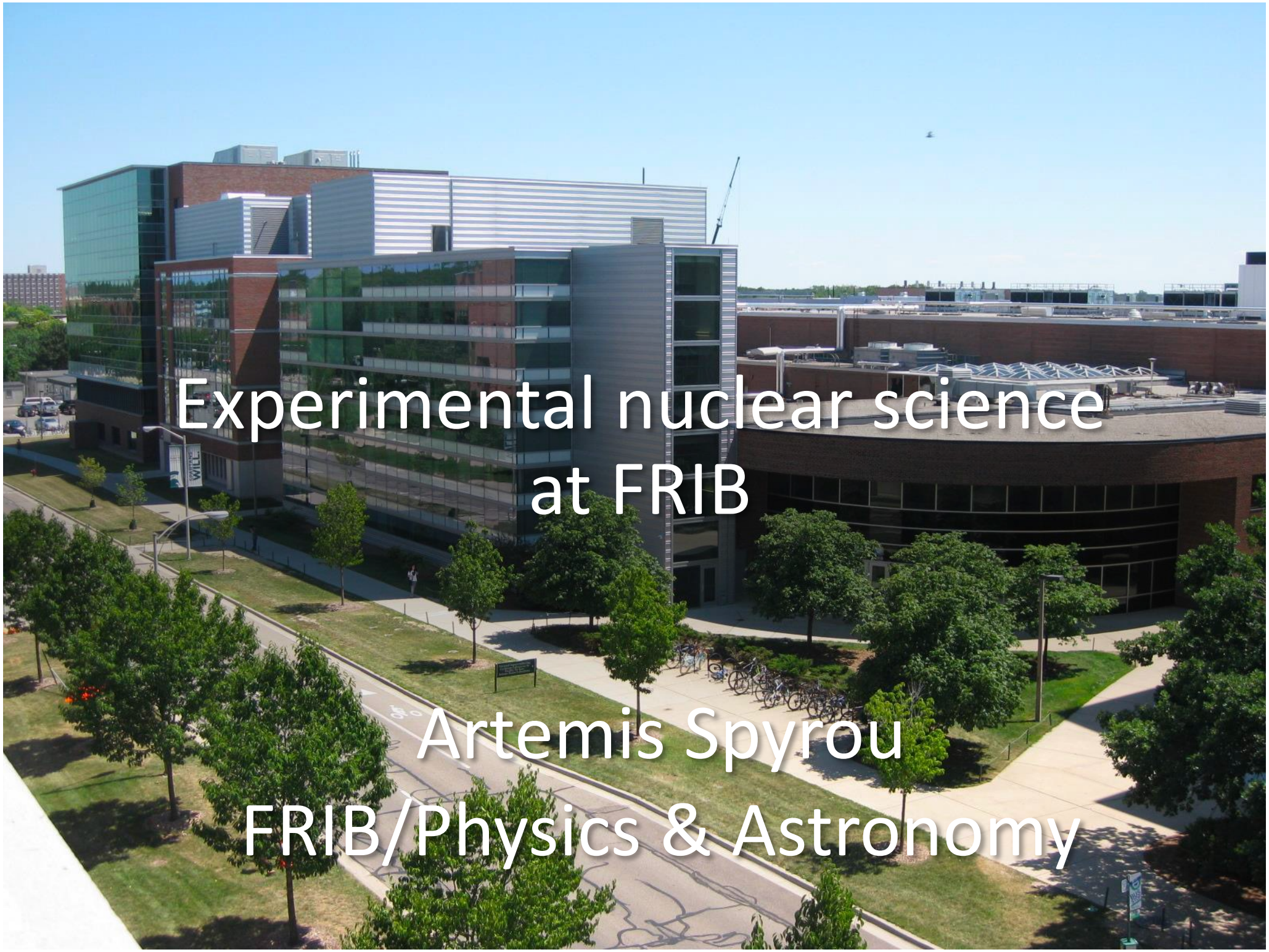
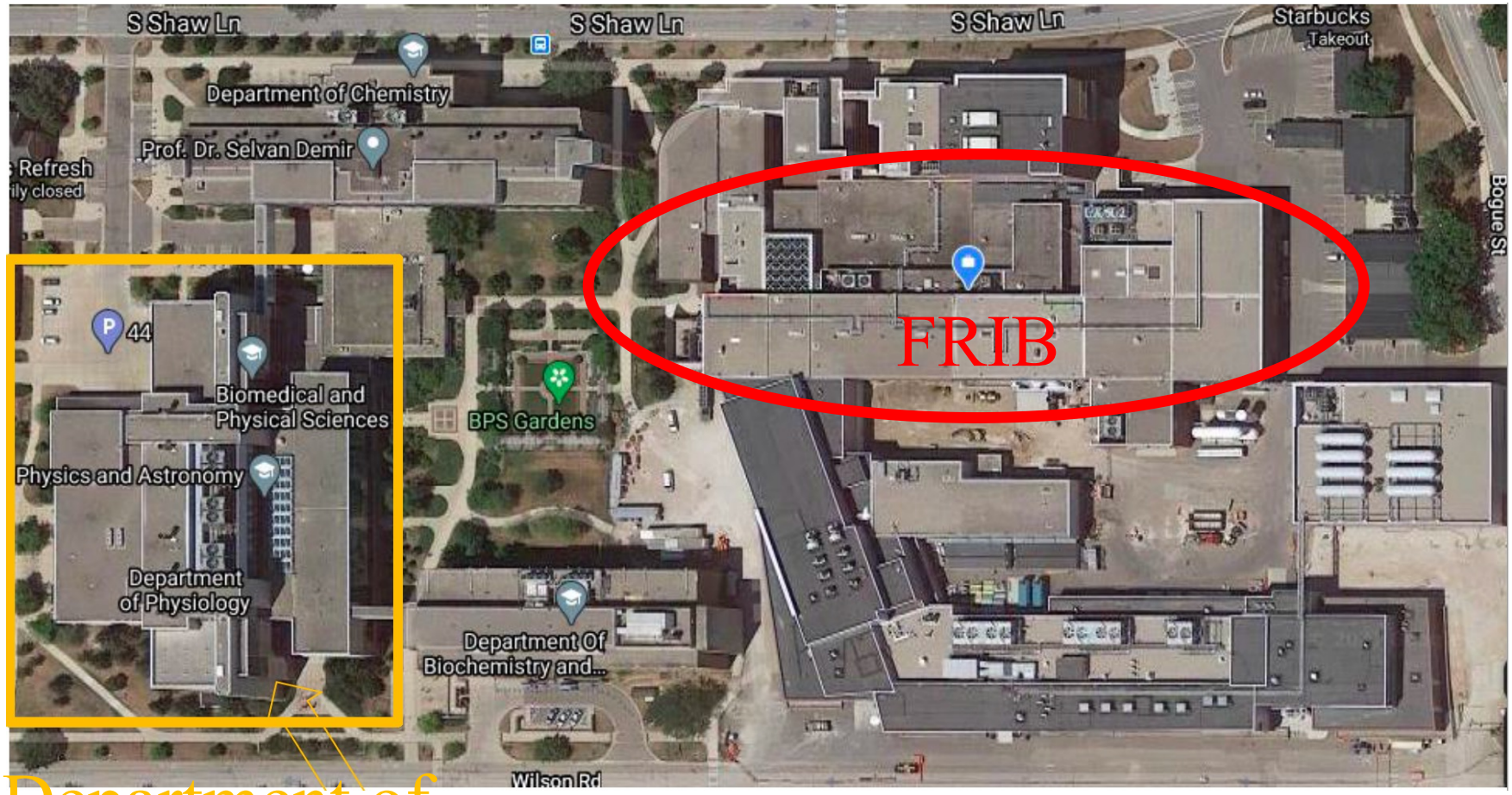
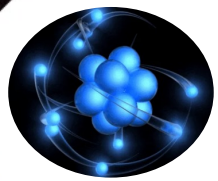

