

Topical Collaboration: Milestones & Deliverables

Year I

Connecting nuclei to nucleon matter.	Pairing gap and neutron matter EoS up to nuclear density. (Carlson, Lattimer, Reddy + Postdoc)
Weak interactions in nuclei and neutrino reactions	Low energy neutrino-nucleus cross-sections in HFB for deformed nuclei. (Engel + student)
Neutrino flavor transformations	Results for 3x3 multi-angle neutrino flavor transformations (Carlson, Friedland, Fuller, Qian + student)
Nucleosynthesis	<p>*** Impact of single angle collective neutrino transformations on composition. ***</p> <p>1. Results for r-process abundances with single angle collective neutrino transformations. (Friedland, Fuller, McLaughlin, Qian + student)</p> <p>2. Helium zone neutrino induced r-process (Haxton, Fryer, Qian)</p>
Neutron Stars (NS) and Phase Transitions	Thermal conductivity and structure of the inner NS crust. Composition of accreting neutron star crust (Carlson, Cirigliano, Prakash, Reddy, Schaefer + PD)
Astrophysics Simulations	Predict neutrino emission from protoneutron stars in 1-d using modern initial conditions and existing microphysics. (Cirigliano, Friedland, Lattimer, Fryer, Reddy)

Year II

Connecting nuclei to nucleon matter.	Benchmarks for nuclear matter EoS at zero temperature using QMC. (Carlson, Reddy + Postdoc)
Weak interactions in nuclei and neutrino reactions	Generalizing the piece-wise moments method to generate shell-model neutrino response function (Haxton + Hayes)
Neutrino flavor transformations	Results for 3x3 multi-angle neutrino flavor transformations, exploration of diverse supernovae environments. (Carlson, Friedland, Fuller, Qian + student)
Nucleosynthesis	Revised beta decay reaction rates in r-process networks and sensitivity analysis. (Engel, Hayes, McLaughlin)
Neutron Stars (NS) and Phase Transitions	<ol style="list-style-type: none"> 1. Composition and conductivity of accreting NS crusts. (Carlson, Engel, Heger, Lattimer, Reddy, Prakash + Postdoc+ Student) 2. Surface & Crust of quark stars. (Alford, Prakash, Rajagopal, Reddy) 3. Model independent NS EOS from simultaneous mass-radius measurements (Lattimer, Prakash)
Astrophysics Simulations	X-ray burst (XRB) simulations, NS structure and library of ash compositions in 1-d. (Heger, Fryer, Lattimer, Prakash + Student)

Year III

Connecting nuclei to nucleon matter.	EoS table for supernova simulations using QMC $T=0$ benchmarks. (Carlson, Lattimer, Prakash, Reddy + PD)
Weak interactions in nuclei and neutrino reactions	Results for neutrino-nucleus and neutrino cross-sections in nuclear matter of relevance to supernova with improved energy functionals. (Carlson, Cirigliano, Engel, Prakash, Reddy + PD)
Neutrino flavor transformations	Results for collective neutrino transformations with multidimensional effects and small scale turbulence. (Carlson, Friedland, Fuller, Qian + student)
Nucleosynthesis	Results for progenitor structure for nucleosynthesis in O-Ne-Mg supernova. (Fuller, Haxton, Heger, Qian)
Neutron Stars (NS) and Phase Transitions	Hydrodynamic description and viscosity of superfluid quark matter and NS oscillations. (Alford, Reddy, Schaefer)
Astrophysics Simulations	Superburst simulations, thermal profiles in accreting neutron star and light-curves. (Heger, Page, Reddy + Student)

Year IV

Connecting nuclei to nucleon matter.	QMC results for finite temperature neutron matter. (Carlson, Reddy + Postdoc)
Weak interactions in nuclei and neutrino reactions	Code to calculate nuclear weak interaction rates at finite temperature for astrophysical applications. (Engel + student)
Neutrino flavor transformations	*** Towards a unified treatment of coherent and incoherent neutrino interactions. *** Simplified 1-d code to solve the quantum kinetic equations for neutrinos in protoneutron stars. (Cirigliano, Friedland, Fuller, Qian, Reddy + student)
Nucleosynthesis	Predict elemental abundances in SN and accretion disks using revised rates and neutrino fluxes. (Engel, Fuller, Friedland, Haxton, McLaughlin, Qian +Student)
Neutron Stars (NS) and Phase Transitions	Spectrum of shear modes in magnetized NS crusts. (Carlson, Lattimer, Reddy + postdoc) Vortex structure in multi-component fluids and relation to NS observables. (Alford, Reddy, Student)
Astrophysics Simulations	Results with Monte Carlo neutrino transport code with updated microphysics. (Cirigliano, Fryer, Reddy + Postdoc)

Year V

Connecting nuclei to nucleon matter.	Revised EoS table for supernova with finite temperature QMC benchmarks.(Carlson, Lattimer, Prakash, Reddy + Postdoc)
Weak interactions in nuclei and neutrino reactions	Weak interaction cross-sections for: (i) detectors, and (ii) supernova, protoneutron stars, and neutron stars. (Carlson, Cirigliano, Engel, Haxton, Prakash, Lattimer, Reddy + PD + Student).
Neutrino flavor transformations	Impact, observability and constraints on supernova conditions and neutrino properties from flavor transformations in supernova. (Carlson, Friedland, Fryer, Fuller, McLaughlin, Qian+ student)
Nucleosynthesis	Nucleosynthesis calculations using latest suite of supernova simulations and neutrino luminosities.(Extended Collaboration)
Neutron Stars (NS) and Phase Transitions	Mass-radius predictions for nucleonic and hybrid NS neutron stars with quark cores with updated EoS. (Alford, Carlson, Lattimer, Prakash, Reddy)
Astrophysics Simulations	<ol style="list-style-type: none"> 1. Suite of predictions for supernova neutrino signals. 2. Burst light-curves and transients and relation to NS properties. (Fryer, Heger, Lattimer, Page, Prakash, Reddy + Student)