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Neutron Scattering Studies of the S=1/2 Triangular Lattice Magnets $NaNiO_2$ and $LiNiO_2$

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$NaNiO_2$ and $LiNiO_2$ are isostructural quantum magnets based on a stacked triangular lattice in which magnetism arises from S=1/2 magnetic moments carried by Ni^{3+} ions. Surprisingly, while these compounds are structurally and electronically very similar, the magnetic properties they exhibit are dramatically different. $NaNiO_2$ undergoes a cooperative Jahn-Teller phase transition at 480K and magnetically orders below $T_N \sim 23K$, adopting a structure which consists of ferromagnetic sheets of S=1/2 moments stacked in an antiferromagnetic fashion. In contrast, $LiNiO_2$ undergoes a spin glass transition at $T_g \sim 9K$ and remains disordered down to the lowest measured temperatures. Understanding the absence of long-range magnetic order in $LiNiO_2$ is a problem which has attracted considerable interest for more than twenty five years. Among many potential explanations, the answer has most notably been attributed to geometric frustration caused by inherent mixing of the Li and Ni sublattices, or orbital degeneracy resulting from the lack of a coherent Jahn-Teller distortion. In this talk I will describe time-of-flight neutron scattering measurements performed on polycrystalline samples of $NaNiO_2$ and $LiNiO_2$ using the wide Angular-Range Chopper Spectrometer (ARCS) at ORNL and the Disk Chopper Spectrometer (DCS) at NIST. These measurements provide a thorough characterization of the excitation spectra for these two compounds, probing the inelastic scattering over energy scales ranging from $\sim$ 0.1 meV to 1.5 eV. In $NaNiO_2$, our measurements reveal two sets of well-defined spin excitations, which we associate with ferromagnetic spin waves mediated by in-plane interactions and antiferromagnetic spin waves mediated by out-of-plane interactions. In $LiNiO_2$, we observe similar, albeit much broader, excitations consistent with short-range two-dimensional magnetic correlations. In the case of $NaNiO_2$, we have developed a simple linear spin wave theory model to describe these excitations and extract the relevant magnetic exchange couplings for this system.