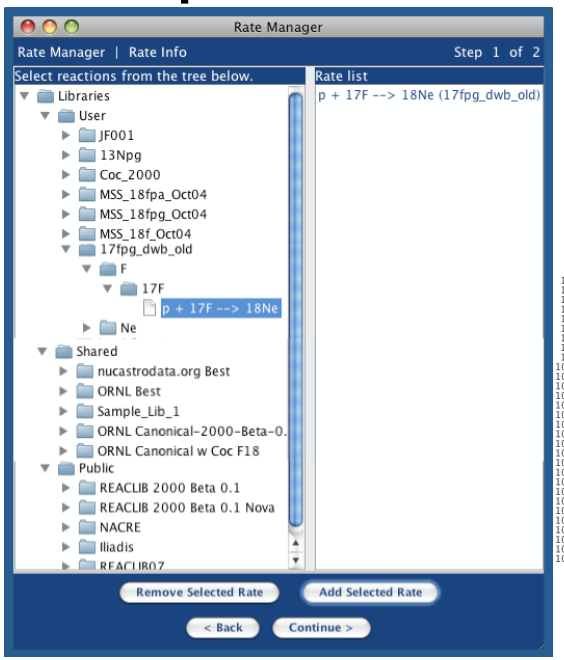
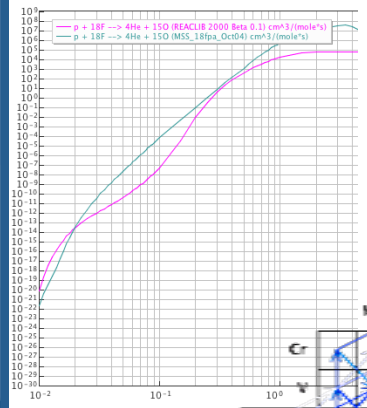
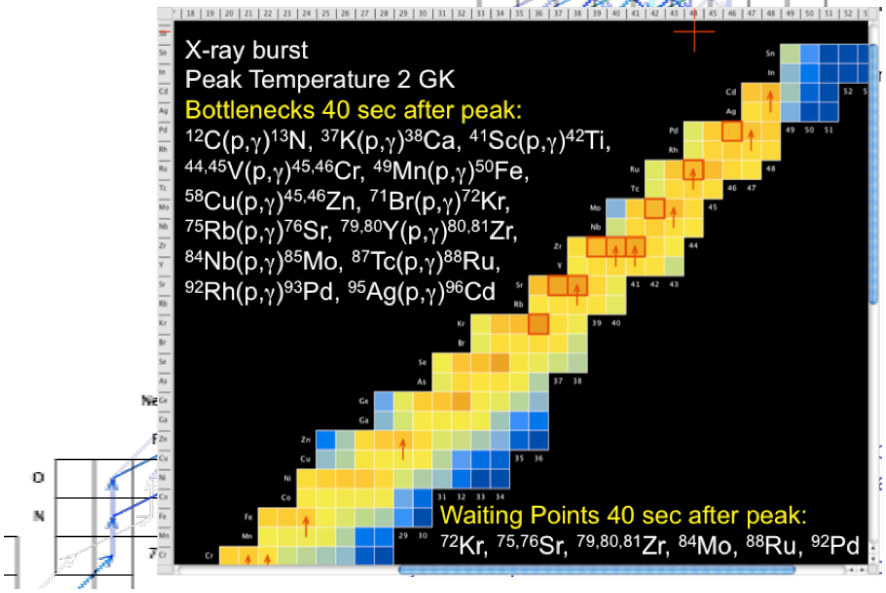
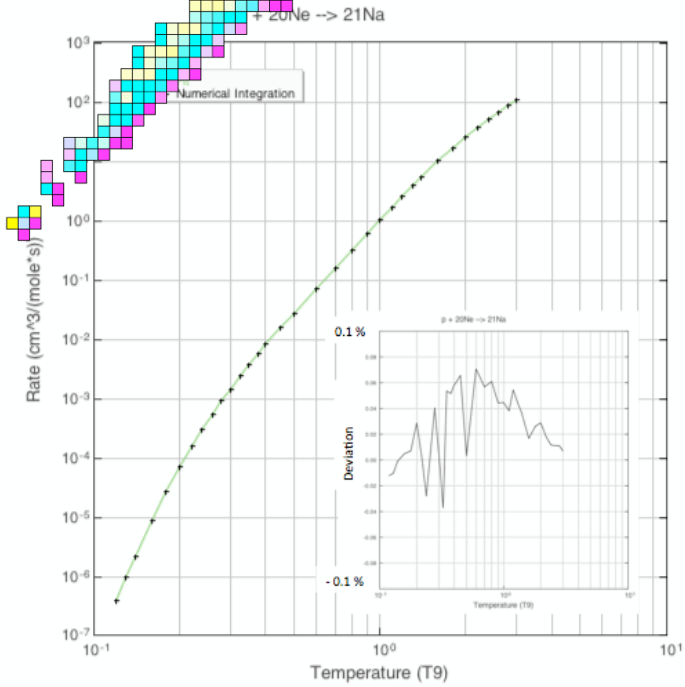
computational infrastructure for nuclear astrophysics









