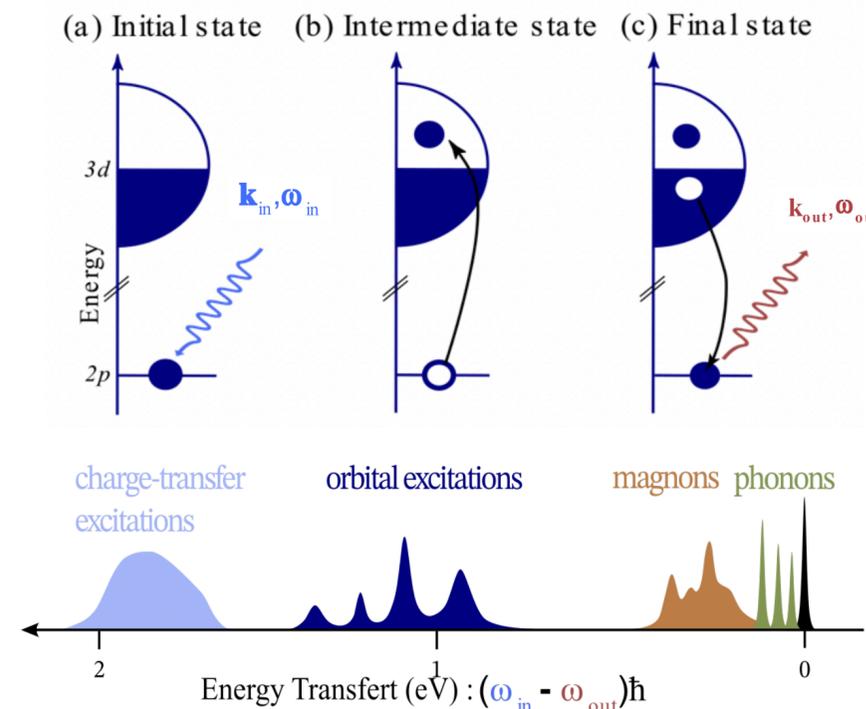


Antiferromagnetic system

- $T_{\text{Neel}} \sim 740 \text{ K}$
- Thickness: 30 nm

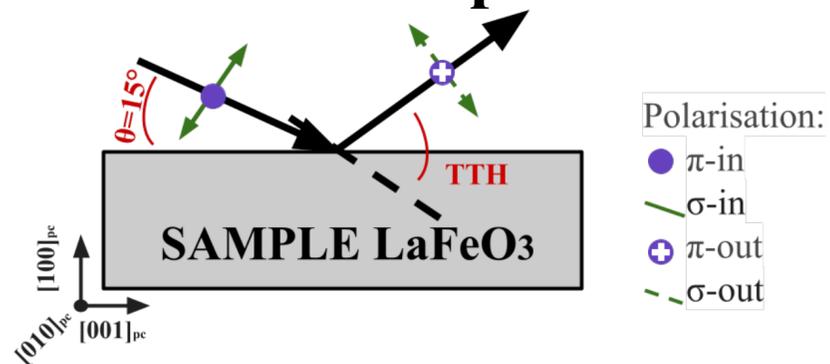
: Spin Orientation [3]
 : Iron (Fe)
 : Lanthanum (La)
 : Oxygen (O)

Resonant Inelastic X-ray Scattering (RIXS) Technique to probe magnons



RIXS Spectra of $\alpha\text{-Fe}_2\text{O}_3$ measured at L_3 Fe edge
 Showing multi-magnon excitations.
 Elnaggar et al. 2023

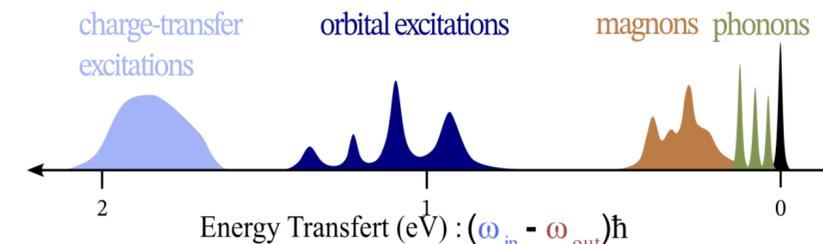
Polarised RIXS experiment to test selection rules :



Conventional wisdom on polarisation dependence:

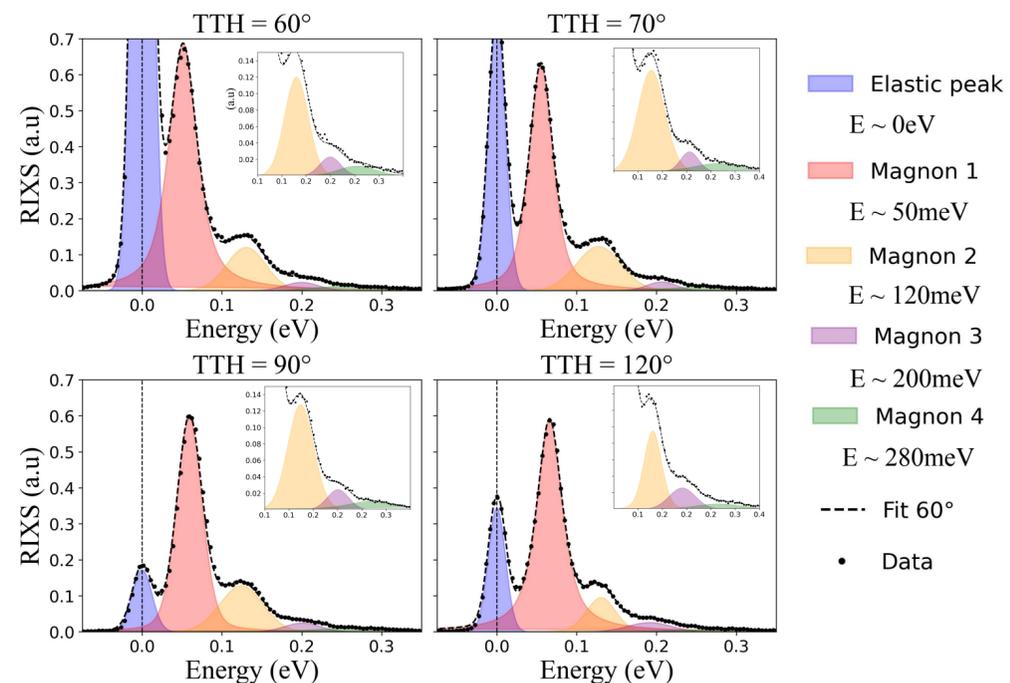
$\pi-\pi / \sigma-\sigma$ select seeing charge excitations e.g. *phonons*

$\sigma-\pi$ or $\pi-\sigma$ select *magnon* excitations

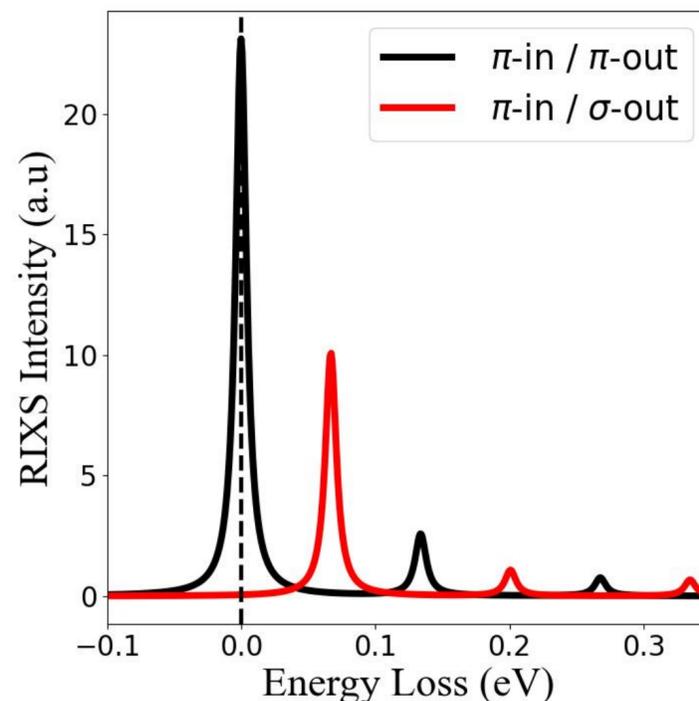


P-RIXS in antiferromagnetic LaFeO3 :

Unpolarized RIXS spectra of LaFeO3 @Fe L3 edge:
multiple excitations up to 4th order



P-RIXS spectra of LaFeO3 @Fe L3 edge
Theoretical



Experimental

