

STELLAR EVOLUTION

by

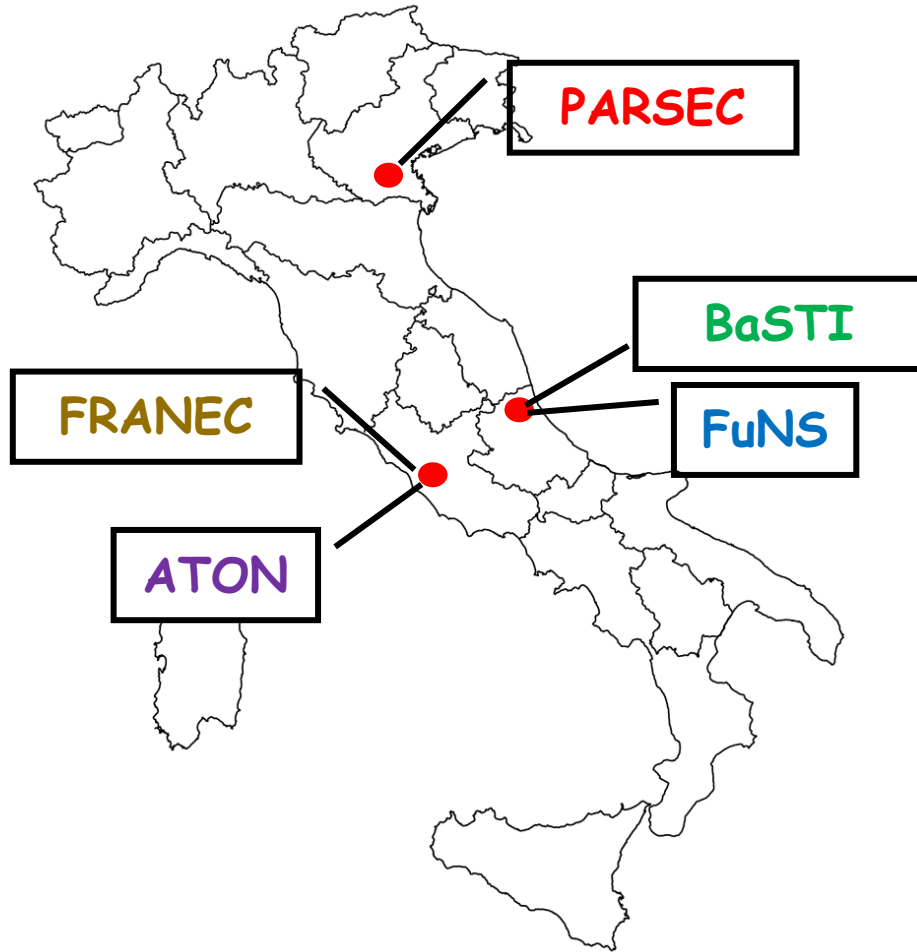
Coordinators of Raggruppamento Scientifico Nazionale 2

Characterization of chemical and physical properties of stars with different initial chemical composition and mass, from their formation to their end (quiescent or explosive)

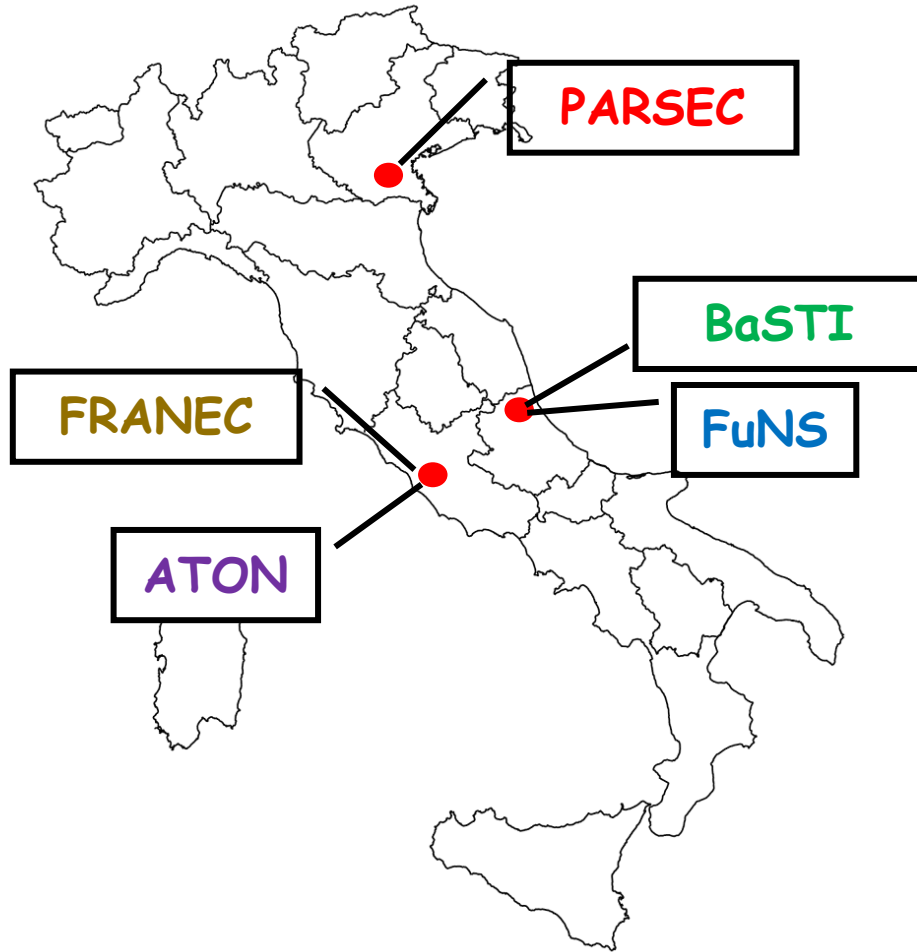
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Comparison between models from different codes provides the most reliable estimate of uncertainties on stellar observables.

