

STARLIB Website Instruction Manual

July 31, 2012

This document is an instruction manual for the STARLIB website, located at

`starlib.physics.unc.edu`

The three main components are the Rate Library, Rate Calculator, and Details. Each will be discussed below.

1 Homepage

Each page allows navigation to all other pages, both as buttons at the top of the page and as links at the bottom. Additionally on the homepage, there are three menu items directing to the three main components of the site. A screen capture of the top and bottom of the homepage is shown in Fig. 1.

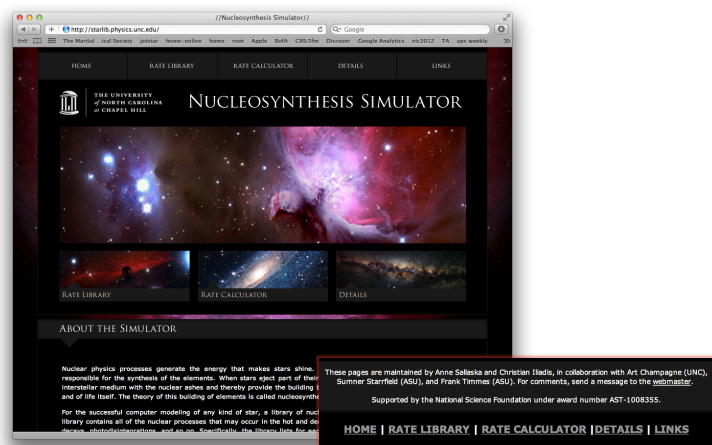


Figure 1: STARLIB homepage.

2 Rate Library

Three elements may be accessed on our Rate Library page, located at `starlib.physics.unc.edu/RateLib.php`:

- Display an individual rate
- Download the entire library
- A subset of the library

A screenshot of the library homepage is shown in Fig. 2, and Fig. 3 displays a screenshot when one scrolls down.

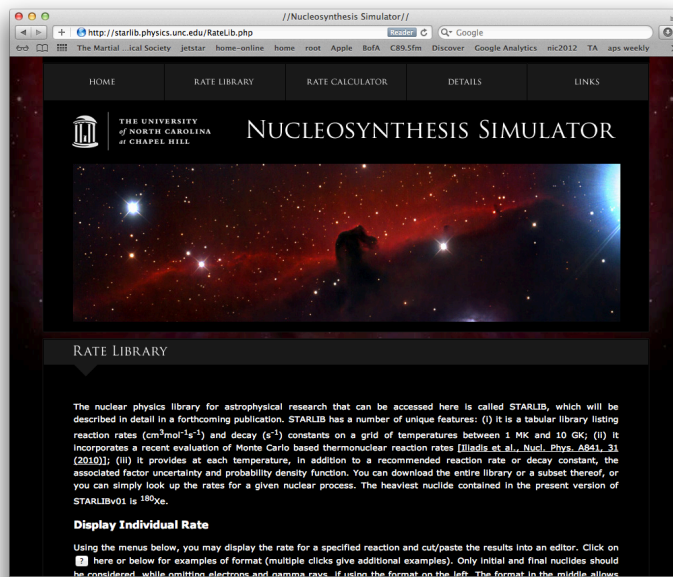


Figure 2: Rate Library, homepage.

First, one may display an individual rate. As shown in the top half of Fig. 3, there are three menus in which to enter the desired reaction. Each menu includes a “?” button that, upon clicking multiple times, presents various examples in the boxes. There is also a master “Reset” button to clear all fields. Allowed formatting of nuclei is also shown. Lowercase and uppercase letters are allowed, and chemical symbol and mass number may be entered in any order, with no spaces or dashes. In addition, formats of “n”, “p”, “d”, “t”, and “a” may be used for neutron, proton, deuteron, triton, and alpha particle, respectively. ^{26}Al is a special case, wherein several formats are allowed, with meanings described on our Details page (Sec. 4). Archived versions of STARLIB may also be accessed by selecting the desired version.