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sample investigations

before & after study: what was the impact of my measurement ?

- assume you just measured a new rate of the $^{18}F(p,\alpha)^{15}O$ reaction
- rate is 10 times lower than previous “best” rate
- how does this impact predictions of ^{18}F production in novae ?

approach

- modify existing $^{18}F(p,\alpha)^{15}O$ rate appropriately, save into new library
- combine with JINA REACLIB v2.0 into full library for a simulation
- choose a novae simulation, run with old rate & new rate
- compare final abundances in the two simulations
- draw your conclusion on the impact of the measurement
- variations: more nova models, different zones or all zones …

sample investigations

sensitivity study: how does one abundance depend on a rate ?

- you just read an article on ^{22}Na observations in nova ejecta
- you wonder if measurements of ^{21}Na(p,γ)^{22}Mg and ^{21}Ne(p,γ)^{22}Na reaction would help clarify the nuclear uncertainties in ^{22}Na abundance predictions
- what are the sensitivities of these predictions on these rates ?

approach

- choose a reference rate library and a novae simulation
- choose a set of variations of these the reactions of interest (e.g., 0.01, 0.1, 1.0, 10, 100 …)
- use automated sensitivity study tool to vary rate and run simulations
- use tools to plot out abundance vs. rate, look for strong correlations
- variations: more nova models, different rate variations, change other rates on neighboring nuclei …

sample investigations

uncertainty analysis: what is the uncertainty of this predicted abundance ?

- you have just made a new measurement of the $^{14}O(\alpha,p)^{17}F$ reaction with an uncertainty that ranges from a factor of 2 higher to a factor of 20 lower
- what are the implications of this uncertainty for final abundance predictions in novae ?

approach

- modify $^{14}O(\alpha,p)^{17}F$ rate to have “max” and “min” values
- save each into library, merge with JINA REACLIB v2.0 library
- choose a novae simulation, run with reference, max, & min rates
- compare final abundances, the spread gives the uncertainty
- draw your conclusion on the impact of the uncertainty on ^{16}O / ^{18}O and $^{17}O/^{18}O$ abundance ratios, on ^{18}F and ^{22}Na abundances …
- variations: examine different abundances; different nova models …