STEV index

Welcome to STEV, the OAPd server for stellar models. Here you'll find a series of web services related with stellar evolutionary tracks, isochrones, synthetic photometry, synthetic photometric data, and opacity tables.

Databases

Newest databases:

PARSEC tracks: The latest stellar evolutionary tracks from PARSEC v1.2S (non-rotating) and v2.0 (rotating). This database is kept by Guglielmo Costa.

pulsation: Periods and growth rates of long period variables. Codes and tables described in Michele Trabucchi's papers.

ComarcS: COMARCS/COMA Cool Star Spectra and Photometry, including all data files from Aringer's papers.

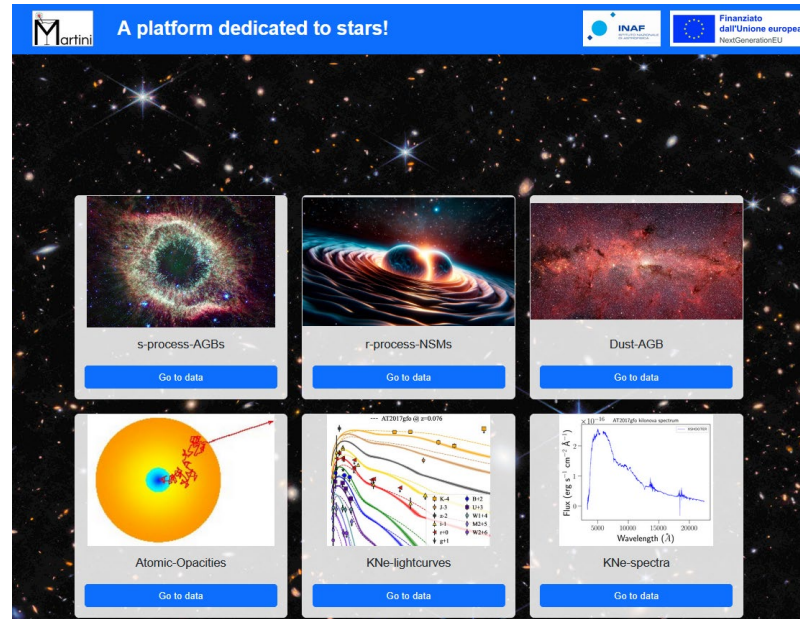
Databases which have not been updated for a while:

The Padova database of evolutionary tracks and isochrones: a (somewhat outdated) repository of static files containing published tracks, isochrones, bolometric corrections, chemical yields, and additional unpublished material (plots, later releases, preprints, etc.).

