Abstract:

This thesis focuses on the synthesis and characterization of a new $AA'B_2F_7$-type pyrochlore fluoride family, $NaCdB_2F_7$ (B = Mn, Fe, Co, Ni, Cu, Zn) predicted by a calculated pyrochlore structural tolerance factor, as well as the synthesis of new kagome fluorides $Na_3CdCo_3AlF_{14}$, $Rb_2SnCo_3F_{12}$ and $Cs_2ZrCo_3F_{12}$, aiming to expand the knowledge about the frustrated pyrochlore and kagome antiferromagnets. The synthesis techniques included solid-state reactions, laser floating zone melting and melt crystallization. All pyrochlore fluorides were successfully synthesized, although only B = Zn, Co, Mn and Ni as phase-pure single crystals. PXRD refinements confirmed the $Fd\bar{3}m$ structure in all synthesized pyrochlores, while SCXRD showed full Na/Cd disorder on the A-site and no A/B intersite mixing in the Co pyrochlore. Magnetization measurements revealed dominant antiferromagnetic interactions evidenced by large negative Curie-Weiss temperatures (from -38 K in Mn to -108 K in Co), with a spin-freezing transition below 4 K in B = Co, Mn and Ni, evidenced by further AC susceptibility and heat capacity measurements in Co and Mn. Cu showed no spin freezing down to the lowest-measured temperature, 1.8 K, implying a very large magnetic frustration. Fe has not been measured due to the large impurity content. The attempted synthesis of the aforementioned kagome fluorides was unsuccessful, therefore no further measurements could be performed.