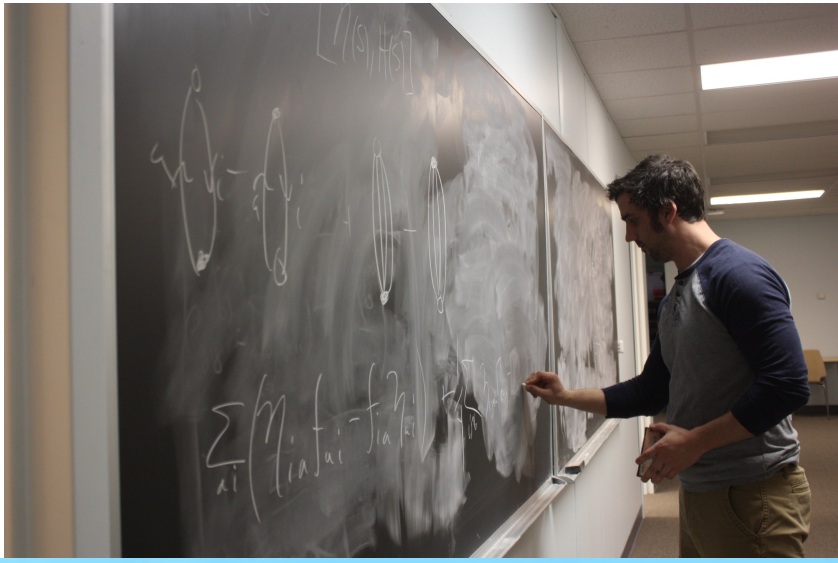
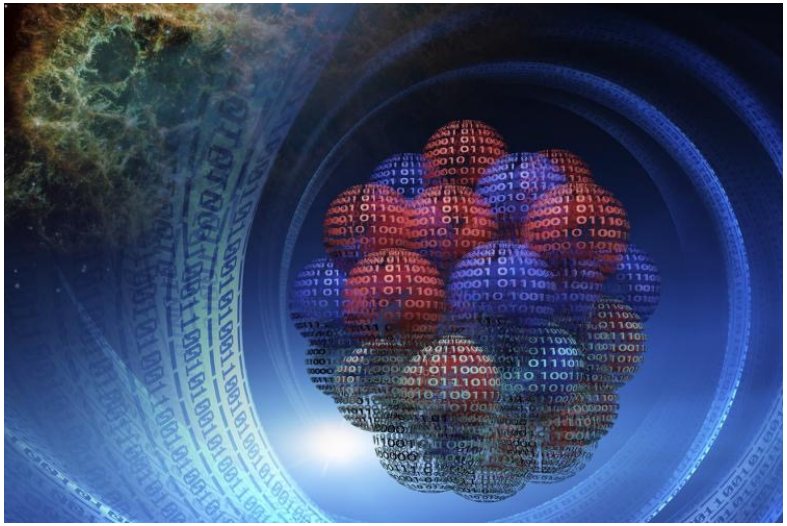
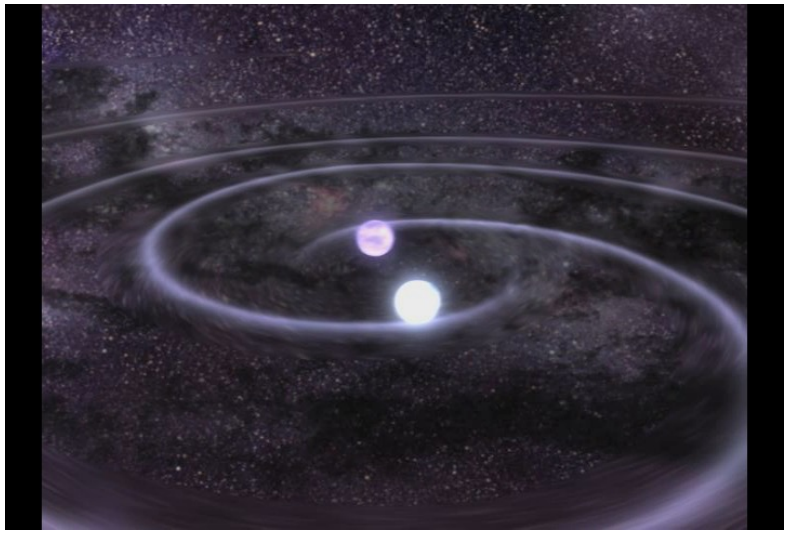
Nuclear Theory Group