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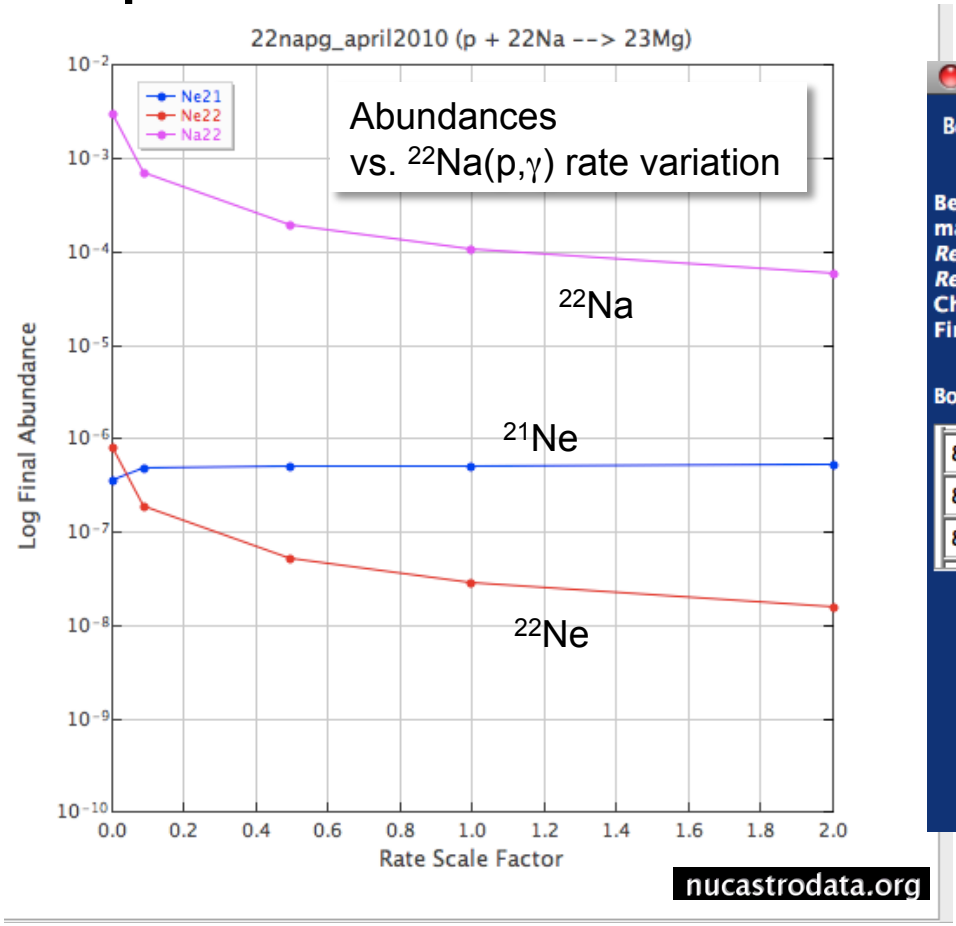

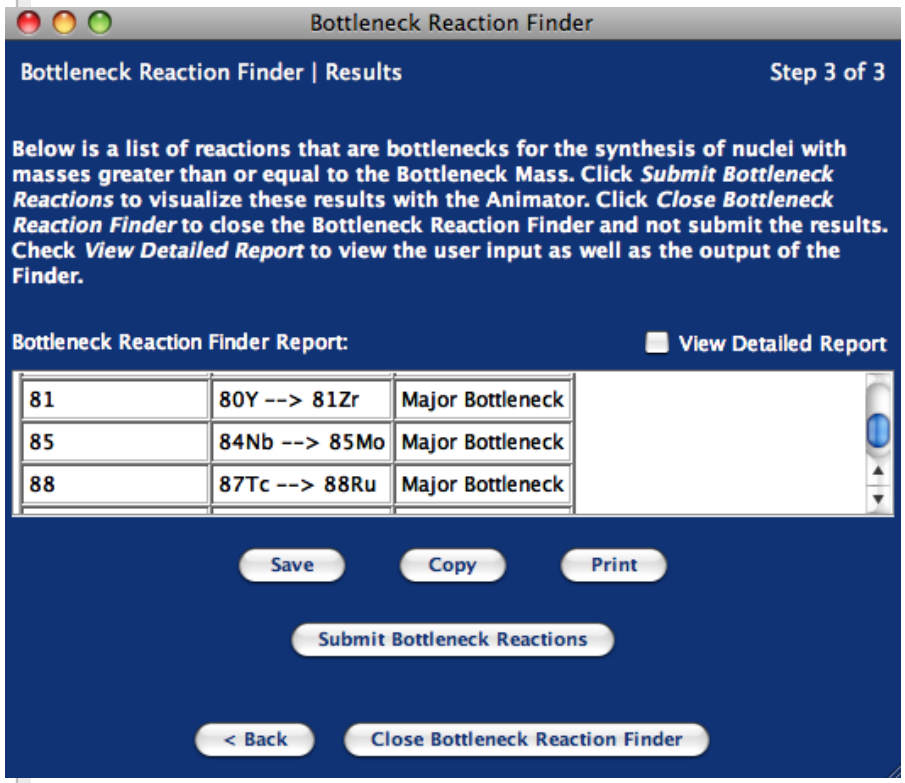

- download java program for free at **nucastrodata.org**
- contact coordinator @ nucastrodata.org for help
- suggest new features for nuclear data / rates / libraries / simulations / visualization / analysis and we will work with you !