CrSb$_2$ is a S=1 Quasi-one-Dimensional Antiferromagnet

MATTHEW STONE, MARK LUMSDEN, STEPHEN NAGLER, BRIAN SALES, DAVID MANDRUS, DAVID SINGH, Oak Ridge National Laboratory — First principle calculations have predicted the existence of a quasi-one-dimensional antiferromagnet in the intermetallic compound CrSb$_2$ (S=1). This is unexpected given that most low-dimensional magnets rely on anisotropies in crystal structure or bonding to produce the anisotropic exchange constants which ultimately lead to their low-dimensionality. We present inelastic neutron scattering measurements of single-crystal samples of CrSb$_2$ which verify the existence of quasi-one-dimensional magnetism in this compound. Triple-axis and time-of-flight spectrometer measurements indicate a single spin-wave branch in all the three reciprocal space directions. The bandwidth of this excitation is only 25 meV along the H and K directions, but approximately 50 meV along the L reciprocal space direction. This corresponds to quasi-one-dimensional excitations propagating along the crystalline c-axis. These measurements provide the first conclusive evidence of a quasi-one-dimensional intermetallic antiferromagnet.