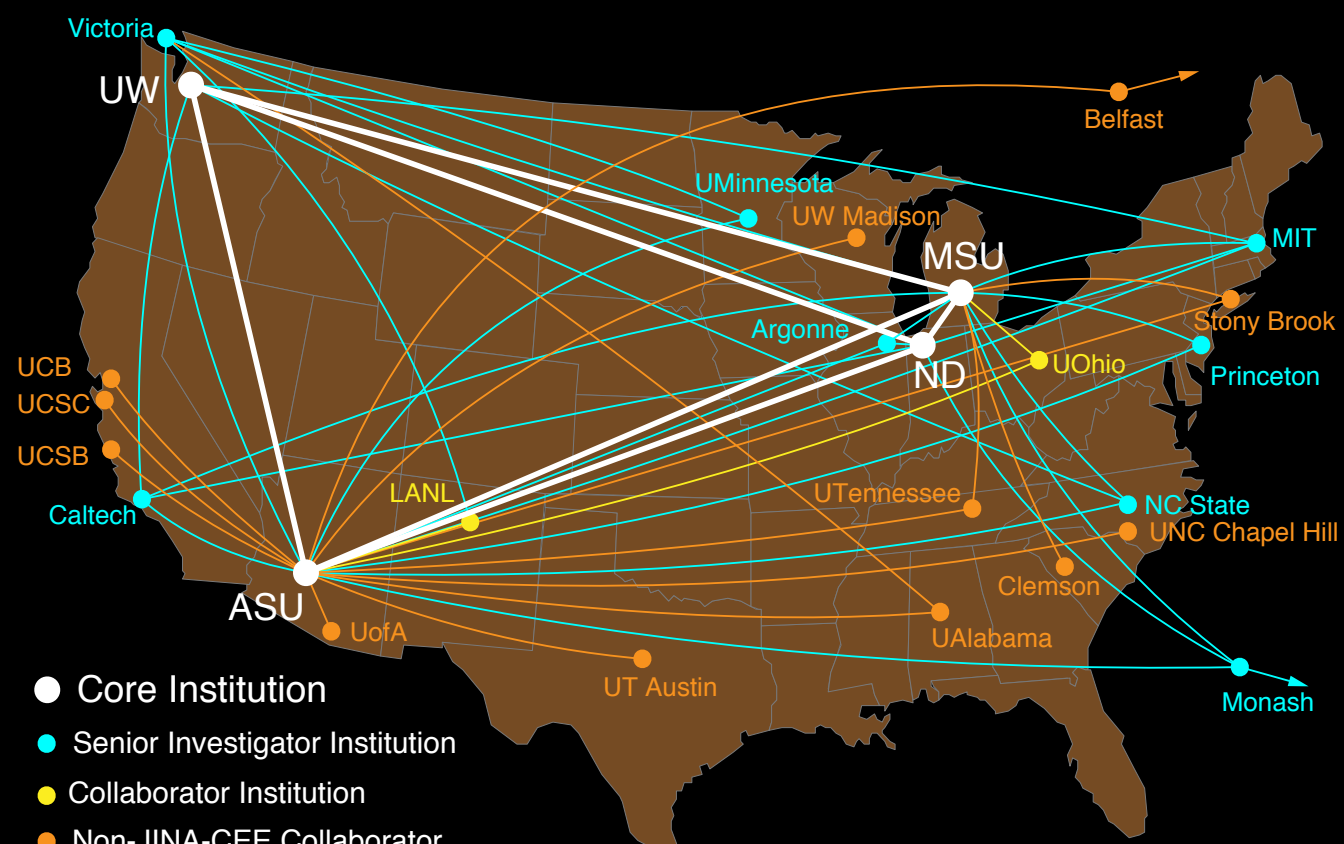
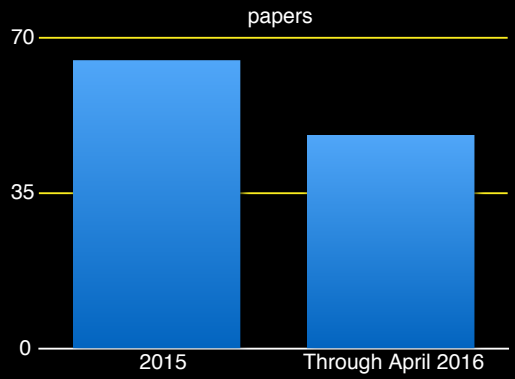
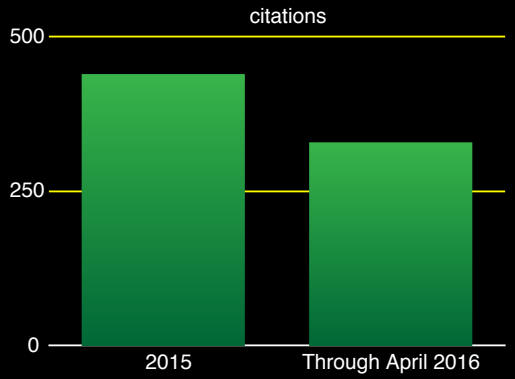
Unstable Isotopes / Explosive Burning

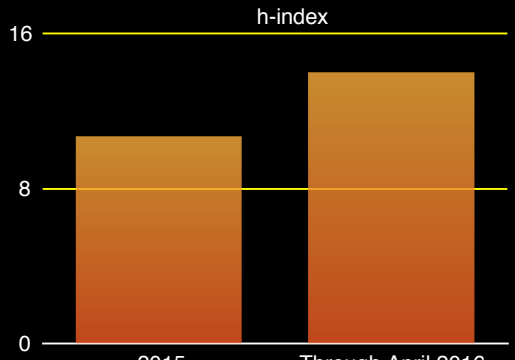


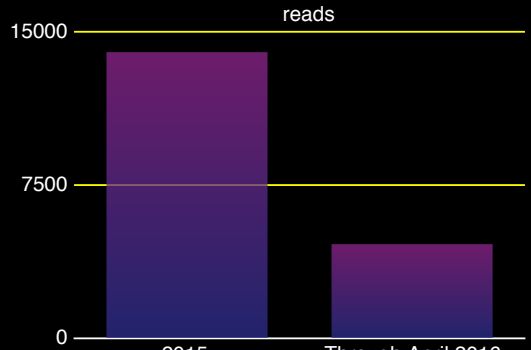
JINA-CEE is having a major impact over the entire stellar mass range.