Experimental nuclear science
at FRIB
Artemis Spyrou
FRIB/Physics & Astronomy

Proximity to Academic Departments



Nuclear Science Goals of FRIB

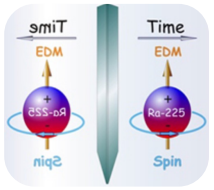


- **How does sub-atomic matter organizes itself – new phenomena**

Bazin, Bollen, Brown, Gade, Gueye, Iwasaki, Liddick, Lynch, Mittig, Revel, Ringle, Tsang

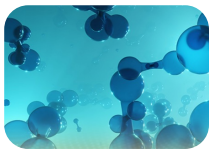
- **How do stars evolve and explode and how do they produce new elements.**

Brown, Liddick, Lynch, Montes, Schatz, Spyrou, Tsang, Wrede, Zegers



- **How can we describe the fundamental interactions in matter**

Bollen, Minamisono, Naviliat-Cuncic, Ringle, Singh, Wrede, Xu



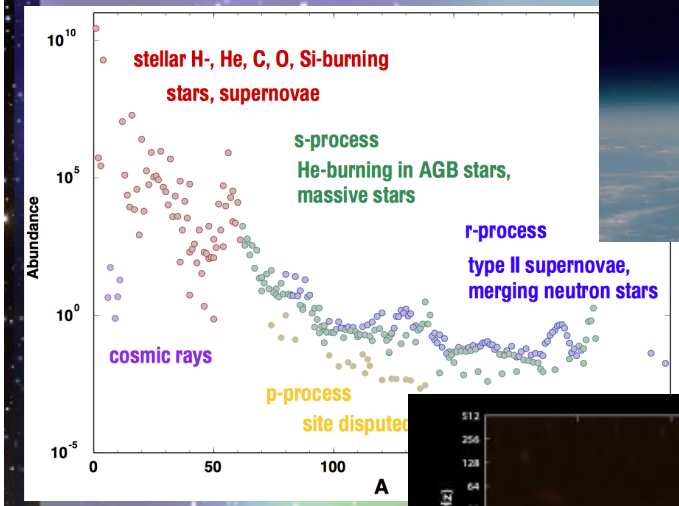
- **How can we use new knowledge and technology to benefit society.**

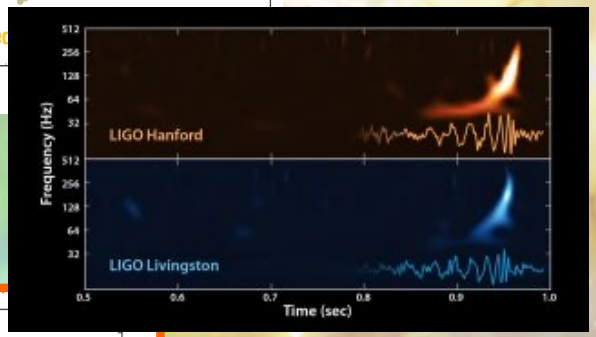
Bollen, Domnanich, Gade,Geiser, Gueye, Iwasaki, Liddick, Mittig, Ringle, Severin, Spyrou, Stolz, Zegers

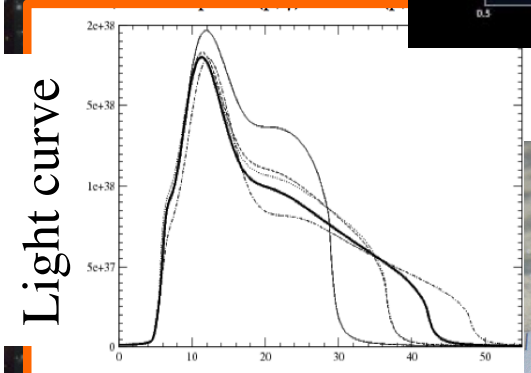
You will meet some of these people today

