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## Understanding the magnon dynamics in LuFeO<sub>3</sub> for magnonics applications

Magnonics is a multidisciplinary field of research focusing on the study and application of magnons in information processing and technology [1]. Magnons can carry the spin information through thermally generated spin-wave spin currents over the large distances [2]. Insulating antiferromagnets (AFMs) are promising for next-generation high-density and high-speed spintronic applications due to their negligible stray field and ultrafast spin dynamics [3]. Especially, non-collinear AFMs with high magnon velocities corresponding to terahertz frequencies are greatly appreciated [1, 4]. In view of the technological prospects LuFeO<sub>3</sub> has attracted the attention [4]. We report here the magnon dynamics based on the inelastic neutron scattering studies performed on the single crystal of LuFeO<sub>3</sub>. The measured magnon dispersions along the (011) matches well with the simulated results obtained using the Holstein-Primakoff theory for the present antiferromagnets. Our analysis including the simulated and experimental results revealed that magnon propagates into such material with supersonic velocities of more than 20 kms<sup>-1</sup>. This source of short wavelength magnon carriers opens the new prospects for terahertz antiferromagnetic magnonics and logic devices at terahertz frequencies.

[1] J. R. Hortensius, et al., Nat. Phys. 17, 1001 (2021).

[2] K. Uchida, et al., Nat. Mater. 2856, 10.1038 (2010)

[3] W. Lin, et al., Nat. Phys. 18, 800 (2022)

[4] J. Xu, et al., Phys. Rev. Lett 129, 117202 (2022)

**Primary author:** BHOSALE, Dnyaneshwar Raghunath (Jülich Centre for Neutron Science JCNS at MLZ, Forschungszentrum Jülich, Lichtenbergstr. 1, 85747 Garching, Germany)

**Co-authors:** Mrs SCHNEIDEWIND, Astrid (Jülich Centre for Neutron Science JCNS at MLZ, Forschungszentrum Jülich, Lichtenbergstr. 1, 85747 Garching, Germany); MEVAN, Martin (Jülich Centre for Neutron Science JCNS at MLZ, Forschungszentrum Jülich, Lichtenbergstr. 1, 85747 Garching, Germany); Mr STEKIEL, Michal (Jülich Centre for Neutron Science JCNS at MLZ, Forschungszentrum Jülich, Lichtenbergstr. 1, 85747 Garching, Germany); Mr FABRYKIEWICZ, Piotr (RWTH University, Aachen, Germany)

**Presenter:** BHOSALE, Dnyaneshwar Raghunath (Jülich Centre for Neutron Science JCNS at MLZ, Forschungszentrum Jülich, Lichtenbergstr. 1, 85747 Garching, Germany)

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