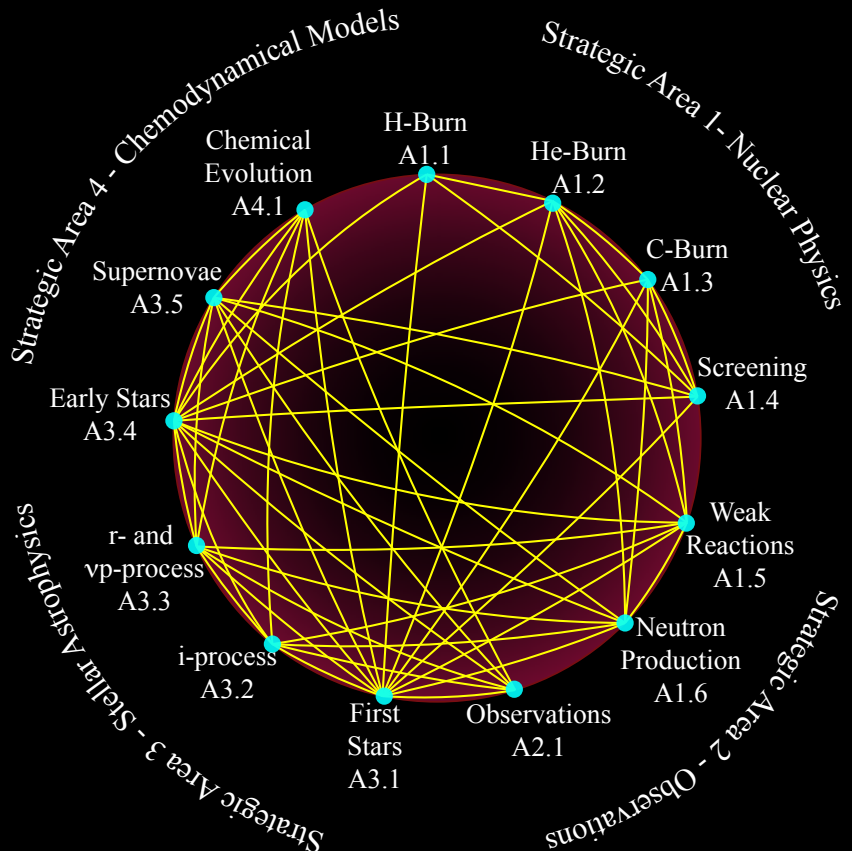


refereed papers only.
estimated accuracy ~20%.





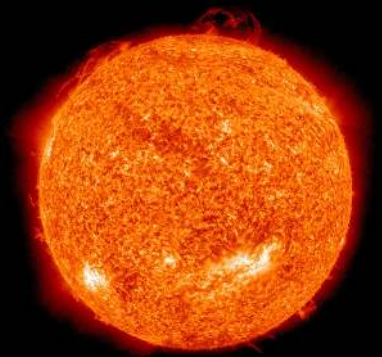
Research Topics - MA1



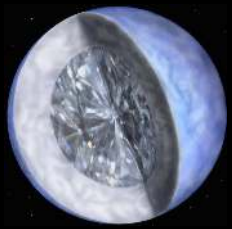
Outline

- evolution to white dwarfs
- i-process
- r-process
- weak reactions
- supernova
- pipeline

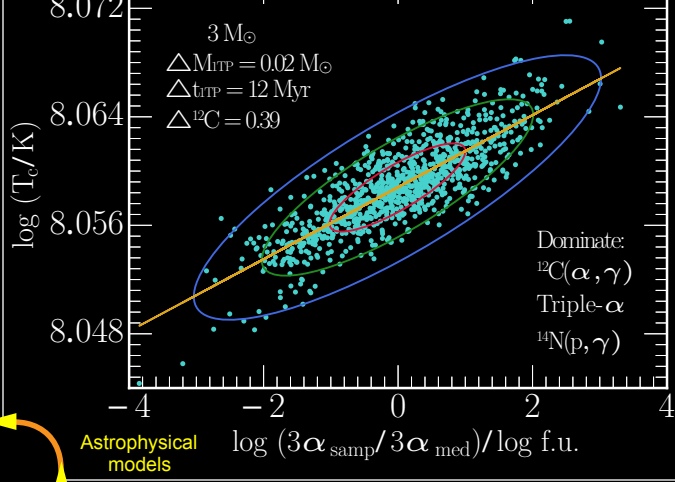
How do the properties of CO white dwarfs, evolved from the main-sequence, vary with respect to the composite uncertainties in the reaction rates?



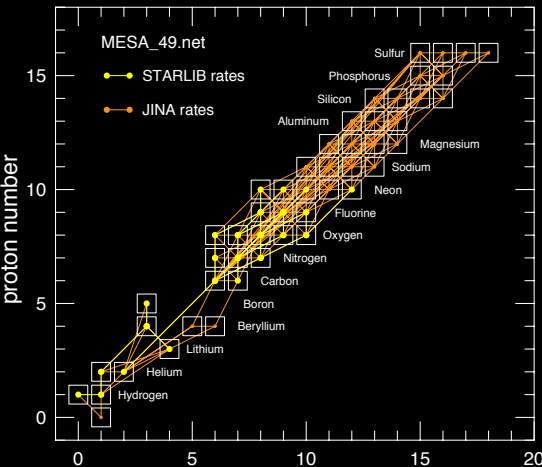
$\sum \delta$(reaction rates) = ?

