Raman signatures of spin-liquid-like state and spin-phonon coupling in $Sr_2CuTe_{0.5}W_{0.5}O_6$

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Disorder or randomness in exchange pathways can produce uncompensated interactions in spin-lattice to induce a spin-liquid state. Sr_2CuTeO_6 and Sr_2CuWO_6 are square-lattice antiferromagnetic double perovskites ($A_2BB'O_6$) with dominant nearest-neighbor (Néel-type) and next-nearest neighbor (Columnar-type) magnetic interactions, respectively [1]. Random distribution of both these interactions in a system has been proposed to the key to spin-liquids [1].Here, we synthesize a possible spin-liquid candidate $Sr_2CuTe_{0.5}W_{0.5}O_6$ with B′-site mixing to explore the phonon properties and their correlation to the liquid-like interactions. Our measurements evidence a broad continuum in the Raman spectra instead of well-defined spin-wave excitations noted for the parent systems. Further, phonon anomalies are marked below the short-range magnetic ordering temperature. Observation of continuum feature in conjunction with the lack of long-range magnetic order strengthens the possibility of liquid-like correlations, as predicted in earlier studies. On the other hand, phonon anomalies indicate the existence of spin-phonon coupling.

References:

[1] O. Mustonen, S. Vasala, E. Sadrollahi, et al. Nature Communications **9**, 1085 (2018)