Nuclear Astrophysics

Observations



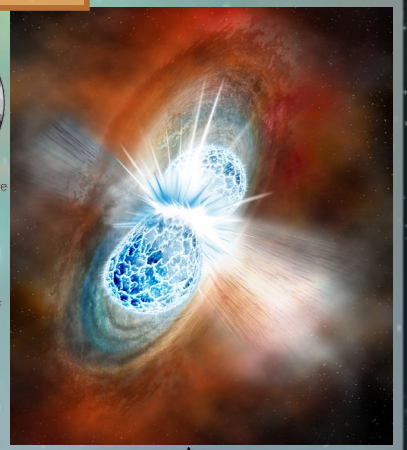




Models

Input

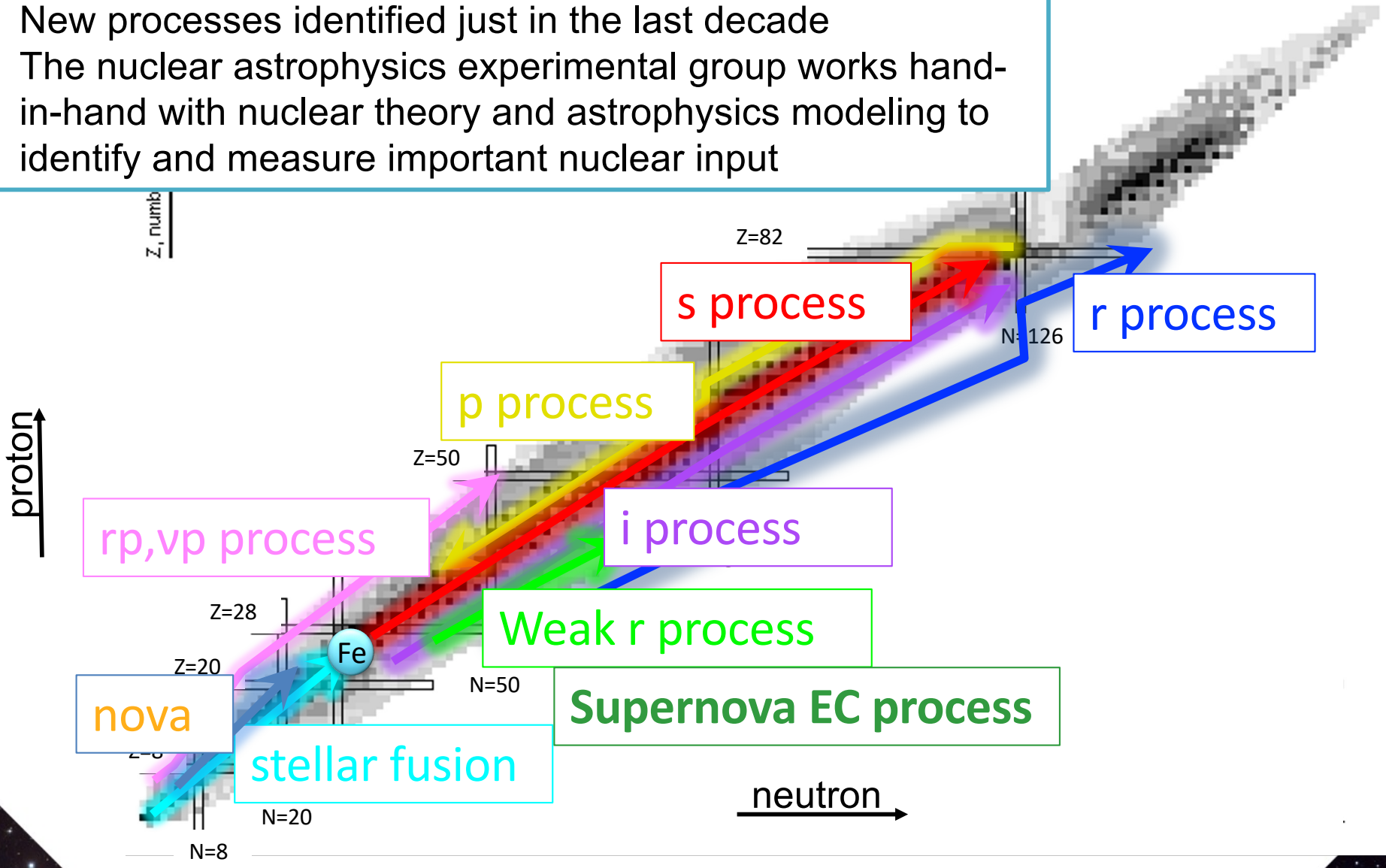
Nuclear
Experiments and theory



Astro

Astrophysical Processes

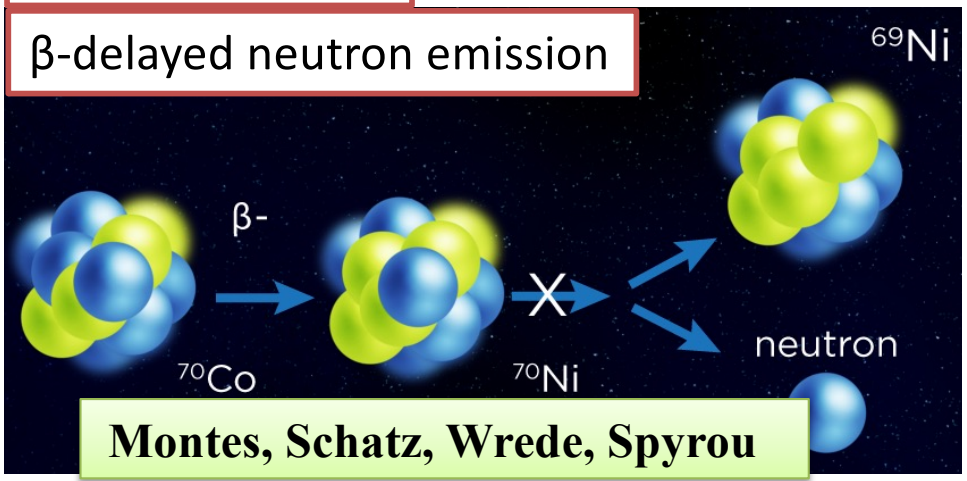
- Stellar processes are more complex than originally thought
- New processes identified just in the last decade
- The nuclear astrophysics experimental group works hand-in-hand with nuclear theory and astrophysics modeling to identify and measure important nuclear input