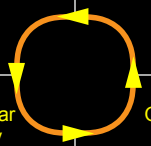


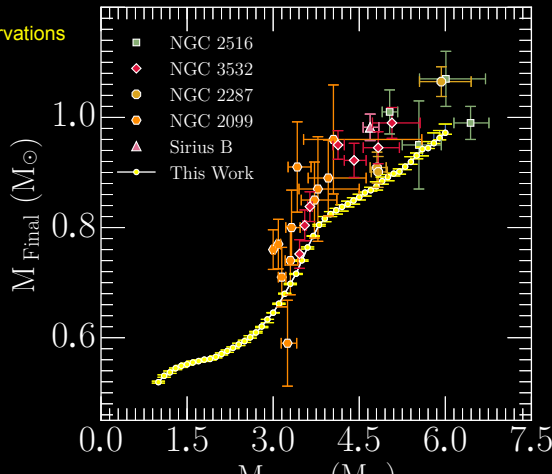
The first Monte Carlo stellar evolution studies that use complete stellar models and probability density functions for the reaction rates.



A1.1 A1.2 A3.5







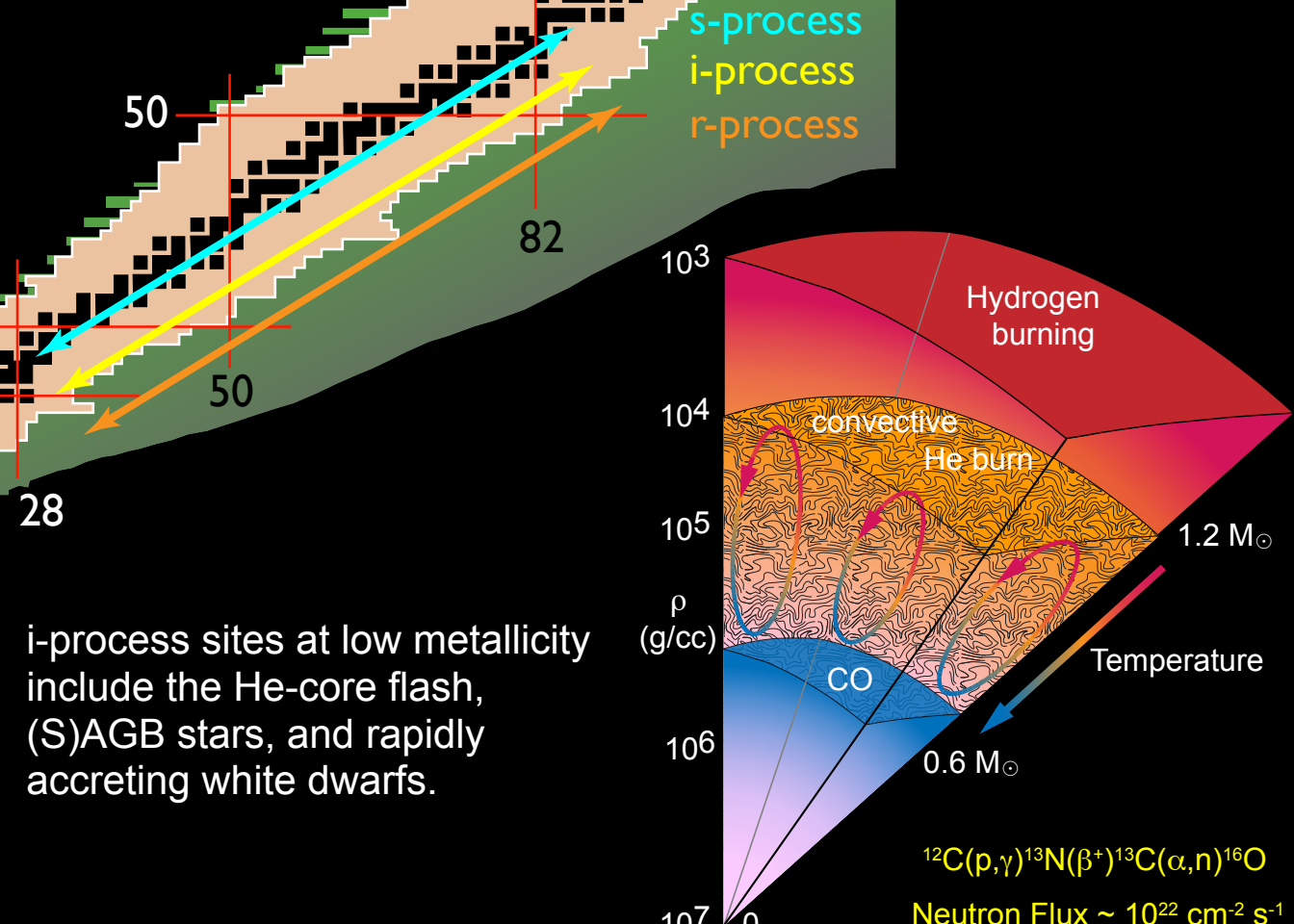
JINA-CEE enables undergraduates to be competitive for National Fellowships.

Carl Fields

2016 NSF Graduate Research Fellowship

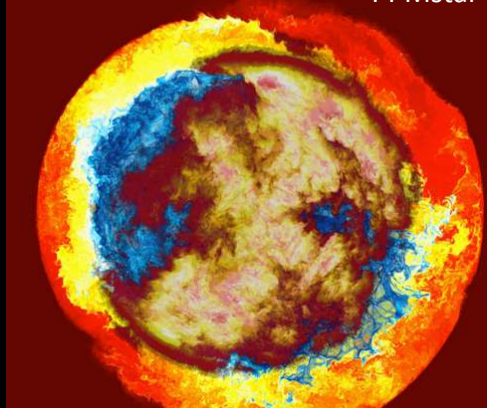
2016 Ford Foundation Predoctoral Fellowship

See Micha Kilburn's talk for additional ERO results



i-process sites at low metallicity include the He-core flash, (S)AGB stars, and rapidly accreting white dwarfs.

