I have explored precision measurements of the standard model (SM) properties and obtained results for new processes in a hadron collider. While the SM successfully describes elementary particles and interactions, and its prediction of the Higgs boson is tentatively confirmed, recent experiments or observations have shown a few phenomena beyond the SM, such as dark matter, dark energy, and evidence of neutrino masses. Among these topics, the discovery of neutrino masses is the first instance which is in conflict with the SM, and I am particularly interested in expanding my exploration into the neutrino sector.

The fruitful results from neutrino experiments in the past two decades have led to the establishment of a simple three-flavor paradigm, however, there are still a number of pressing questions left. For example, measuring the CP-invariance violation from neutrino oscillation (and mixing) and nature (Majorana or Dirac) from neutrinoless double-beta decay will complement the measurements in the hadron sector, and may even provide another source of the CP-invariance violation that yields the existing matter-antimatter asymmetry. On the other hand, based on the fact that neutrinos are much lighter than the other elementary fermions, determining the neutrino mass hierarchy and its absolute mass could point to evidence of a more complicated electroweak symmetry breaking or even a new mass scale. Moreover, new physics may appear in searches for additional neutrino states (sterile neutrinos) or non-standard interactions. To uncover these questions, precise measurements are required, and the current detector and analysis techniques will provide sensitive results.

The accelerator neutrino sources which provide mostly pure ν_μ or $\bar{\nu}_\mu$ beams and liquid argon time projection chamber (LAr TPC) with its efficient neutrino detection and high energy resolution, motivate my enthusiasm. I would like to pursue precision measurements together with searches for new phenomena in the MicroBooNE and the proposed LBNE experiments in the next few years. The short-baseline MicroBooNE aims to measure the neutrino cross sections and investigate the anomalies at low energy observed by MiniBooNE and LSND, and I think the result will be important to understand neutrino detection in the LBNE experiment, and to probe existence of sterile neutrinos. LBNE, on the other hand, is sensitive to a large parameter space of neutrino oscillations, mass hierarchy, CP-invariance violation in the lepton sector, and beyond, owing to its wide energy-band of neutrinos, long baseline, and large volume of LAr TPC detector. Furthermore, I am eager to get involved in detector commissioning, event reconstruction, and physics analyses, and the time scale of the MicroBooNE and LBNE is perfect for me. I believe that the size of these two experiments makes it possible to participate in most of the aspects of the experiments.

Through my Ph.D. dissertation, I have demonstrated that I am capable of independently delivering a challenging analysis, the measurement of the electroweak top-quark production cross section at DØ. Because the signal events contain low-energy jets and background events are about 500 times more than the signal in the selected phase space, this measurement requires a selection covering a broad phase space, a precise background modeling, and

the ability to extract tiny signal production rates from an overwhelming background. As the lead analyzer, I was responsible for the event selection, in which I achieved great signal acceptance, and for the correction and tuning of the background modeling. Moreover, I improved the sensitivity of the signal-background discrimination based on the Matrix Element method by performing dedicated Monte Carlo studies and refining the algorithm. Finally, I developed a new method to simultaneously measure two channels of the electroweak top-quark production cross section with high precision, yielding a SM-independent measurement. My overall work led to the first evidence of a rare process, the s-channel electroweak top-quark production with no assumption on the other electroweak top-quark production channel, the t-channel. I was thereby awarded the Lobkowicz thesis prize of the University of Rochester, and was invited to deliver the first presentation of this result at the Fermilab Joint Experimental-Theoretical Physics seminar (Wine and Cheese seminar).

In addition, I contributed to the calibration of the jet energy scale by determining the absolute calorimeter response, the largest component of the overall calibration. I participated in a dedicated study on the energy scale of photons, which are used as the tag objects for the tag-and-probe method in this analysis, and finally achieved a precision of 1-2% on the calorimeter response. In the meanwhile, as an on-call expert, I was responsible for the ethernet-based data acquisition system (Level 3 DAQ), ensuring the continuity and efficiency of data-taking, and testing the spare single-board computers.

As top-quark physics utilizes all DØ subdetectors and sophisticated reconstruction techniques for the final state (an electron or muon, a neutrino, two or three quarks including one or two b-quarks), I have gained extensive knowledge of the reconstruction algorithm, and the experiences on disentangling and correcting the problems on mismodeling in the simulation. Moreover, my study on the jet energy scale determination provided me with experience in calibration with precision at 1-2 percent level, and my contribution to the analyses has also proven my ability. I believe the MicroBooNE and LBNE will benefit from my expertise in high-precision calibration and in data analysis, and my experience on the Level 3 DAQ system will be helpful to the detector installation and data-taking.

In conclusion, I am excited by the opportunity to contribute to the exploration of the neutrino sector, which has just started to unveil its potential. I am confident that my previous experience in precision analyses at the hadron collider will serve me well as I tackle event reconstruction and data analyses in liquid argon detectors, and I am looking forward to contributing to the detector operations of the MicroBooNE and construction for the LBNE. I believe that my abilities and enthusiasm will match the challenge, and yield significant contributions to the SLAC group.