

## Research Summary

Jason Bono

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The Mu2e experiment at Fermilab provides an excellent opportunity to probe for New Physics on mass scales inaccessible to colliders by searching for the Charged Lepton Flavor Violating (CLFV) conversion of a muon into an electron in the vicinity of a nucleus,  $\mu N \rightarrow e N$ , with unprecedented sensitivity. Such a search is well motivated, as a numerous and diverse collection of leading New Physics models predict CLFV rates to be within the experimental discovery sensitivity. Furthermore, the discovery of neutrino oscillations necessarily implies that Charged Lepton Flavor is not an exact symmetry, and yet, owing to the tiny Standard Model rates, the observation of a violating process would provide the first *unambiguous* evidence of New Physics. Ultimately, Mu2e will serve as one of the most sensitive probes to physics Beyond the Standard Model in the coming decade, with deep and broad access to uncharted regions of the parameter-space that potentially harbor these new phenomena. Thus regardless of a discovery, the Mu2e measurement will rule out a large number of currently favored physical models.

As an Intensity Frontier Fellow, I will work on some of the most pressing issues relating to Mu2e's primary detector, the Straw Tube Tracker. During the fellowship I will help ensure that the first fully operational tracking prototype is produced, thereby demonstrating that a reliable design has been achieved for large scale production. Additionally, I will implement a number of tracker related physical models into the tracking reconstruction and simulation algorithms which will be important for achieving Mu2e's ultimate sensitivity goal. While the proposed projects were chosen based on urgency, they are natural extensions of my previous work on prototyping and the physics modeling of the detector. The experience I gain will pay dividends for the experiment after the duration of the fellowship, at which point I will establish a tracker production program at Rice University. The identified hardware and software projects are important for ensuring that Mu2e reaches its sensitivity goal and that data collection begins according to schedule. Since Mu2e is in direct competition with COMET and indirect competition with other experiments, timeline and sensitivity are both critical for the success of Mu2e.