JINA-CEE is conducting a world-leading integrated effort on the i-process.



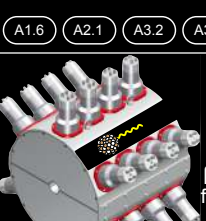
A1.6 A2.1 A3.2 A3.4 A4.1

Astrophysical models

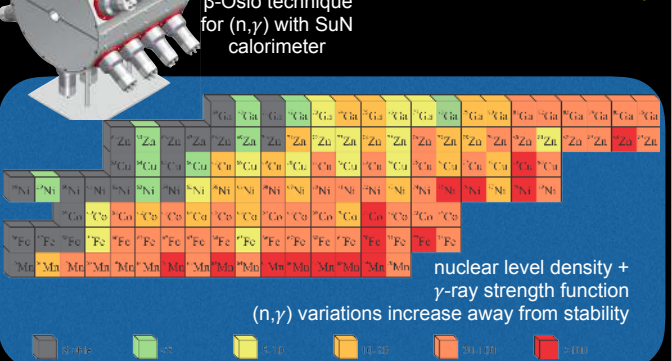
Nuclear experiment

Observations

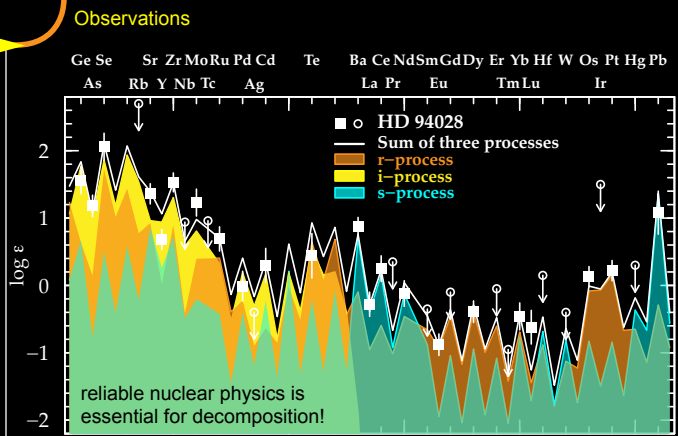
Nuclear theory



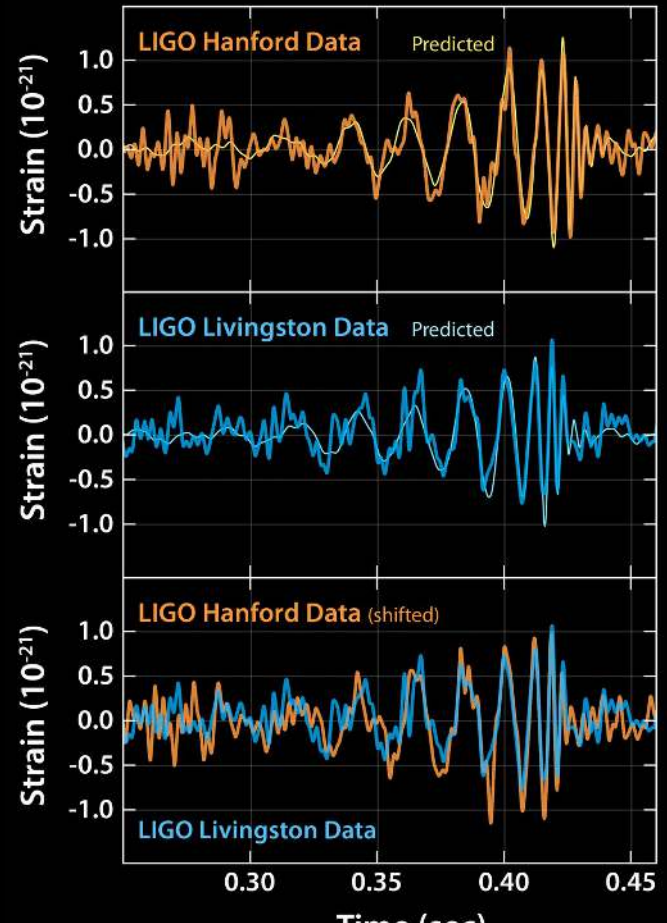
β-Oslo technique for (n,γ) with SuN calorimeter

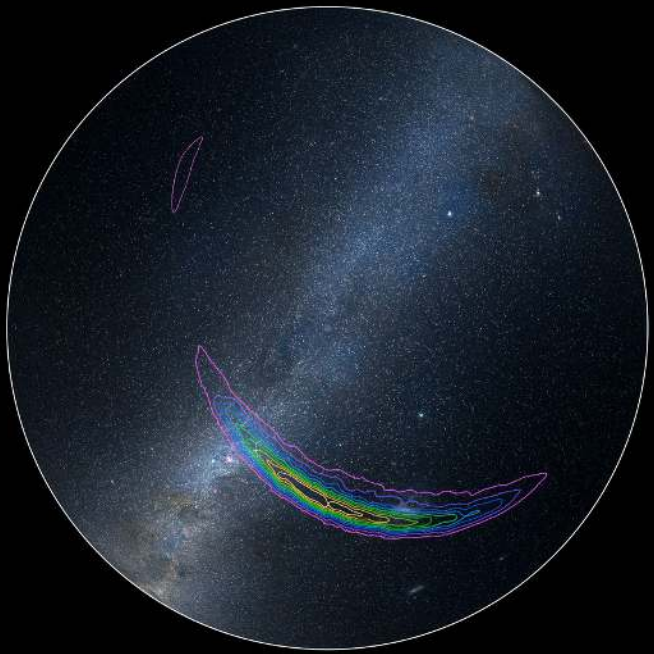


nuclear level density + γ-ray strength function
(n,γ) variations increase away from stability

