High energy magnetic excitations in Cr

HYUNGJE WOO, BNL/ISIS Facility/ U. of Tennessee, E. CLEMENTYEV, P. BÖNI, Physik Dept. E21, Garching, Germany, M. FUJITA, IMR, Tohoku Univ. Japan, T.G. PERRING, ISIS Facility, RAL UK, S.M. HAYDEN, Univ. Bristol, UK, G. SHIRANE, BNL — Pure Cr has a simple bcc structure but the magnetism is known to be rather complicated, and so far its properties are not yet understood well [1]. Below $T_N = 311 K$ it is antiferromagnetic (AF) with an incommensurate (IC) spin density wave showing long-range order. We have used inelastic neutron scattering to map the dynamics of the spin density wave in a single-Q (i.e. untwined) single crystal of Chromium.

We observe fluctuations of the magnetism wavevectors corresponding to the commensurate (1, 0, 0), the allowed IC positions ($1 \pm \delta$, 0, 0) and the silent IC positions (0, 1$\pm\delta$, 0) at energies up to 83 meV. Interestingly, as the energy of the fluctuations increases, spectral weight moves from the IC peaks to smaller $\delta$, becoming commensurate at around 64 meV. This behaviour, namely IC AF fluctuations that move to the commensurate position, is also a common feature observed in high-TC superconductors such YBa$_2$Cu$_3$O$_{6.6}$ [2], La$_{15/8}$Ba$_{1/8}$CuO$_4$ [3], and La$_{1.84}$Sr$_{0.16}$CuO$_4$ [4]. An understanding of the magnetism in the itinerant AF Chromium may well help unravel that in the high-TC superconductors. [1] E. Fawcett, Rev. Mod. Phys. 60, 209 (1988). [2] Hayden et. al. Nature 429, 531 (’04). [3] Tranquada et. al. Nature 429, 534 (’04). [4] Christensen et. al. Phys. Rev. Lett. 93, 147002 (2004).