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Monday, March 13, 11:00 am. UC 302

Femtosecond coherent magnonic manipulation of antiferromagnetism



The wildly growing field of antiferromagnetic spintronics is currently addressing several fundamental questions. A major topic of investigation concerns the generation and manipulation of coherent magnons on the ultrafast timescale. The development of novel pulsed-laser sources has enabled scientists to address the following scientific question: which magnetic excited state can be induced by resonantly drive coherent magnons throughout the Brillouin zone? In my talk I will outline our approach to this open issue, which relies on the resonant drive of pairs of high-energy magnons in the weak ferromagnet α -Fe₂O₃, with wavevector near the edges of the Brillouin zone. This unprecedented concept results in strongly perturbing the entire magnetic system of the material, in particular: i) magnon modes with different wavevectors are excited and amplified; ii) the eigenfrequencies of magnons are modified, which demonstrates a modification of the magnon dispersion; iii) coupling

between magnon modes that are orthogonal eigenstates of the magnetic Hamiltonian of the material is observed. All these groundbreaking observations are rationalised in view of a resonant impulsive stimulated Raman scattering mechanism. The perspective of our results in terms of femtosecond coherent magnonics will be discussed.

Short Bio

Davide Bossini got his PhD in Nijmegen (The Netherlands) from the group of Prof. Theo Rasing and Prof. Alexey Kimel in 2015. He moved to Tokyo to work as a postdoc in the group of Prof. Kuwata-Gonokami, supported by a fellowship of the Japanese Society for the Promotion of Science (JSPS). In 2017 he moved to Germany (TU Dortmund), where he took a position of senior postdoc. Shortly after, he was awarded the Emmy Noether grant from the German science foundation (DFG), allowing him to establish his independent junior group with the support of a host in a German academic institution. He moved to Konstanz where, hosted by Prof. Alfred Leitenstorfer he is developing his research group.

In 2017 he received a postdoc Award from the journal Applied Sciences. In 2019 he was awarded the early-career Award from the IEEE Magnetics Society.