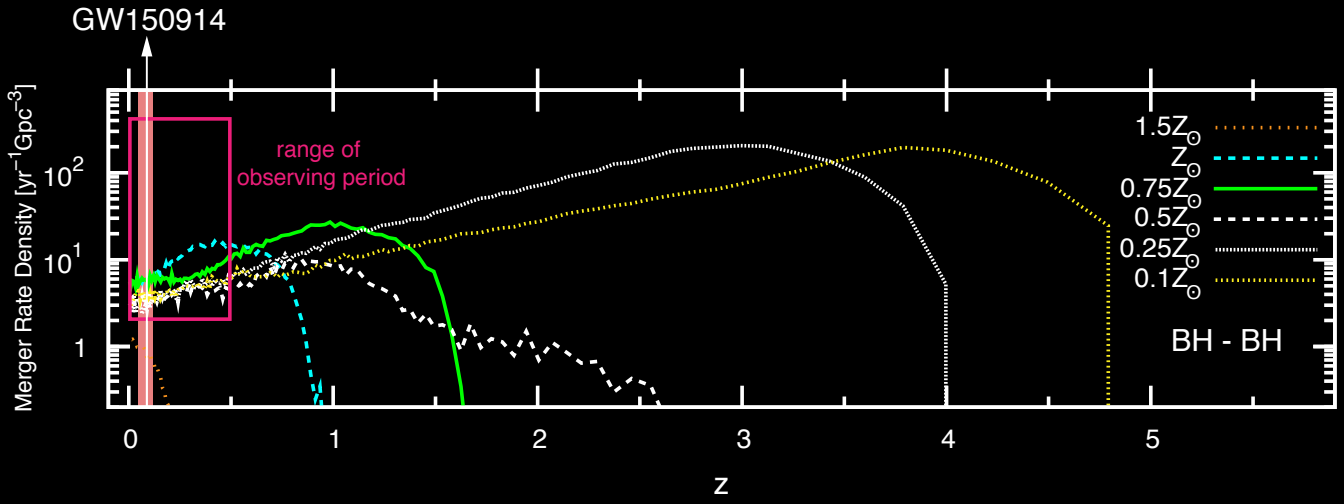


GW150914 …


LIGO Hanford Data
Predicted
LIGO Livingston Data
Predicted
LIGO Hanford Data (shifted)
LIGO Livingston Data
Strain (10-21)
1.0
0.5
0.0
-0.5
-1.0
0.30
0.35
0.40
0.45

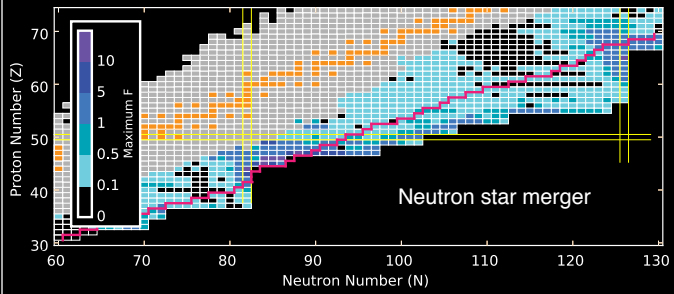


… and forthcoming friends can constrain the merger rate of neutron stars thus one promising origin site for the r-process.



See Sanjay Reddy's talk on EOS and

JINA-CEE is conducting an enterprise level, consolidated undertaking on the r-process.



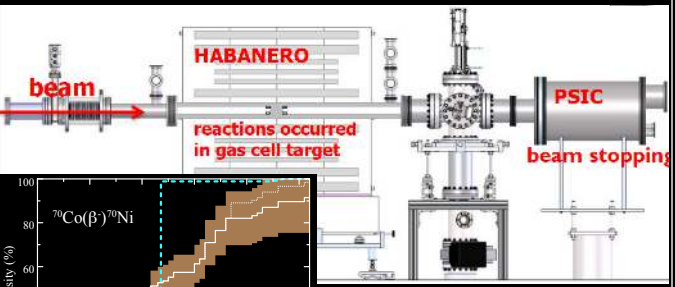
A1.5 A1.6 A2.1 A3.1 A3.3 A3.4 A3.5 A4.1

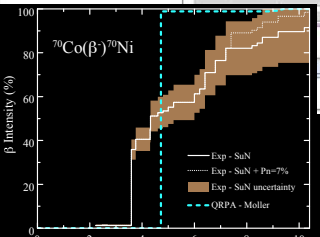
Astrophysical models

Observations

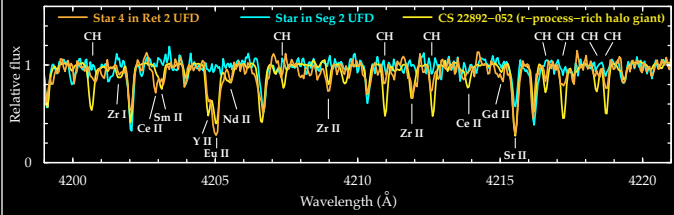
Nuclear experiment

Nuclear theory





See Jason Clark's talk on mass and beta- results

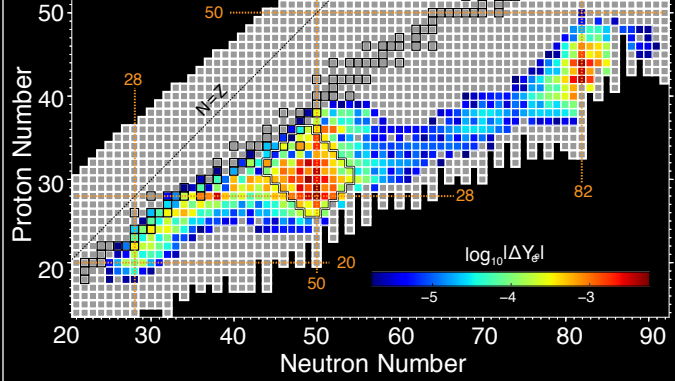


See Tim Beer's and Anna Frebel's talks on observational results

The Problem of Electron-capture in the Stars. By A. S. Eddington, F.R.S., Plumian Professor.

method checks the result approximately. I should be very glad of data which might enable an estimate to be made of the number of additional

JINA-CEE is delivering new state-of-the-art weak reaction data & tools to the community.



