THE IMPACT OF SYSTEMATIC AND STATISTICAL NUCLEAR UNCERTAINTIES ON THE I-PROCESS NUCLEOSYNTHESIS

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i-process in early AGB phase





i-process in early AGB phase





i-process in early AGB phase





I-process in early AGB phase





Radiative Neutron Capture Rates



THE IMPACT OF SYSTEMATIC AND STATISTICAL NUCLEAR UNCERTAINTIES ON THE I-PROCESS NUCLEOSYNTHESIS Statistics



Model B: based on phenomenological models Cst-T + SMLO



2 parameters affecting the photon strength function

Radiative Neutron Capture Rates



Non-correlated Uncertainties

Backward-Forward Monte Carlo approach

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2 parameters affecting the photon strength function (shift and width)



Radiative Neutron Capture Rates



Non-correlated **Uncertainties**

> Backward-Forward Monte Carlo approach

 \rightarrow Random combinations of these 4 parameters to probe statistical uncertainties of (n,g) reactions

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2 parameters affecting the photon strength function (shift and width)





Radiative Neutron Capture Rates



parameters to probe statistical uncertainties of (n,g) reactions



Radiative Neutron Capture Rates - Parameters uncertainty range constrain by model uncertainties



SYSTEMATIC AND STATISTICAL NUCLEAR UNCERTAINTIES ON THE I-PROCESS NUCLEOSYNTHESIS THE IMPACT



Radiative Neutron Capture Rates - Extension to non-experimental (n,g) reactions





Effect of statistical uncertainties on the surface enrichment of early AGB stars





Maximum and minimum (n,g) theoretical rates (862 nuclei) (with 4-parameter variation s.t. $f_{rms} \le 2.0$)

 \rightarrow Random combination of maximum and minimum rates for a large number of stellar models (n>50)

2)	3)	• • • • • • • • • • • • • • • • • • • •	862)	
32(n,g)	Si32(n,g)		Pu252(n,g)	
Max	Min	••••••	Min	
Max	Min	•••••	Max	
Min	Min	•••••	Max	
••••	••••	•••••	••••	
Min	Max	•••••	Min	

Effect of statistical uncertainties on the surface enrichment of early AGB stars









Effect of statistical uncertainties on the surface enrichment of early AGB stars







Effect of statistical uncertainties on the surface enrichment of early AGB stars

Uncorrelated parameter uncertainties





Identify important (n,g) reactions during the i-process in AGB stars





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Identify important (n,g) reactions during the i-process in AGB stars

Identifying important reactions by studying correlation between:

 \rightarrow distribution of max and min (n,g) rates

 \rightarrow distribution of final surface abundances





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NetGen

Nuclear Network Generator



CHETEC INFRA Links NACRE-II BRUSLIB NACRE RIPL-3 EXFOR ORNL Clemson JINA Reaclib JCPRG

Checking and plotting individual Reaction rates available





- 1 v N v 13 v		
e): 1		
	0.1	
	10.0	
	9	
	● Log ○ Linear	

NetGen

Nuclear Network Generator







Mass Offset
-1
1

NetGen

Nuclear Network Generator









Nuclear Network Generator

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Databases

Barium Star Repository

A database of Barium stars has been created and filled with first data. The data collection is openly available as a GitHub repository and will be reviewed / expanded on a regular basis.

Reaction Network Generator – NetGen



NetGen is a tool for astrophysicists to build up nuclear reaction networks for a given set of reactions, generate tables of nuclear reaction rates on a temperature grid, and to plot the individual reaction rates against temperature.

Nuclear Reaction Rates – ChANUREPS

ChANUREPS ChETEC AstroNUclear REPositorieS

ChANUREPS is a platform where the nuclear-astrophysics community is providing new nuclear reaction rates, and other users can find them easily open source with a simple format. These rates could be used for many research tasks, such as nucleosynthesis calculations, comparison when new rates are becoming available and much more.



The impact of Systematic and Statistical nuclear uncertainties on the i-process nucleosynthesis



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NUCLEAR NETWORK GENERATOR

→ Accessible through chetec-infra.eu/resources/

Identifying important reactions

Interesting reactions such as Possibility to quantify the impact of these reactions, especially for the ones that impact observable

Results consistent for model A

Bi217(n,q)

Compatibility with experiment uncertainties







Effect of statistical uncertainties on the surface enrichment of early AGB stars

STAREVOL code (Siess et al. 2006)

 \rightarrow i-process nucleosynthesis in a 1 Msol at metallicity [Fe/H] = - 2.5 during the proton ingestion event in the early AGB phase with a network nuclear (1160 large species).





Statistical and Systematic uncertainties

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 \rightarrow i-process nucleosynthesis in a 1 Msol at metallicity [Fe/H] = - 2.5 during the proton ingestion event in the early AGB phase with a network (1160 large nuclear species).