FRIB

MICHIGAN STATE UNIVERSITY



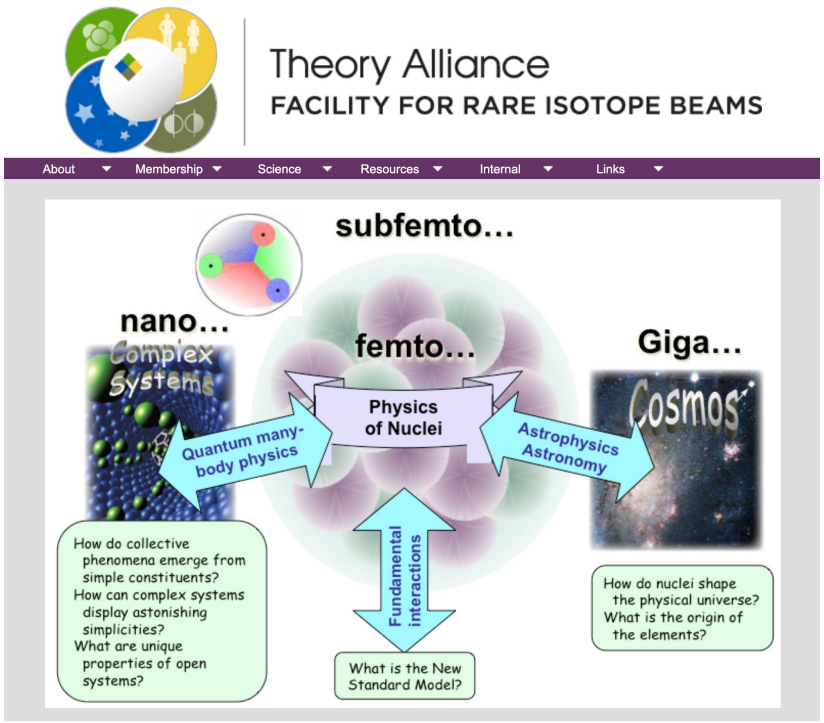


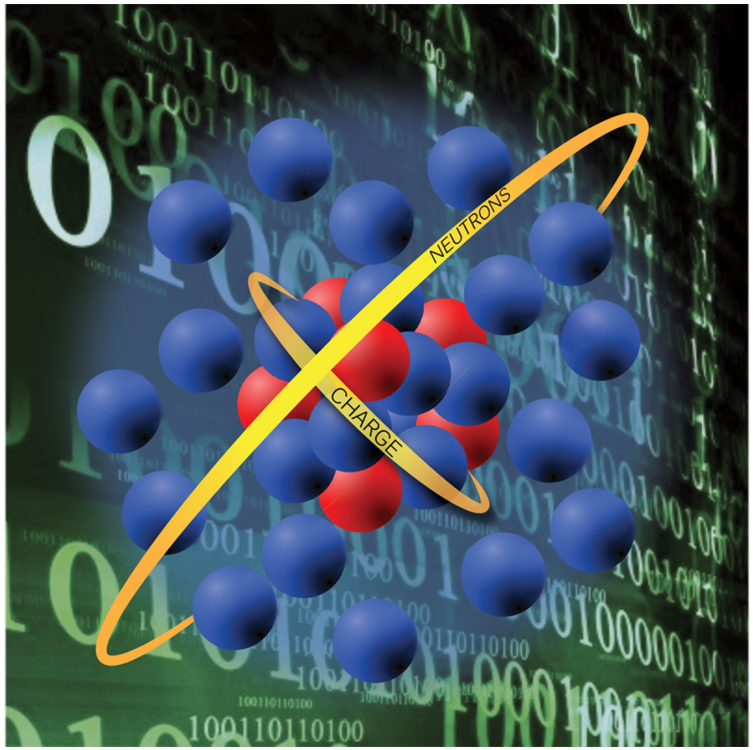


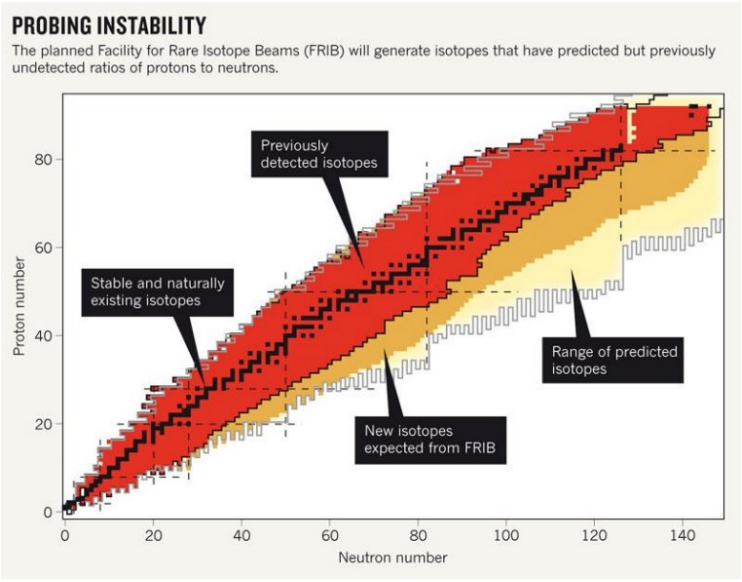
Theoretical nuclear science seeks to understand and predict the structure, dynamics, and origins of visible matter in the universe.

- **How are quarks and gluons confined within protons and neutrons?**
- **How do protons and neutrons bind to form nuclei and what are the limits of stability?**
- **How can we accurately predict complex nuclear reactions?**
- **Why does emergent collective behavior appear in quantum many body systems?**
- **How and where were the chemical elements formed in the universe?**
- **What are the phases of nuclear matter under extreme conditions?**

Our nuclear theory group works at frontiers of many different research areas. In addition to collaborating with our experimental colleagues at FRIB, our research program includes topics such as quantum chromodynamics, fundamental symmetries, physics beyond the Standard Model, nuclear forces, chiral symmetry, structure and reactions of atomic nuclei, the creation of elements, heavy ion collisions, matter under extreme conditions, neutron stars, and emergent phenomena such as superfluidity and collective behavior.







