Ubiquitous Graded Magnonic Index: Friend or Foe?

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Even the most general definitions of magnonics leave a lot of freedom for interpretation and scientific discussion of directions of the field's further development. Thus, we have recently seen a number of review papers with emphasis on different aspects of spin wave research and technology. There is however an aspect of magnonics that has been both ubiquitous and somewhat underrated so far: magnonics is the study not only of spin but also (and most importantly) of waves, which have an extremely rich and peculiar dispersion. The spin wave dispersion is very sensitive to the sample's magnetic properties and micromagnetic state, including both the internal magnetic field and magnetisation, so that spin waves are rarely observed to propagate in uniform media. Inspired by and feeding from other fields of wave physics, such as quantum mechanics and transformation optics, we have recently formulated the concept of graded-index magnonics[1] as a unifying theme focusing on general aspects of spin wave excitation and propagation in media with continuously non-uniform properties. In this talk, we will discuss and provide demonstrations (see e.g. the figure) of exciting new physics as well as technological issues and opportunities associated with the graded magnonic index, highlighting the theme as the "next big thing" in magnonics research.

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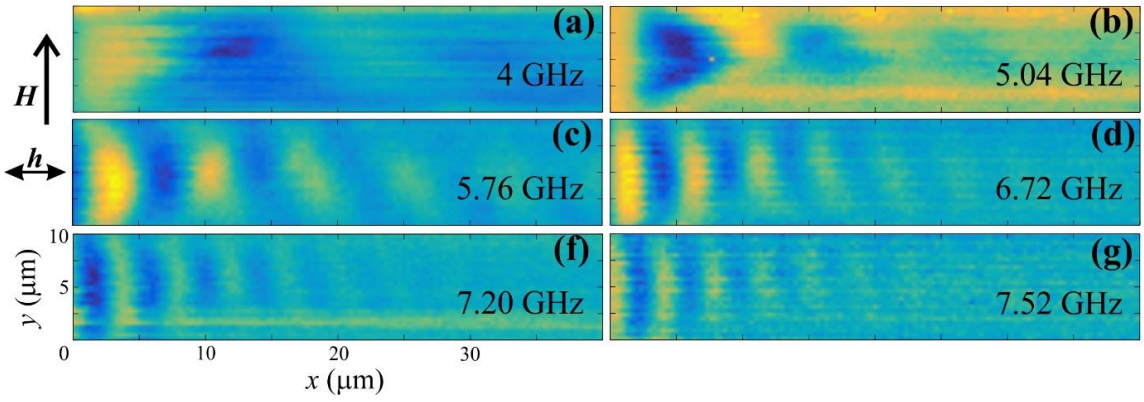

The spin wave excitation from graded magnonic index in patterned magnetic structure is demonstrated with help of time resolved Kerr images of a Permalloy stripe driven by microwave field ***h*** at indicated frequency values. The bias magnetic field ***H*** has value of 200 Oe.

[1] C. S. Davies and V. V. Kruglyak, *Graded-index magnonics*, Low Temp. Phys. **41**, 760 (2015).