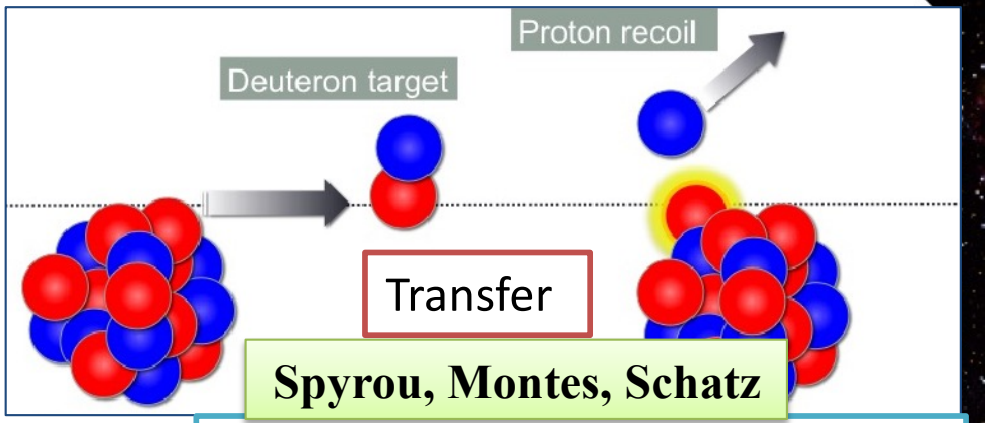
Nuclear Data Needs

β-decay half-lives

β-delayed neutron emission



Montes, Schatz, Wrede, Spyrou

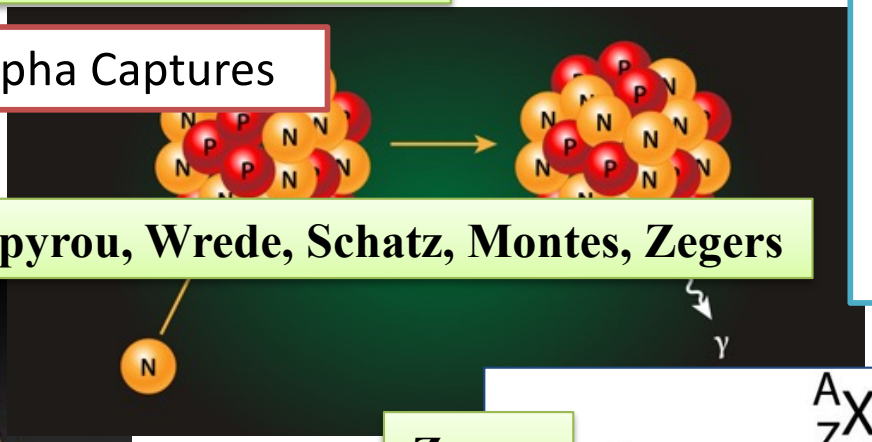


Spyrou, Montes, Schatz

- Equation of state
- (α,p), (p,n), (α,n) …
- γ-ray spectroscopy
- Statistical properties (nuclear level density, γ-ray strength)

Lynch, Tsang, Brown, Spyrou, Wrede, Schatz, Montes, Zegers

Neutron/proton/alpha Captures

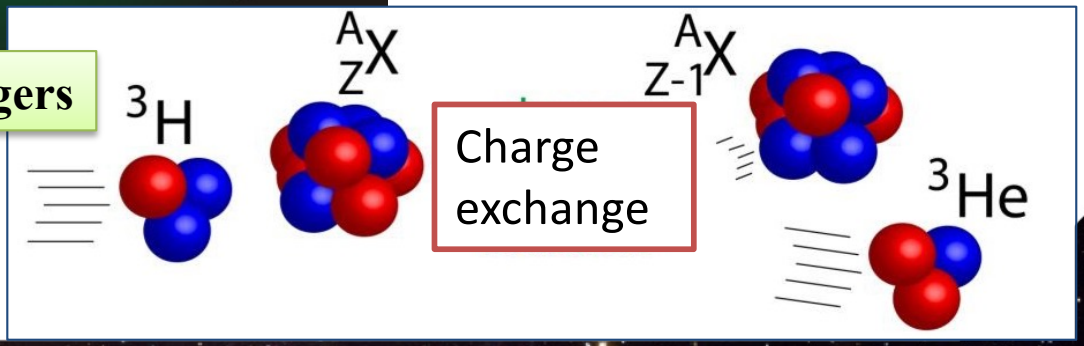


Spyrou, Wrede, Schatz, Montes, Zegers

Masses

Schatz, Montes

Zegers



Charge exchange

SuN @ MSU and friends

Junior Researchers

Stephanie Lyons, PNNL

Jordan Owens-Fryar MSU

Ellie Ronning MSU

u Greaves U. Guelph

Andrea Richard, LLNL

^{95}Sr

^{76}Ge

Adriana Ureche, LLNL

Mejdi Mogannam MSU

Artemis Tsantiri MSU

Hannah Berg, MSU

Erin Good, MSU

Mallory Smith, MSU

Debra Richman, MSU

Caley Harris, MSU

The life of an experimental nuclear (astro) student

- Collaboration with other experimental groups, theorists and astronomers
- Detector design/simulation/characterization/setup/calibration
- Run experiments (yours or participate in others)
- Data Analysis
- Write papers, experiment proposals
- Travel to other laboratories for experiments
- Attend conferences and schools, present posters and talks
- Run your own theoretical calculations (if interested)
- Computational projects:
    - Machine Learning for detector characterization
    - Large scale astrophysical calculations
    - Large scale theoretical calculations
    - Complex analysis methods

*** Most probably a little bit of everything ***

Please contact me if you have questions

spyrou@frib.msu.edu