Resources: python

- https://www.python.org/doc/
- https://jupyter.org/ < jupyter website
- Some books on Python-based Computational Physics:
  - Newman: Computational Physics with Python
  - Cunningham: Python in 24 hours
- stackoverflow.com
- Jupyter servers[1] (we use this for the afternoon activity):
  - wendi.nugridstars.org

[1] F. Herwig, R. Andrassy, N. Annau, O. Clarkson, **B. Côté**, A. D'Sa, S. Jones, B. Moa, J. O'Connell, D. Porter, C. Ritter, and P. Woodward, "Cyberhubs: Virtual Research Environments for Astronomy," ASTROPHYS J SUPPL S, vol. 236, no. 1, p. 2, May 2018.

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NuGrid stellar data set – II. Stellar yields from H to Bi for stellar models with $M_{\rm ZAMS} = 1$–$25\ {\rm M}_{\odot}$ and $Z = 0.0001$–0.02

ABSTRACT

We provide here a significant extension of the NuGrid Set 1 models in mass coverage and towards lower metallicity, adopting the same physics assumptions. The combined data set now includes the initial masses $M_{\rm ZAMS}/{\rm M}_{\odot} = 1, 1.65, 2, 3, 4, 5, 6, 7, 12, 15, 20, 25$ for $Z = 0.02$, 0.01, 0.006, 0.001, 0.0001 with α-enhanced composition for the lowest three metallicities. These models are computed with the MESA stellar evolution code and are evolved up to the AGB, the white dwarf stage, or until core collapse. The nucleosynthesis was calculated for all isotopes in post-processing with the NuGrid MPPNP code. Explosive nucleosynthesis is based on semi-analytic 1D shock models. Metallicity-dependent mass-loss, convective boundary mixing in low- and intermediate-mass models and H and He core burning massive star models are included. Convective O-C shell mergers in some stellar models lead to the strong production of odd-Z elements P, Cl, K, and Sc. In AGB models with hot dredge-up, the convective boundary mixing efficiency is reduced to accommodate for its energetic feedback. In both low-mass and massive star models at the lowest metallicity, H-ingestion events are observed and lead to *i*-process nucleosynthesis and substantial ^{15}N production. Complete yield data tables, derived data products and online analytic data access are provided.

What is your favourite element/isotope?

- We will use a couple of notebooks developed for data analysis and to write scientific papers.
- CCSNe (*Explosion_explorer.ipynb*) and low-mass stars (*Star_explore.ipynb*) available for the activity;
- Make a copy of the notebook, and use the copy. If you break it, you can go back to the original.
- Stellar models are in directory "/data/nugrid_local". You will need to update this in the notebook.
- Activity: Choose the isotope/element that you like, and see where/how it is made.
- Suggestion: check what are the most abundant isotopes made together with your isotope. In what stellar conditions it is made?
- You could work in small groups