A1.5 A1.6 A2.1 A3.1 A3.3 A3.4 A3.5

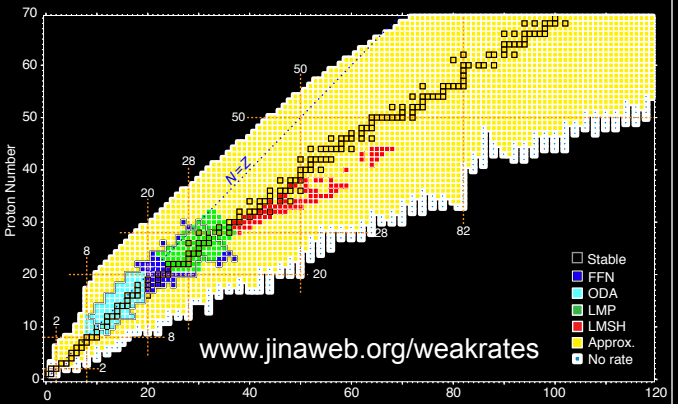
Astrophysical models

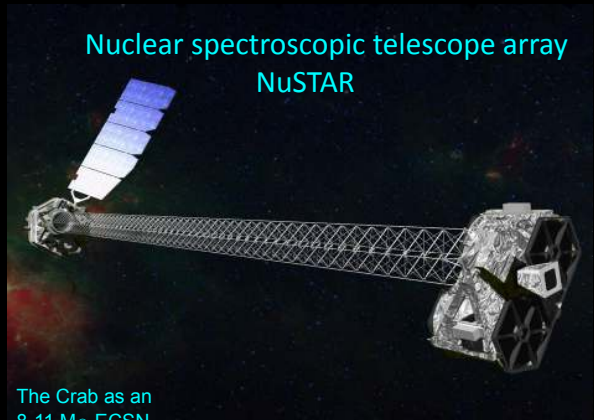
Nuclear experiment

Nuclear theory

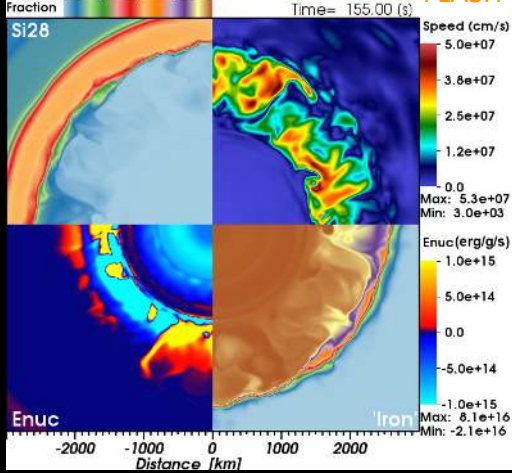
Observations

Good example of a JINA-CEE triggered and enabled student/postdoc exchange.





JINA-CEE is providing leadership on the growth of a massive star's iron core, up to and including collapse and the resulting nucleosynthesis.