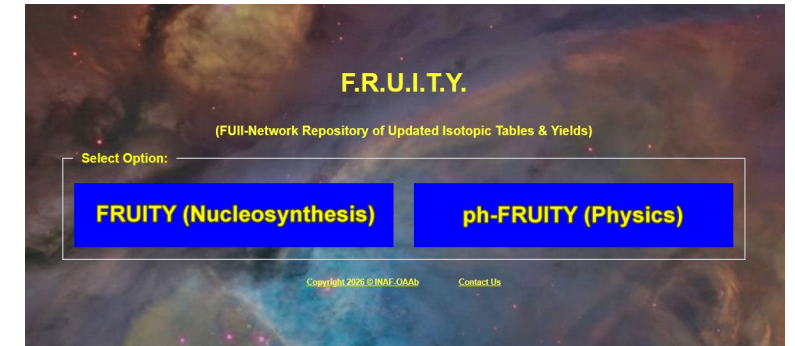
distyAGB07: data files for the calibrated TP-AGB tracks from Marigo & Girardi (2007), and their related optical-to-far-IR isochrones (Marigo et al. 2008). It includes interstellar extinction coefficients as in Girardi et al. (2008). Note: superseded by CMD and YBC.

YZVAR: stellar evolutionary tracks and isochrones for a large region of the Y-Z plane (Bertelli et