We are also investigating new technologies and algorithms in high performance computing, machine learning, uncertainty quantification, quantum computing, and their impact on the most challenging problems of nuclear science. Many of our former students and postdoctoral researchers have gone on to become prominent scientists at universities and laboratories in nuclear science as well as leaders in many other fields of science, technology, finance, education, and industry.

Scott Bogner

Professor of Physics, Managing Director of FRIB Theory Alliance

Many-Body Theory, Renormalization Group Methods, Computational Physics, Equation of State

Alex Brown

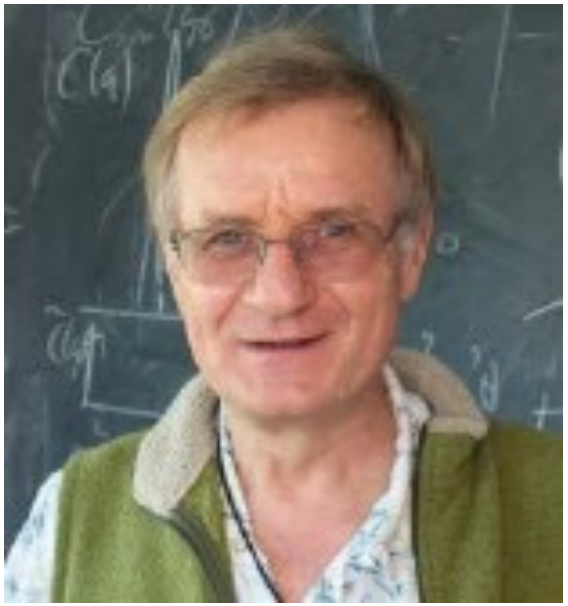
Professor of Physics

Configuration Interaction Theory, Energy Density Functional Theory, Applications to Nuclear Structure and Astrophysics, Applications to Fundamental Interactions.

Pawel Danielewicz

Professor of Physics

Reaction Theory, Heavy-Ion Collisions,
Many-Body Theory, Transport Theory,
Equation of State



Kyle Godbey

Research Assistant Professor of Physics

Nuclear Dynamics, Fusion, Fission, Nuclear Astrophysics, Emulators, High Performance Computing

Chloë Hebborn

Assistant Professor of Physics

Reaction Theory, Breakup Reactions, Capture Reactions, Knockout Reactions, Halo Nuclei, Optical Potentials

Heiko Hergert

Associate Professor of Physics

Nuclear Structure, Many-Body Theory, Computational Physics, Machine Learning, Fundamental Symmetries