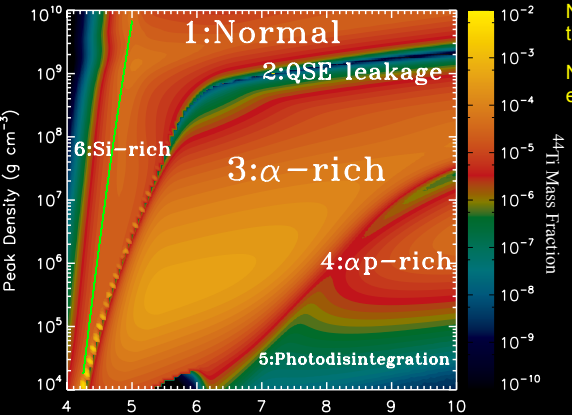
Astrophysical models

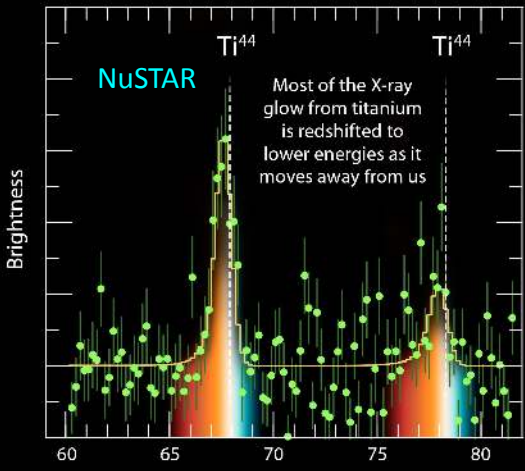
A1.3 A1.4 A1.5 A1.6 A2.1 A3.3 A3.5 A4.1

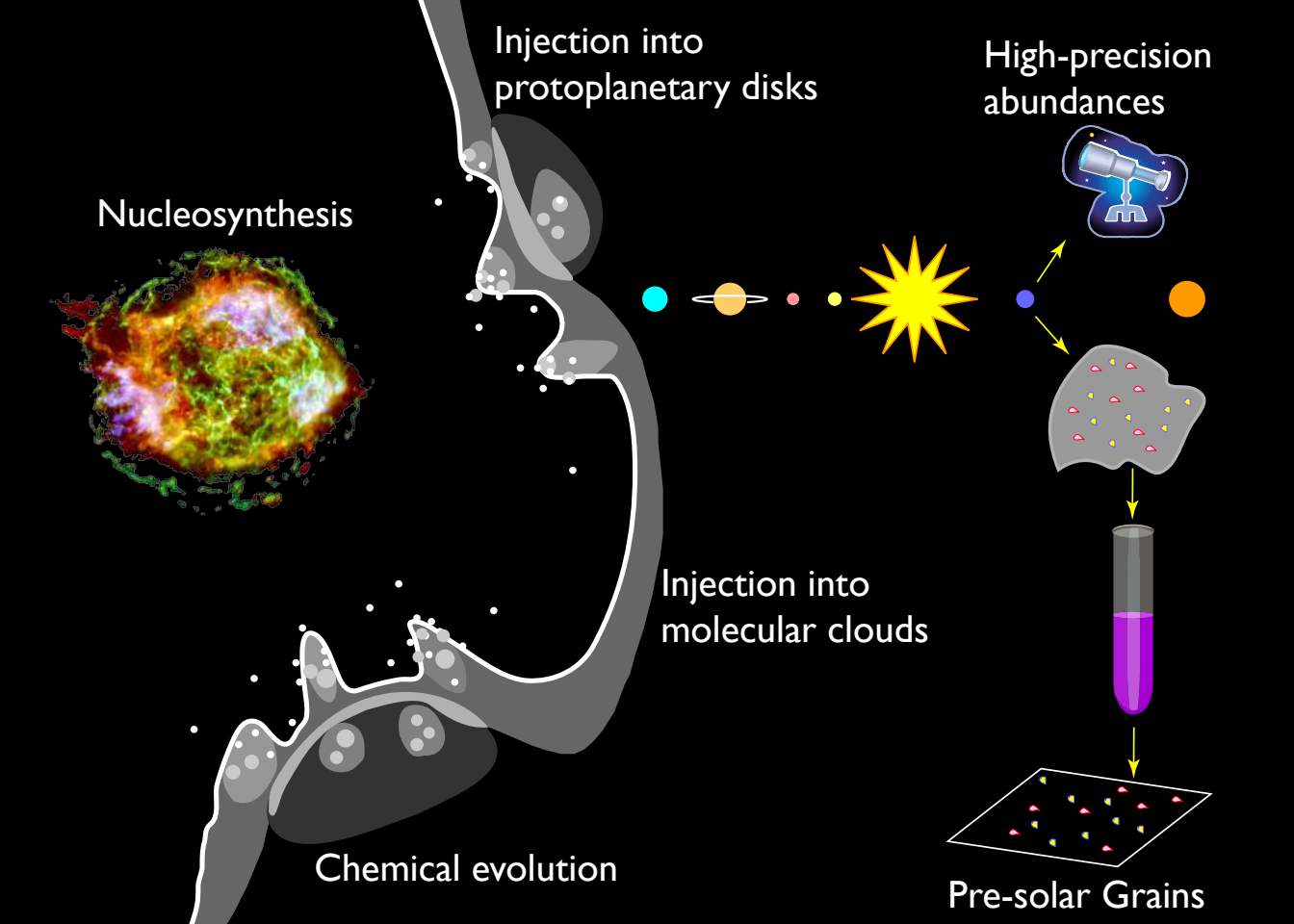
Nuclear theory

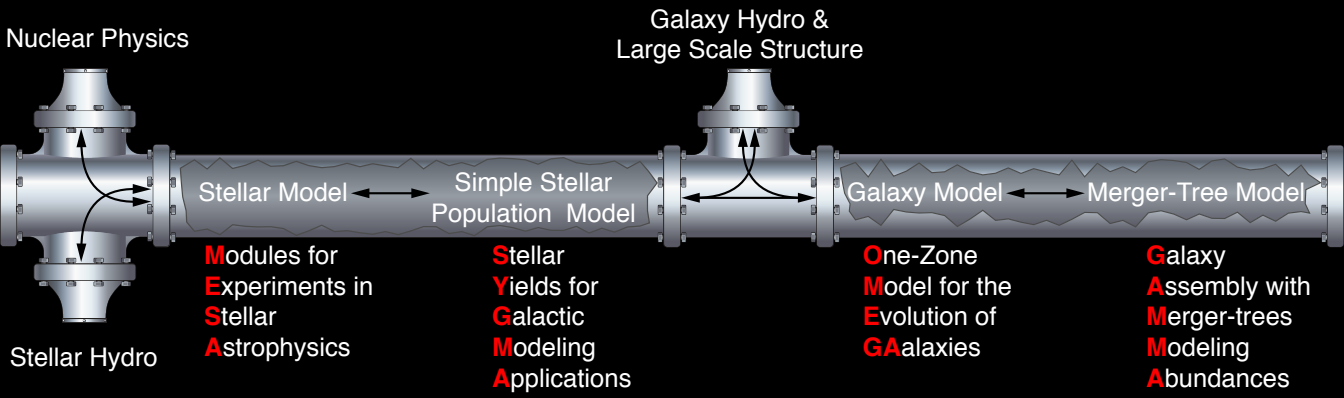
Nuclear experiment

Observations





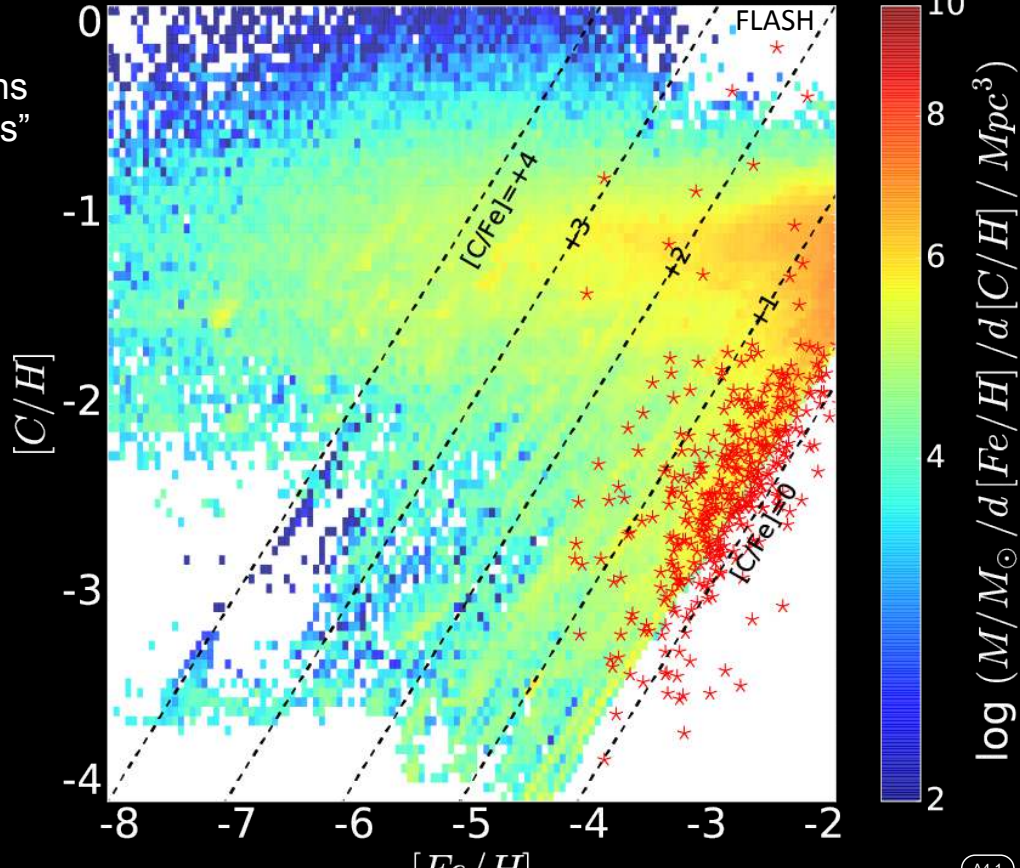

Injection into
protoplanetary disks
High-precision
abundances
Nucleosynthesis
Injection into
molecular clouds
Chemical evolution
Pre-solar Grains



