

Project Summary: Neutrinos as a Portal to the Twin Sector

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June 29, 2017

In this application to become a Fermilab Intensity Frontier Fellow, I propose to investigate the neutrino phenomenology of the Mirror Twin Higgs model, which is a well-motivated extension of the standard model (SM) that predicts the existence of three light sterile neutrinos. This model is gaining attention in light of the Higgs discovery and the apparent lack of other new physics at the LHC. However, the sterile neutrinos in this model can have important phenomenological implications that have yet to be fully explored. They contribute to the energy density of the universe at early times, and may be able to resolve some long-standing cosmological puzzles. They can mix with the SM neutrinos, leading to oscillations between active and sterile states. Furthermore, because both the SM and sterile neutrino masses are likely to be generated at low scales, this scenario may offer the possibility of testing the mechanism of neutrino mass generation at the LHC, and at Fermilab's LBNF. The combination of the strong model building and neutrino phenomenology expertise of the FNAL theory group, the connection to the LHC through the LPC, and the world leading neutrino program, including the Neutrino Physics Center (ν PC), would be tremendously valuable to push this research program forward.

The fellowship will facilitate a two-semester sabbatical at Fermilab. My sabbatical at Fermilab would consist of the Fall 2017 and the Fall 2018 semester as well as parts of the summer periods preceding each of these (with spring of 2018 back at UMD). My total residency at Fermilab would consist of about 9.5 months. In this proposal I am applying for six months of funding for half of my salary. The remainder of my salary will be covered by the University of Maryland, my NSF research grant, and a URA Visiting Scholars Award which I have secured. My time at Fermilab will allow me to collaborate with members of the Fermilab Theoretical Physics Department which would act as host. It will also allow for regular interactions with members of the experimental neutrino community, such as members of LBNF, DUNE, NO ν A, MicroBooNE and SBNF, as well as CMS experimentalists, and cosmologists. Fermilab is unique in that it has a significant number of members from all of the above experiments permanently present, as well as a world class collection of theorists, making it the ideal setting to explore these directions.