Competing phases in a frustrated magnet: a study with neutron scattering.\textsuperscript{1} DAVID HSIEH, Princeton University, YINWAN LI, ZHIMING TAN, ROBERT CAVA, ZAHID HASAN, Princeton University, YIMING QIU, JAE-HO CHUNG, JEFFREY LYNN, NIST — Zero-field magnetic neutron diffraction on the pyrochlore magnet ZnCr$_2$S$_4$ reveals successive phase transitions from a paramagnet into a helical ($T_{N1} = 13$ K) then collinear ($T_{N2} = 8$ K) spin ordered state as the system is cooled. This occurs as the system crosses a critical line in $J_1$-$J_2$ space, where $J_1$ and $J_2$ are the first and second nearest neighbor exchange constants respectively. We report the magnetic field dependence of the dc susceptibility and neutron scattering of ZnCr$_2$S$_4$ in the form of a temperature-field phase diagram. We also study the low energy excitation spectrum of ZnCr$_2$S$_4$ which was found to be consistent with the $J_1$-$J_2$ model.

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David Hsieh  
Princeton University

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