

Renewed investigation of the double umbrella.

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The double umbrella structure of certain rare earth iron garnets has been a long-discussed feature of garnets for numerous reasons. Updated theoretical understanding of the temperature dependence of rare earth iron garnets has shown the potential for the double umbrella to remain at high temperatures, even at room temperature. [1] This prompted the search for experimental evidence of magnetic reflections observed with; resonant elastic x-ray scattering (REXS) (Tb L_{2,3} edges) and neutron diffraction (ND), on bulk single crystals and epitaxial thin films. Preliminary results prove promising with critical peaks of the (1 1 0) type, observed at high temperatures. Peculiarly, REXS has shown both a charge type (sigma-sigma) and spin type (sigma-pi) contribution to the double umbrella peaks. Similarly single crystal ND has indicated that the magnetic model from powder ND may be incomplete, across the temperature range. A discussion of REXS and ND experiments on terbium iron garnet and results along with the structural interest shall be made.

[1] Tomasello, B., Mannix, D., Geprägs, S., & Ziman, T. (2022). Origin and dynamics of umbrella states in rare-earth iron garnets. *Annals of Physics*, 447, 169117.