2020 RHIC/AGS Thesis Award Competition

Paolo Parotto

Advisor: Professor Claudia Ratti, University of Houston

Thesis entitled:

Characterization of the transition region of the QCD phase diagram

Paolo Parotto's thesis is comprised of two parts, both of which have already had a large impact on our field. The first area focuses on the low baryon density/chemical potential region of the QCD phase diagram by calculating partial pressures in different strange sectors and comparing them to the results of the Hadron Resonance Gas model containing different hadronic spectra, which validated the existence of some not-yet-identified resonances. This spawned a dedicated two-day workshop and a new experiment at Jefferson National Laboratory. The second part pertains to the study of the equation of state (EoS) of QCD, with the creation of a new code that couples the state- of-the-art Lattice QCD results on the the equation of state to a parameterized (movable) 3D Ising model that describes the critical point. This is crucial to the search for the QCD critical point because first principle calculations are not possible in the large baryon density regime.

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Irina Petrushina

Advisor: Professor Vladimir Litvinenko, Stony Brook University

Thesis entitled:

The Chilling Recount of an Unexpected Discovery: First Observations of the Plasma-Cascade Instability in the Coherent Electron Cooling Experiment

Irina Petrushina's thesis was a depth study of superconducting RF (SRF) systems and beam dynamics in the Coherent electron Cooling (CeC) experiment and was a direct benefit to the world record performance of the CeC SRF Photocathode gun. This work found an elegant solution to the major problem in the SRF gun generating 1.25 MeV CW electron beam using the CsK2Sb photocathode, using both simulation and experimental studies of the multipacting zones in the SRF gun. Additionally, it details the self-consistent simulation of beam dynamics in CeC accelerator, including the wake-fields of its transport system and the newly discovered Plasma-Cascade Instability. The results were absolutely critical for finding the operational modes of the CeC system necessary for demonstration of hadron cooling, which lead to the success of the project.