The left menu requires that every nuclide involved be entered, up to three interacting and three product nuclei (i.e. omitting electrons, gamma rays, etc). A drop-down menu highlights special reactions and reactions that have more than three nuclei in one channel. The middle menu requires the input of the initial nuclide and the type of reaction, in “(x,y)” or “x,y” format. The right menu is specifically for decays, with boxes for parent and daughter nuclide. Upon clicking “Submit” in any of the three menus will display the desired rate, shown in Fig. 4.

The version will be shown, as well as the header, including reaction, reference source, and Q -value. The source is a hyperlink to our Details page, where one may view the publication from which the data is taken or derived. The temperature grid includes 60 points in GK. The rate is either the thermonuclear reaction rate in units of $\text{cm}^3 \text{mol}^{-1} \text{s}^{-1}$, or the decay constant of a photodisintegration or a beta decay in units of s^{-1} . The factor uncertainty is the factor by which one can multiply and divide the rate to calculate the upper and lower rates, respectively.

The bottom half of Fig. 3 illustrates how to download the entire library or a subset. Again, archived versions of STARLIB will still be available, as we continue to update the library. Clicking the “Submit” button will automatically download the full version to your computer. If only a subset is required, a list of nuclei to include may be copied and pasted into the text box at the right. Accepted formatting is the same as above, and right or left alignment of the list is allowed. The subset will be downloaded upon clicking of the “Submit” button under the list of required nuclei.

http://starlib.physics.unc.edu/RateLib.php

Display Individual Rate

Using the menus below, you may display the rate for a specified reaction and cut/paste the results into an editor. Click on [here](#) or below for examples of format (multiple clicks give additional examples). Only initial and final nuclides should be considered, while omitting electrons and gamma rays, if using the format on the left. The format in the middle allows the input of the reaction type with the initial nuclide. The far right format is for beta decays, exclusively. For the special case of ^{26}Al , the format "a126", "a146", "a146", "a103", "a103" must be used (see Details). In addition, the source of the rates and the Q value used will be displayed (see Details). Special reactions (for example, those including four final nuclei in the exit channel) can be chosen from the drop-down menu. Past STARLIB versions (when available) may also be chosen.

STARLIB Version 1.0.1

Interacting Nucl

Nuclide 1:

Nuclide 2: (if applicable)

Nuclide 3: (if applicable)

Nuclide:

Reaction:

Submit

Parent:

Daughter:

Submit

Product Nucl

Nuclide 1:

Nuclide 2: (if applicable)

Nuclide 3: (if applicable)

Special Reactions:

Submit Reset

Nucl Format

	26Al	Reactions
p	h1	a126 a146 x,y
d	h2	a146 a101 (x,y)
t	h3	a102 a103
a	he4	4he
n	n1	1n
-	na22	22na

Submit

Figure 3: Rate Library, main details.

http://starlib.physics.unc.edu/formLib.php

HOME RATE LIBRARY RATE CALCULATOR DETAILS LINKS

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

NUCLEOSYNTHESIS SIMULATOR

RATE LIBRARY

Display Individual Rate

STARLIB Version 1

Reaction rate: $p + {}^{22}\text{Na} \rightarrow {}^{23}\text{Mg}$

source: mc12

Q value: 7.58072E+00 MeV

T (GK)	Rate	factor unc.
1.00E+03	0.000E+00	1.000E+00
2.00E+02	0.000E+00	1.000E+00
3.00E+03	0.000E+00	1.000E+00

Figure 4: Rate Library, individually displayed rate.

3 Rate Calculator

The Rate Calculator section, located at `starlib.physics.unc.edu/RateCalc.php`, allows users to run our Monte Carlo code to calculate their own reaction rates. This is especially useful if one has measured new nuclear physics parameters and would like to calculate the resulting reaction rate. Details on this calculation can be obtained in Refs. [1, 2, 3, 4] and in the forthcoming publication on STARLIB [5]. The components of this section include how to:

- Display our input files
- Run the Monte Carlo simulation on our server
- Monitor simulation progress
- Download output files

A screen capture of the Rate Calculator homepage is shown in Fig. 5.