<https://stev.oapd.inaf.it/>



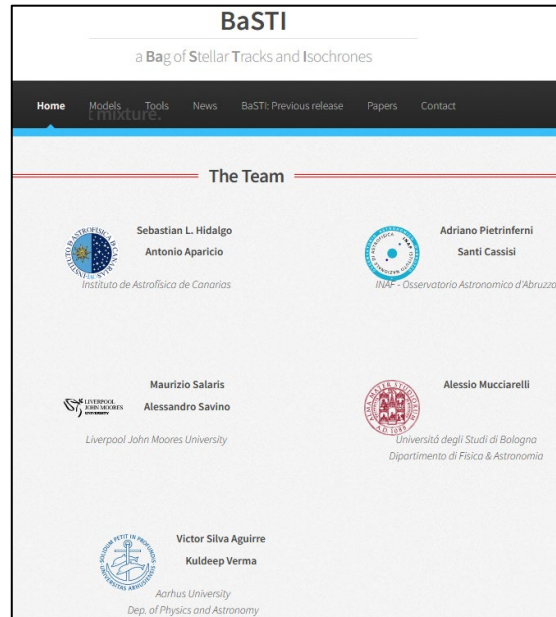
<https://martini.oa-abruzzo.inaf.it/>



<http://fruity.oa-teramo.inaf.it/>



<https://orfeo.oa-roma.inaf.it/>



<http://basti-iac.oa-abruzzo.inaf.it/>

Giornate INAF del RSN2 - Napoli, 13-15 January, 2026

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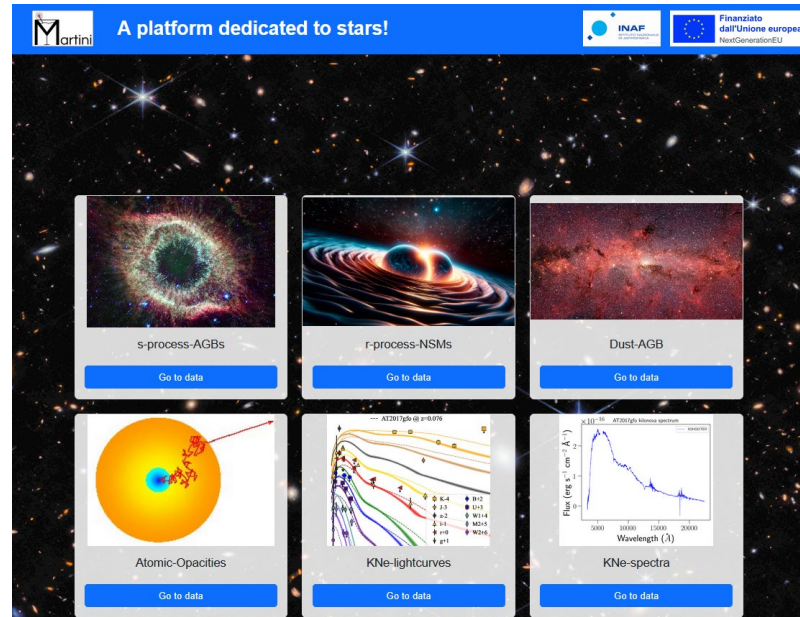
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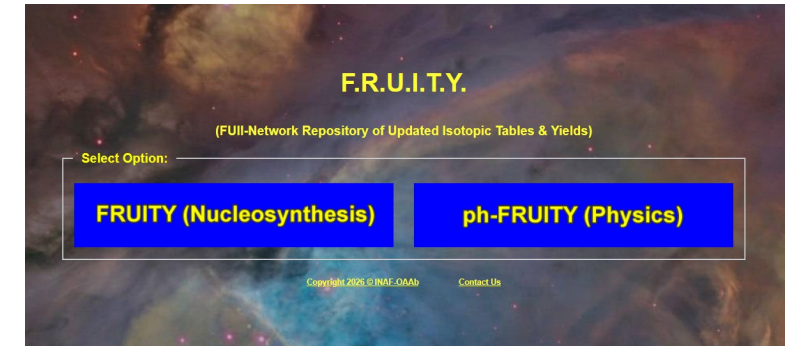
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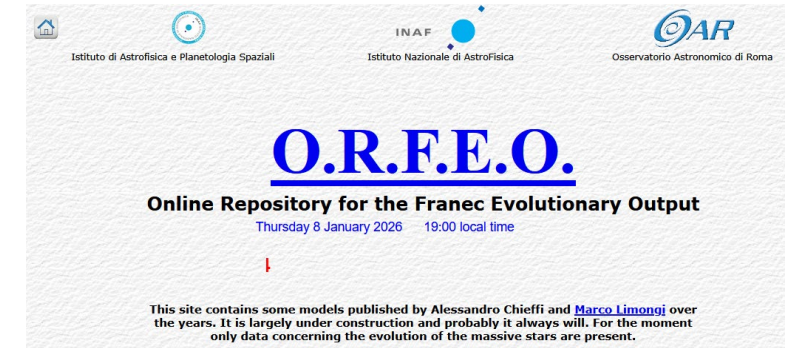
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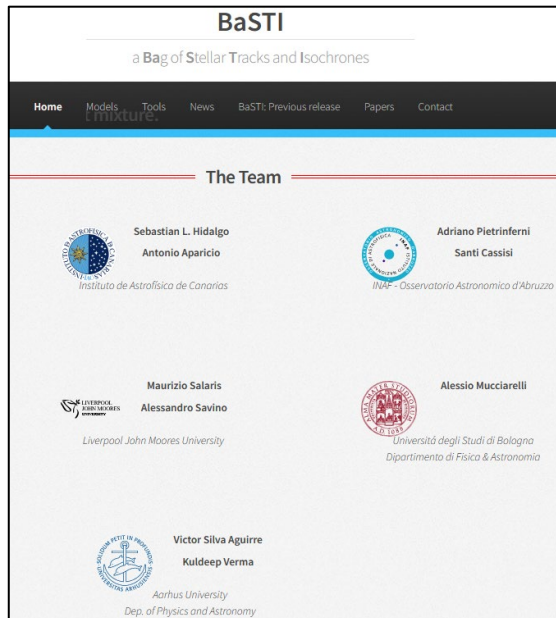
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Population synthesis study
Galactic chemical evolution
Surface Brightness Fluctuations

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Improving Physical Inputs

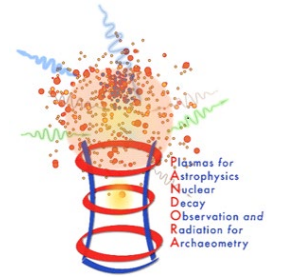
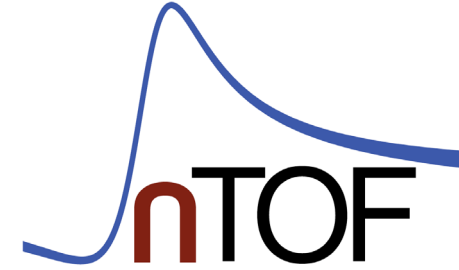
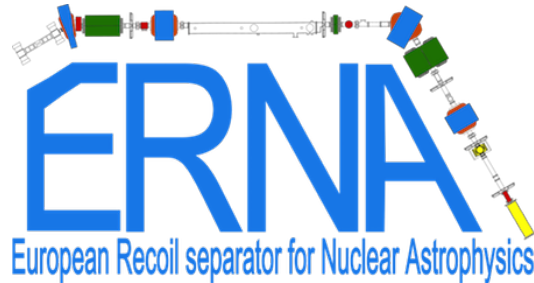
- Improving nuclear cross sections evaluation at astrophysical relevant energies

Improving Physical Inputs

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GIANTS Collaboration

(Collaboration with INFN & ENEA)

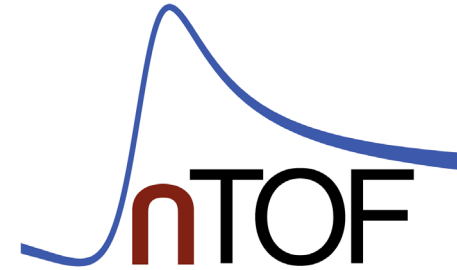


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- Improving the treatment of stellar angular momentum evolution

