Updates on the ChANUREPS Reaction Rate Library

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A few words about ChANUREPS

ChANUREPS is an open-access platform where nuclear reaction rates of astrophysical interest can be exchanged and other users can find them easily and all in the same simple format.

Why use ChANUREPS?

- ChANUREPS (http://chanureps.chetec-infra.eu/) is meant to be a useful service for the community to allow any scientist that calculated or measured a new rate and would like to have this advertised and used more by the community, to quickly share it once published.

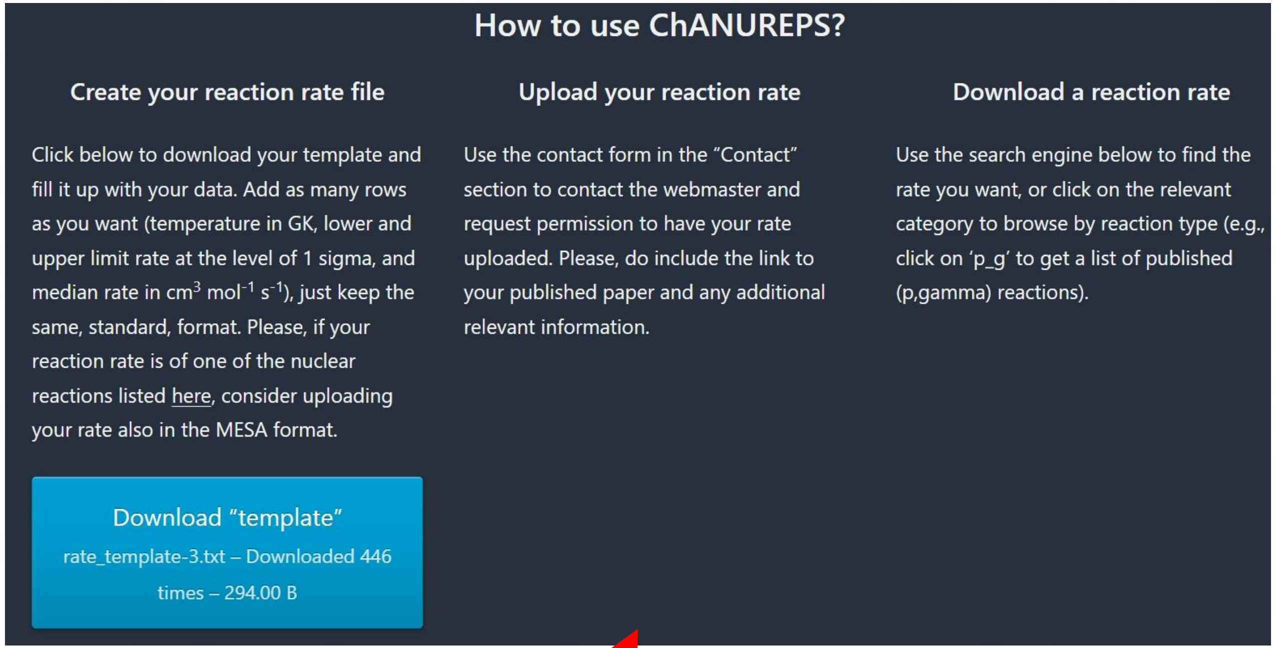
- Additionally, on ChANUREPS users can find some of the newest evaluations and measurements of nuclear reaction rates in a single place, together with their related publications.

A few words about ChANUREPS

The main difference between ChANUREPS and the main nuclear libraries for astrophysics is that there is not any "superuser" selection, or recommended set of nuclear reactions.

New nuclear rates are directly provided by the authors in a standard format once published and inserted into their relevant categories, in order to be quickly found and downloaded by other users.

As soon as a new reaction rate measurement/evaluation is published, it can be submitted following the **simple instructions** and using the template provided at the bottom of the homepage.



Present Status of ChANUREPS

34 Nuclear reactions available and 39 reaction rates available.

Nuclear reactions per category:

- (a,n): 3
- (n,a): 1
- (n,p): 1
- (p,a): 3
- (p,g): 18
- (t,n): 1
- (a,g): 5
- (^{3}He, p): 1

All reaction rates available (except the ^{14}N(p,g)^{15}O from Imbriani et al. 2005) were published between 2014 and 2023.

Present Status of ChANUREPS

Several reaction rates downloaded over 200 times, many (~40% of total) downloaded more than 100 times.

All the most recent rates by LUNA are available. For some nuclear reaction, rates from both LUNA and JUNA are provided.

$^{25}Mg(p,g)^{26}Al_g$

Laird et al. 2022

A re-evaluation of the $^{25}Mg(p,g)^{26}Al_g$ reaction rate based on updated nuclear data. This reaction produces ^{26}Al in the ground state ($^{26}Al_g$).

Link to the paper

Download "Mg25pg_laird"
Mg25pg_laird.txt – Downloaded 117 times – 2.64 KB

Zhang et al. 2023

Updated thermonuclear $^{25}Mg(p,\gamma)^{26}Al_g$ reaction rates implementing the results of a complete experimental investigation of the Ec.m.= 92, 130, and 189 keV resonances with the Jinping Underground Nuclear Astrophysics (JUNA) Experimental Facility. This reaction produces ^{26}Al in the ground state ($^{26}Al_g$). The authors also provided the total rate (available for download below), including the contribution of both channels producing the ground and isomer state of ^{26}Al.

