Solitonic lattice and Yukawa forces in the rare-earth orthoferrite TbFeO$_3$ - DTU Orbit

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The random fluctuations of spins give rise to many interesting physical phenomena, such as the ‘order-from-disorder’ arising in frustrated magnets and unconventional Cooper pairing in magnetic superconductors. Here we show that the exchange of spin waves between extended topological defects, such as domain walls, can result in novel magnetic states. We report the discovery of an unusual incommensurate phase in the orthoferrite TbFeO$_3$ using neutron diffraction under an applied magnetic field. The magnetic modulation has a very long period of 340 Å at 3 K and exhibits an anomalously large number of higher-order harmonics. These domain walls are formed by Ising-like Tb spins. They interact by exchanging magnons propagating through the Fe magnetic sublattice. The resulting force between the domain walls has a rather long range that determines the period of the incommensurate state and is analogous to the pion-mediated Yukawa interaction between protons and neutrons in nuclei. © 2012 Macmillan Publishers Limited. All rights reserved.

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