

## Investigating the nature of the magnetoelectric coupling in molecular $(\text{ND}_4)_2[\text{FeCl}_5(\text{D}_2\text{O})]$ via neutron scattering studies

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$(\text{NH}_4)_2[\text{FeCl}_5(\text{H}_2\text{O})]$  is a rare molecular magnet exhibiting coupled magnetic and ferroelectric properties as a function of temperature and applied magnetic field [1-4]. Unlike its counterpart compounds where  $\text{NH}_4$  group is replaced by K, Cs, and Rb,  $(\text{NH}_4)_2[\text{FeCl}_5(\text{H}_2\text{O})]$  is the only system in this family that exhibits magnetically induced ferroelectricity at low temperature, suggesting that  $\text{NH}_4$  plays a critical role in the unusual properties of  $(\text{NH}_4)_2[\text{FeCl}_5(\text{H}_2\text{O})]$ . Neutron scattering is a powerful tool to study the magnetism of a materials. In this talk, I will present results of neutron scattering studies on deuterated  $(\text{NHD}_4)_2[\text{FeCl}_5(\text{D}_2\text{O})]$  single crystals that provide insights on the nature of the coupled phenomena. Both elastic and inelastic neutron scattering experiments were performed at the High Flux Isotope Reactor (HFIR) and the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory to determine the magnetic structures and investigate the dynamics in this material. Our inelastic neutron scattering results also reveal the role the ion played in the intriguing properties observed in  $(\text{NH}_4)_2[\text{FeCl}_5(\text{H}_2\text{O})]$ .

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