Link to the paper.

Download "25Mgpg_groundstate_JUNA"
25Mgpg_groundstate_JUNA.txt – Downloaded 106 times – 25 KB

Download "25Mgpg_totalrate_JUNA"
25Mgpg_total_JUNA.txt – Downloaded 223 times – 26 KB

$^{22}Ne(a,n)^{25}Mg$

Adsley et al. 2021

A reevaluation of both $^{22}Ne(a,n)^{25}Mg$ and $^{22}Ne(a,g)^{26}Mg$ reaction rates using updated nuclear data from a number of sources including updating spin and parity assignments.

Link to the publication: PHYSICAL REVIEW C 103, 015805 (2021)

Download "22Ne(a,n)25Mg Adsley et al. 2021"
Ne22alphan_Ad21-1.txt – Downloaded 219 times – 3.02 KB

Nuclear reaction rates for MESA

MESA is one of the most popular and performant 1D stellar evolution codes in the scientific community.

In the most recent MESA code revisions, the NACRE nuclear database is the default source for nuclear reaction rates at all times (unless the user overwrites the rates with input tables), while the JINA-Reaclib database is adopted only if a rate is not in NACRE. This represents a significant change compared to older revisions, where setting the JINA-Reaclib database as default was an option.

Thus, in order to use a different reaction rate instead of NACRE in MESA, the user needs to insert a table in the dedicated MESA data directory. In particular, there are more than 50 rates that are significantly different between NACRE and JINA-Reaclib (see list below). So tabulated rates for these nuclear reactions are definitely of interest to the MESA community.

- $^{26}Al_g(p,g)^{27}Si$
- $^{27}Al(p,a)^{24}Mg$
- $^{27}Al(p,g)^{28}Si$
- $^{10}B(n,a)^{7}Li$
- $^{11}B(p,g)^{12}C$
- $^{11}B(p,n)^{11}C$
- $^{9}Be(a,n)^{12}C$
- $^{9}Be(p,a)^{6}Li$
- $^{9}Be(p,d)^{8}Be$
- $^{9}Be(p,n)^{9}B$
- $^{11}C(a,p)^{14}N$
- $^{12}C(a,g)^{16}O$
- $^{12}C(p,g)^{13}N$
- $^{13}C(a,n)^{16}O$
- $^{1}H(p,e^{+})^{2}H$
- $^{2}H(d,n)^{3}He$
- $^{2}H(d,p)^{3}H$
- $^{2}H(a,g)^{6}Li$
- $^{2}H(p,g)^{3}He$
- $^{3}H(a,g)^{7}Li$
- $^{3}H(d,n)^{4}He$
- $^{3}He(a,g)^{7}Be$
- $^{4}He(2a,g)^{12}C$
- $^{4}He(a,n)^{9}Be$
- $^{6}Li(p,a)^{3}He$
- $^{7}Li(a,n)^{10}B$
- $^{7}Li(p,g)^{8}Be$
- $^{24}Mg(p,g)^{25}Al$
- $^{25}Mg(n,a)^{22}Ne$
- $^{25}Mg(p,g)^{26}Al_g$
- $^{25}Mg(p,g)^{26}Al_m$
- $^{26}Mg(p,g)^{27}Al$
- $^{13}Ng(p,g)^{14}O$
- $^{14}N(a,g)^{18}F$
- $^{14}N(p,a)^{11}C$
- $^{14}N(p,g)^{15}O$
- $^{15}N(a,g)^{19}F$
- $^{15}N(p,g)^{16}O$
- $^{22}Na(p,g)^{23}Mg$
- $^{23}Na(p,a)^{20}Ne$
- $^{23}Na(p,g)^{24}Mg$
- $^{20}Ne(a,g)^{24}Mg$
- $^{20}Ne(p,g)^{21}Na$
- $^{21}Ne(p,g)^{22}Na$
- $^{22}Ne(a,g)^{26}Mg$
- $^{22}Ne(a,n)^{25}Mg$
- $^{22}Ne(p,g)^{23}Na$
- $^{16}O(a,g)^{20}Ne$
- $^{16}O(p,g)^{17}F$
- $^{17}O(p,a)^{14}N$
- $^{17}O(p,g)^{18}F$
- $^{18}O(a,g)^{22}Ne$
- $^{18}O(p,a)^{15}N$
- $^{18}O(p,g)^{19}F$
- $^{28}Si(p,g)^{29}P$

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- $^{21}Ne(p,g)^{22}Na$
- $^{22}Ne(a,g)^{26}Mg$
- $^{22}Ne(a,n)^{25}Mg$
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Future plans

- New published reaction rates are always welcome on ChANUREPS! (Again, no “superuser”/”official” rates selection).
- Advertise ChANUREPS within your collaboration (worked and keeps working very well with LUNA).
- ChANUREPS publication, in collaboration with M. Pignatari et al.

Thank you!

Grazie!