

Jeremy Wolcott – HEP Seminar – December 6, 2022
Tufts

Title: "Chasing precision neutrino oscillation measurements with the NOvA & DUNE experiments"

Abstract:

Where should we look for guidance on how to reconcile the Standard Model's storied history and remarkable predictive successes with hints that it is not a complete fundamental theory? Among the many possible answers, the phenomenon of neutrino oscillations stands out: already "Beyond the Standard Model" simply by virtue of demanding that at least some neutrinos are massive, the rich phenomenology associated with oscillations also admits access to deep questions about the lepton family's structure. Are there fundamental symmetries in the way the generations relate to one another through mixing, or in how the masses are distributed? Can we at last find CP violation in the lepton sector, perhaps paving the way for a complete understanding of our universe's present matter-antimatter asymmetry?

In this talk I will discuss how the road to addressing these questions is paved with precision measurements of neutrino oscillations, and how the long-baseline neutrino oscillation program at Fermilab---consisting of the current NOvA and future DUNE experiments---is working to make them. I will discuss how we search for the disappearance of muon neutrinos and appearance of electron neutrinos from a muon neutrino beam and the current state of our measurements in NOvA. I will briefly consider the outsized role that essential model ingredients like those used for neutrino interactions with the detector play in this search. I will also report on progress towards the next-generation measurements intended for DUNE, including how we are preparing for

the challenge of reconstructing complex event topologies in a high-pileup environment with an end-to-end machine learning-based approach.