

Competing Interactions and Continuum Excitations in the Spin-1 Triangular Lattice Antiferromagnet NiGa₂S₄

J.-J. Wen^{a,b}, Y. Nambu^c, J. Rodriguez^b, C. Stock^b, S. Nakatsuji^c, S. Onoda^d, Y. Maeno^e, and C. Broholm^{a,b}

^aIQM and Department of Physics and Astronomy, the Johns Hopkins University, Baltimore, USA

^bNIST Center for Neutron Research, NIST, Gaithersburg, USA

^cISSP, University of Tokyo, Kashiwa, Japan

^dCondensed Mater Theory Laboratory, RIKEN, Wako, Japan

^eDepartment of Physics, Kyoto University, Kyoto, Japan

Quasi-2D NiGa₂S₄ is the only known S=1 antiferromagnet with an exact triangular lattice. Recent neutron scattering experiment on high quality NiGa₂S₄ single crystals revealed short range quasi-2D incommensurate spin correlation with a critical wavevector close to (1/6, 1/6, 0). Here we report a measurement of the dynamic spin correlation function through a volume of Q-E space for T≪J. A gapless spectrum was observed at the incommensurate critical wavevector while a softened but still gapped response was found at (1/3,1/3,0). This indicates dominant third neighbor interaction and competing weaker near neighbor interactions. The excitation spectrum takes the form of a bounded continuum throughout the 2D Brillouin zone, which is quite different from conventional resonant spin waves.

This work is supported by the DoE, BES, Division of Material Science and Engineering through DE-FG02-08ER46544.