Figure 5: Rate Calculator, homepage.

Scrolling down this page shows our repository of current input files, shown in Fig. 6. Because formatting is very important, we suggest displaying an old input file and editing it with the new information. Details on the formatting of the input file are discussed in Ref. [3]. Two menu options are available for accessing our input files, and the formatting is the same as for the library, discussed in Sec. 2. Additionally, for the reaction $^{25}\text{Mg}(p, \gamma)^{26}\text{Al}$, one may select a check box that will display the input file for only the metastable state of ^{26}Al . Selecting the “Total” check box for this reaction includes both the ground state and the metastable state. Leaving both check boxes blank for this reaction will show the input file for the ground state only. Again, clicking the “?” button multiple times will cycle through various examples of acceptable formats. The input file will be displayed in the text box below the two menu options. Alternatively, you may copy and paste an input file directly into the text box.

Once an input file is selected, you simply need to supply an email address and click “Run simulation” below the input file, shown in Fig. 7. This will then take you to the page where you may monitor your simulation and download output files (Fig. 8). Here, your job ID will be issued. This number will allow you to track the simulation and identify the simulation’s output files, as each file is tagged with both job ID and reaction name for clarity. The STARLIB server employs a queue

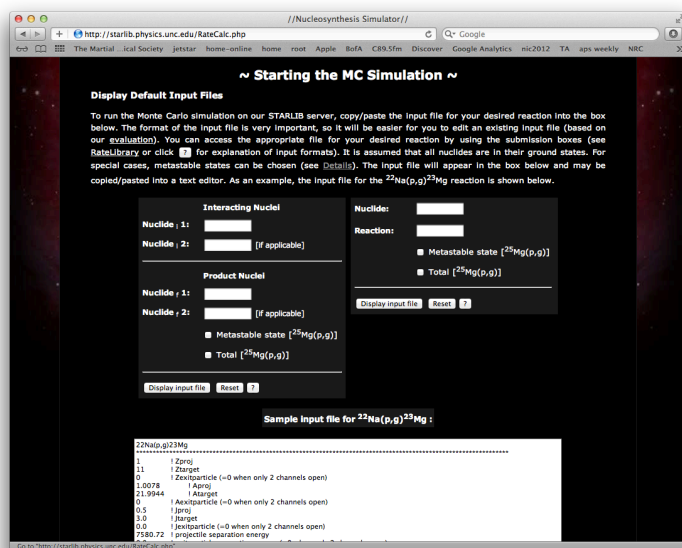


Figure 6: Rate Calculator, displaying existing input files.

system. If the input file includes any resonances to be integrated, the simulation will be filtered into the default queue and will be started when other simulations complete, if the queue is full. However, if no resonances require integration, the simulation will be filtered into another queue where it will be run immediately, bypassing all waiting simulations in the default queue.

In the middle of Fig. 8, you may view the status of *all* simulations currently running (i.e. this is for the entire server, not only your simulations). The status is given, either as an “R” for running or “Q” for waiting in the queue, as well as total run time, progress through the simulation in percent, and an estimate of remaining time. Below the status shown in Fig. 8 is a section in which one may abort simulations. Scrolling farther down the page displays the output files, shown in Fig. 9. These may also be accessed from the main Rate Calculator page by submitting the email address used to start the simulations (see bottom of Fig. 7).

Upon completion, an email alert will be sent to the address provided, indicating by job ID which simulation has been finished. As it is currently set up, you may click the link in the email directing you to our main Rate Calculator page, where inputting your email address will take you to your output file repository. You may also return to this page to monitor simulations at any time.

