Magnetic excitations of the quantum dimer antiferromagnet $Sr_3Cr_2O_8$

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$Sr_3Cr_2O_8$ displays a rich and complex variety physical phonemona. Firstly it is a dimerised quantum magnet with gapped excitations which displays Bose-Einstein condensation in an applied magnetic field. Secondly it has highly unusual lattice and orbital fluctuations over an extended temperature regime below its Jahn-Teller distortion. $Sr_3Cr_2O_8$ consists of triangular bilayers of magnetic Cr^{5+} ions that are stacked in a ABCABC sequence. The dominant antiferromagnetic bilayer coupling pairs them in dimers, and the interdimer couplings are geometrically frustrated. The Cr^{5+} ions have one electron in the 3d shell and a spin value of $\frac{1}{2}$. At 285K $Sr_3Cr_2O_8$ undergoes a cooperative Jahn-Teller distortion which lifts the frustration. We will describe single crystal growth, DC susceptibility, high field magnetization and powder and single crystal inelastic neutron scattering of $Sr_3Cr_2O_8$. The data reveals a singlet ground state and gapped dispersive triplet excitations. The magnetic exchange interactions were extracted using the first moment sum rule and a random phase approximation. Our results will be discussed in the context of the current experimental data for $Sr_3Cr_2O_8$ as well as being compared with the related compounds $Ba_3Cr_2O_8$ and $Ba_3Mn_2O_8$.