JINA-CEE and NuGrid are leading the charge on an integrated numerical pipeline from dynamic nuclear physics input to transformative comparisons with observations, and loop back.

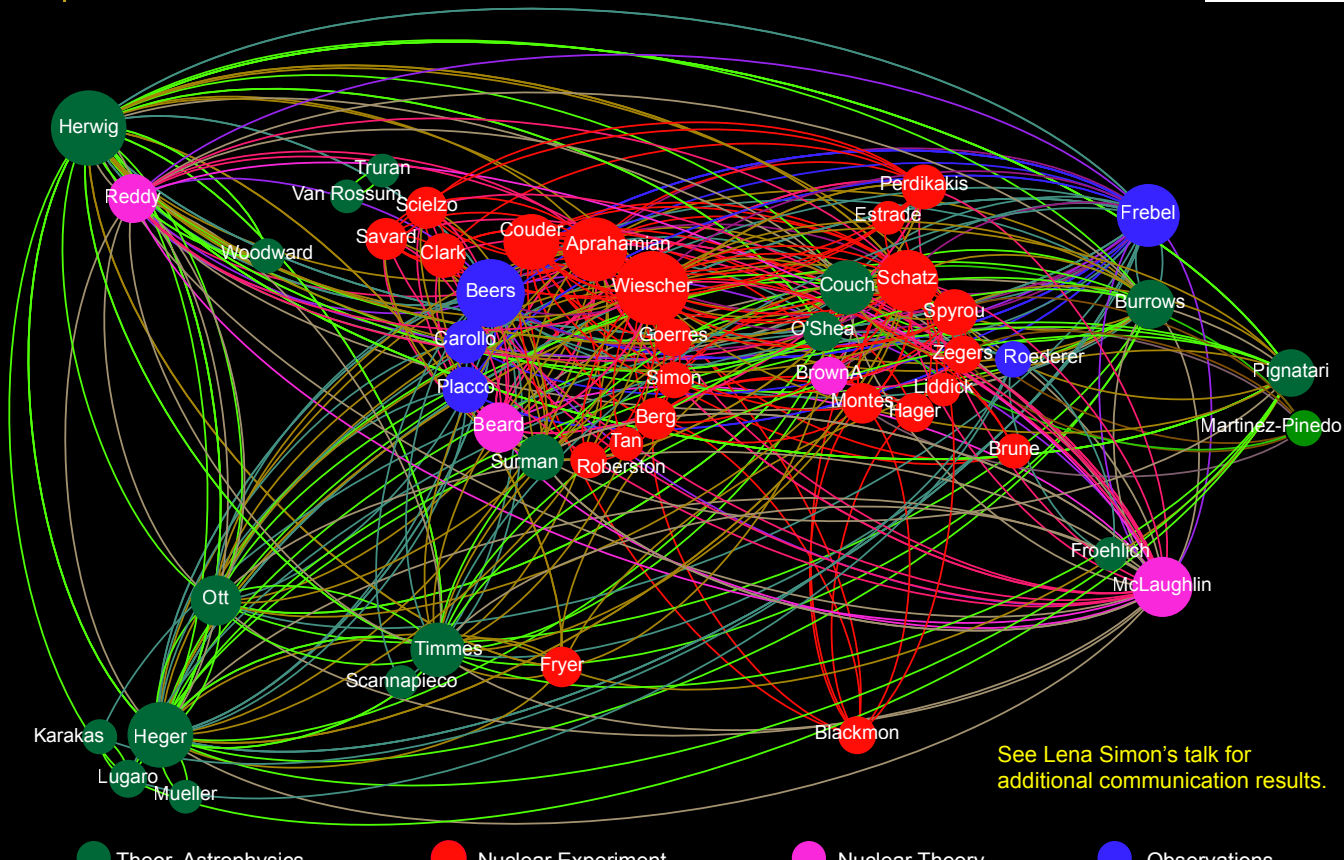
Pipeline example: following the cosmic evolution of pristine gas

3D hydro simulations of “primordial metals” from Pop III SN correlate well with CEMP Milky Way halo stars.



See Brian O’Shea’s talk for additional pipeline results

Advice / Suggestions



See Lena Simon's talk for additional communication results.