Output files are tagged by both reaction name and job ID and may be sorted by name, size, or date. A “Refresh” button is included to update output files. To aid bookkeeping, the original input file (*.in) has been copied here and tagged with the same information to correlate to the output file (*.out). The output file *.out includes all information on temperature, recommended rate, lower and upper rates. Examples of *.in files and *.out files are shown in Fig. 10. A detailed description of the format is in Ref. [2]. Also given are the rate in a convenient latex format (*.latex) and a histogram of the rate probability density function at each temperature (*.hist). Unwanted output files may be deleted by entering in the job IDs at the bottom of the page.

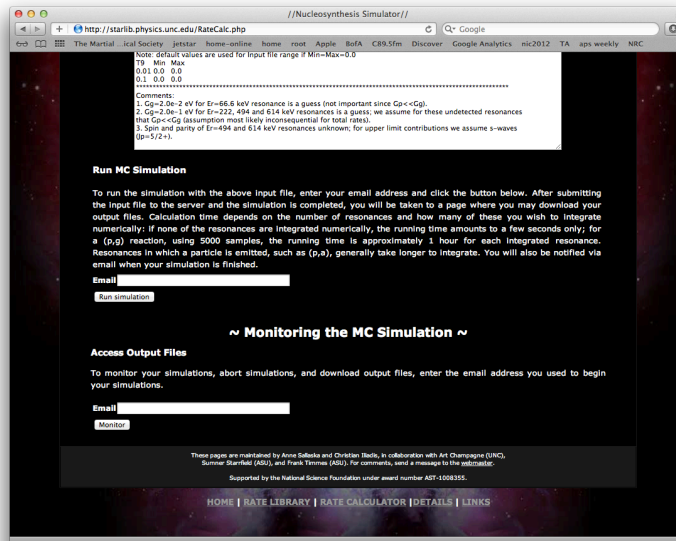


Figure 7: Rate Calculator, starting the Monte Carlo simulations and accessing output files.

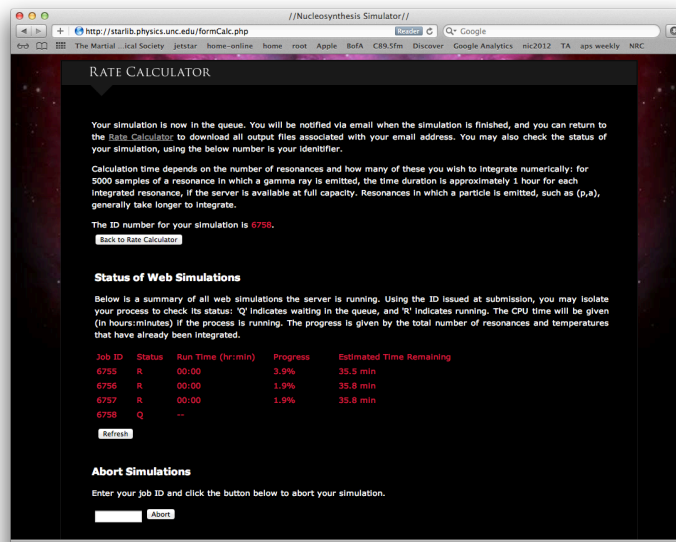


Figure 8: Rate Calculator, upon submission of a simulation.

