

Modelling uncertainty of the Rhenium-Osmium cosmic clock

Øyvind Brynhildsvoll Svendsen¹

Supervisor: Sijing Shen¹

Co-supervisor: Signe Riemer-Sørensen¹

¹Institute of Theoretical Astrophysics, University of Oslo

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Intro

Methods

- ▶ Fitting Omega to data from Eris
- ▶ Manipulate yields in Omega
- ▶ Main experiments **TODO! rewrite this**
- ▶ Postprocessing

Fitting Ω to data from Eris

- ▶ TODO! rough model
- ▶ TODO! χ^2 -by-eye
- ▶ TODO! data available
- ▶ Steps

Direct Insertion

Mass

Stellar parameters

Neutron star mergers

Time steps

Final model

Manipulate yields in Omega

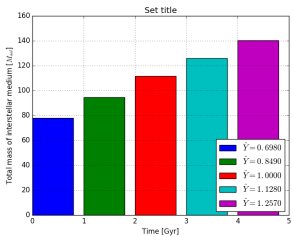
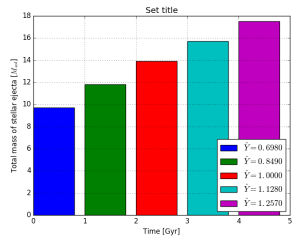
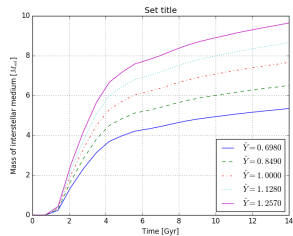
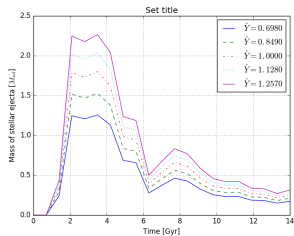
- ▶ Yields from arnould and other **TODO!**
- ▶ Fudge-factors **TODO!**
- ▶ Linear relationship

Table of observed abundances

isotope	standard	min	max	σ_{lower}	σ_{upper}
Re-187	0.0318	0.027	0.0359	-0.1509	0.1289
Re-185	0.0151	0.011	0.0176	-0.2715	0.1656
Os-188	0.0707	0.0633	0.0781	-0.1047	0.1047
Os-189	0.103	0.0961	0.109	-0.067	0.0583
Os-190	0.152	0.137	0.168	-0.0987	0.1053
Os-192	0.273	0.252	0.289	-0.0769	0.0586
Eu-151	0.0452	0.0267	0.0482	-0.4093	0.0664
Eu-153	0.0495	0.046	0.0526	-0.0707	0.0626

Table: Values and uncertainties of r-process nuclei near $^{187}_{75}\text{Re}$ from [1]. The relative uncertainty, σ -values, are calculated on the assumption that min/max are the one-sigma standard deviations in either direction.

Chemical evolution of $^{187}_{75}\text{Re}$



Statistical deviation of $^{187}_{75}\text{Re}$

σ_{init}	$\sigma_{ISM}(z=0)$	$\Sigma\sigma_{ISM}$	$\sigma_{\dot{m}}(z=0)$	$\Sigma\sigma_{\dot{m}}$
-0.302	-0.301887	-0.301887	-0.301887	-0.301887
0.128	0.128931	0.128931	0.128931	0.128931
0.257	0.257862	0.257862	0.257862	0.257862
0	0	0	0	0
-0.151	-0.150943	-0.150943	-0.150943	-0.150943

Main experiments **TODO! rewrite this**

- ▶ Draw random “fudge-factor” from gaussian distribution
- ▶ 1500 individual calculations
- ▶ **Yields**
- ▶ **Yields+IMFslope**
- ▶ **Yields+IMFslope+NSM**

Postprocessing

β^- -decay

- ▶ $\Delta\text{Re} = -\lambda_{\text{Re}}\text{Re}\Delta t$
- ▶ $\Delta\text{Os} = \lambda_{\text{Re}}\text{Re}\Delta t$

Removing negative negative yields

- ▶ $\hat{Y} \leq 0 \rightarrow$ Do not consider calculation

References I



[Arnould et al. (2007)] Arnould, M. and Goriely, S. and Takahashi, K.

The r-process of stellar nucleosynthesis: Astrophysics and nuclear physics achievements and mysteries

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