Dean Lee

Professor of Physics, Theory Department Head

Nuclear Structure, Nuclear Reactions, Nuclear Lattice Effective Field Theory, Many-Body Theory, Superfluidity, Quantum Computing, Machine Learning

Witek Nazarewicz

University Distinguished Professor of Physics, FRIB Chief Scientist

Nuclear Structure, FRIB Science, Quantum Many-Body Problem, Physics of Open Quantum Systems, Machine Learning, High-Performance Computing

Filomena Nunes

Professor of Physics,
Director of Reaction Theory Initiative

Reaction Theory, Breakup Reactions, Transfer Reactions, Few-Body Methods, Uncertainty Quantification, High-Performance Computing, Indirect Methods in Astrophysics

Scott Pratt

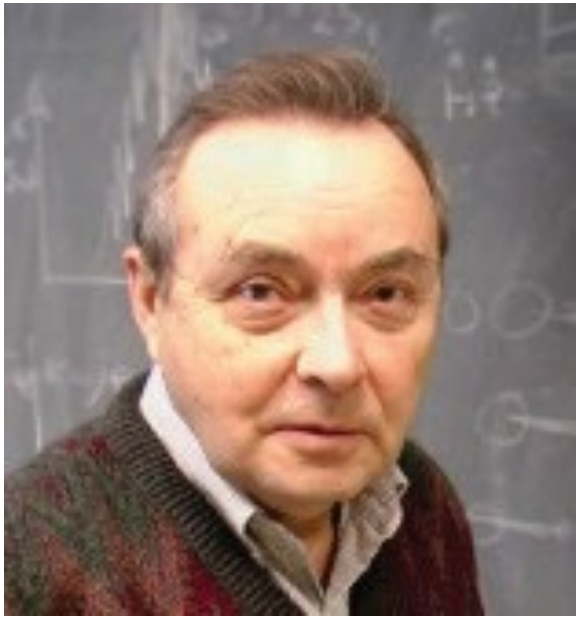
Professor of Physics

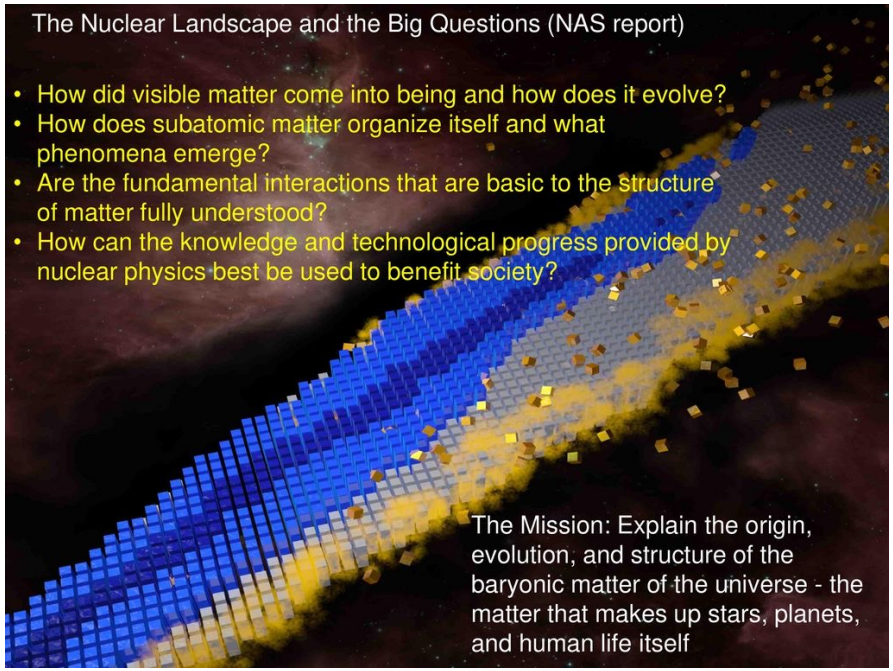
Relativistic Heavy Ion Collisions, Quantum Chromodynamics, Two-Particle Correlations, Phenomenology, Uncertainty Quantification

Vladimir Zelevinsky

Professor of Physics

Many-body Quantum Theory, Applications to Nuclei, Quantum Chaos, Weak Interactions, Fundamental Symmetries





Students listen to a lecture during the FRIB Theory Alliance Summer School on Machine Learning

Thanks for visiting!

leed@frib.msu.edu