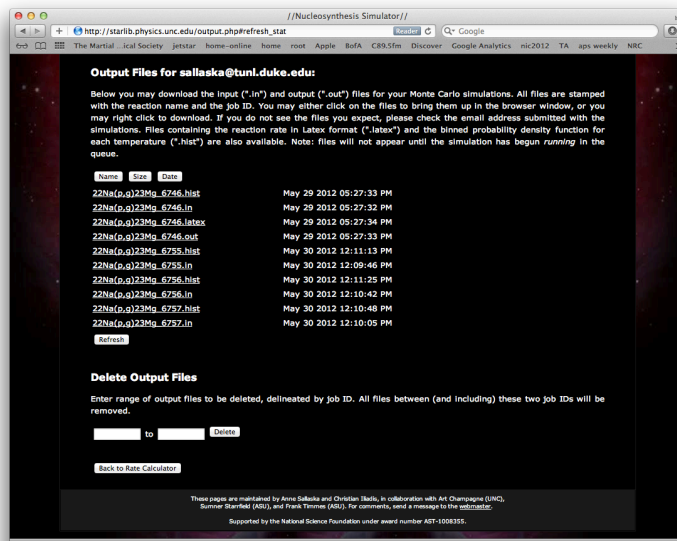


Figure 9: Rate Calculator, accessing output files.

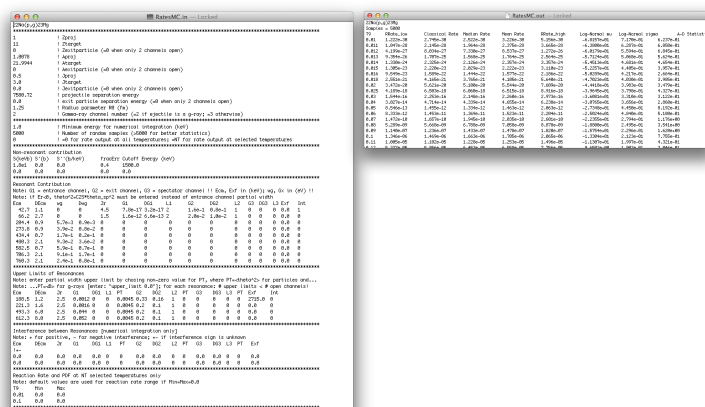


Figure 10: Examples of input files (left) and output files (right).

4 Details

Details about STARLIB may be accessed at starlib.physics.unc.edu/Details.php. Topics included on this division of the webpage are:

- Construction of the library
- Library formatting
- References and links to original papers
- Information on STARLIB updates
- Details on the special case of ^{26}Al

A screen capture of this page is shown in Fig. 11.

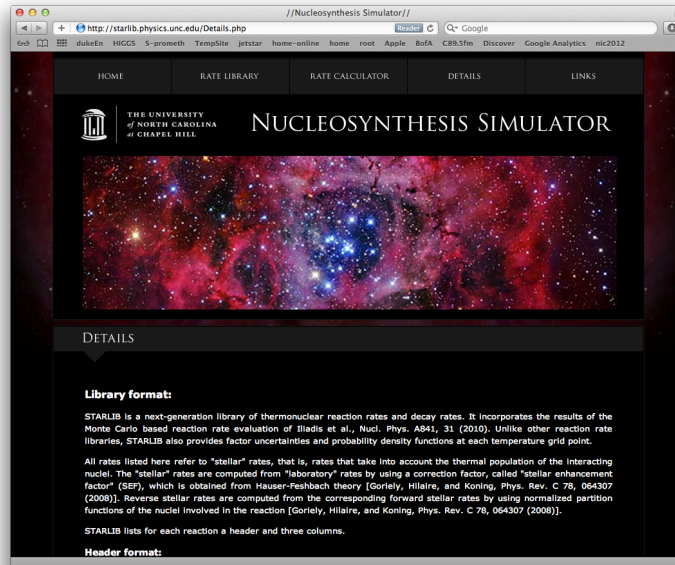


Figure 11: Details, homepage.

References

- [1] R. Longland et al. *Nucl. Phys. A*, 841:1–30, October 2010.
- [2] C. Iliadis et al. *Nucl. Phys. A*, 841:31–250, October 2010.
- [3] C. Iliadis, R. Longland, A. E. Champagne, and A. Coc. *Nucl. Phys. A*, 841:251–322, October 2010.
- [4] C. Iliadis, R. Longland, A.E. Champagne, and A. Coc. *Nucl. Phys. A*, 841:323–388, October 2010.
- [5] A. L. Sallaska et al., to be submitted (2012).