Rotation affects:

T and ρ distribution

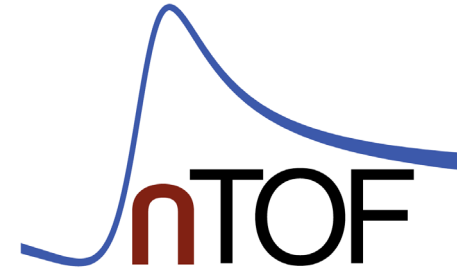
Chemical profiles

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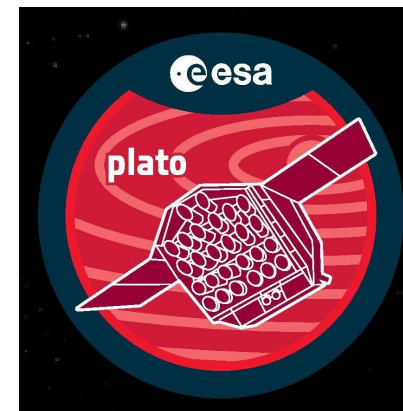
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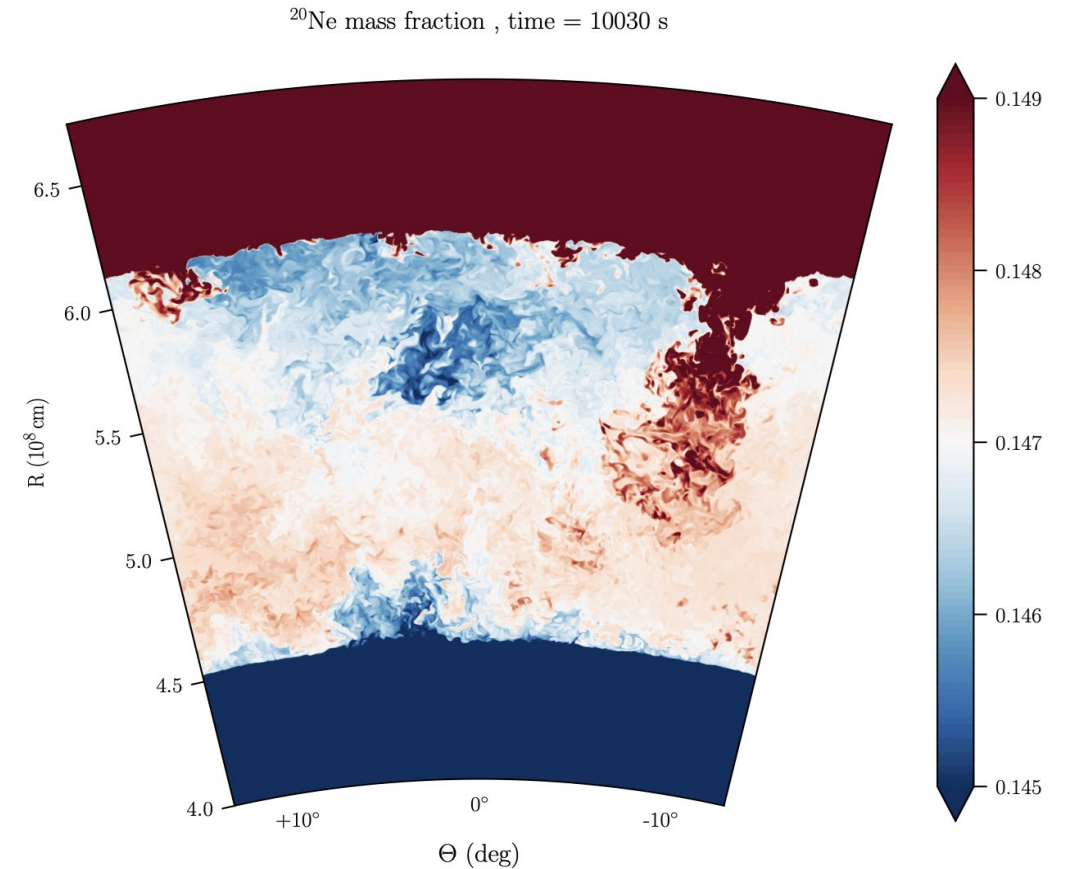
Asteroseismic observations



Improving Physical Inputs

- Developing 3D evolutionary models

Rotation and convection are intrinsically multidimensional phenomena

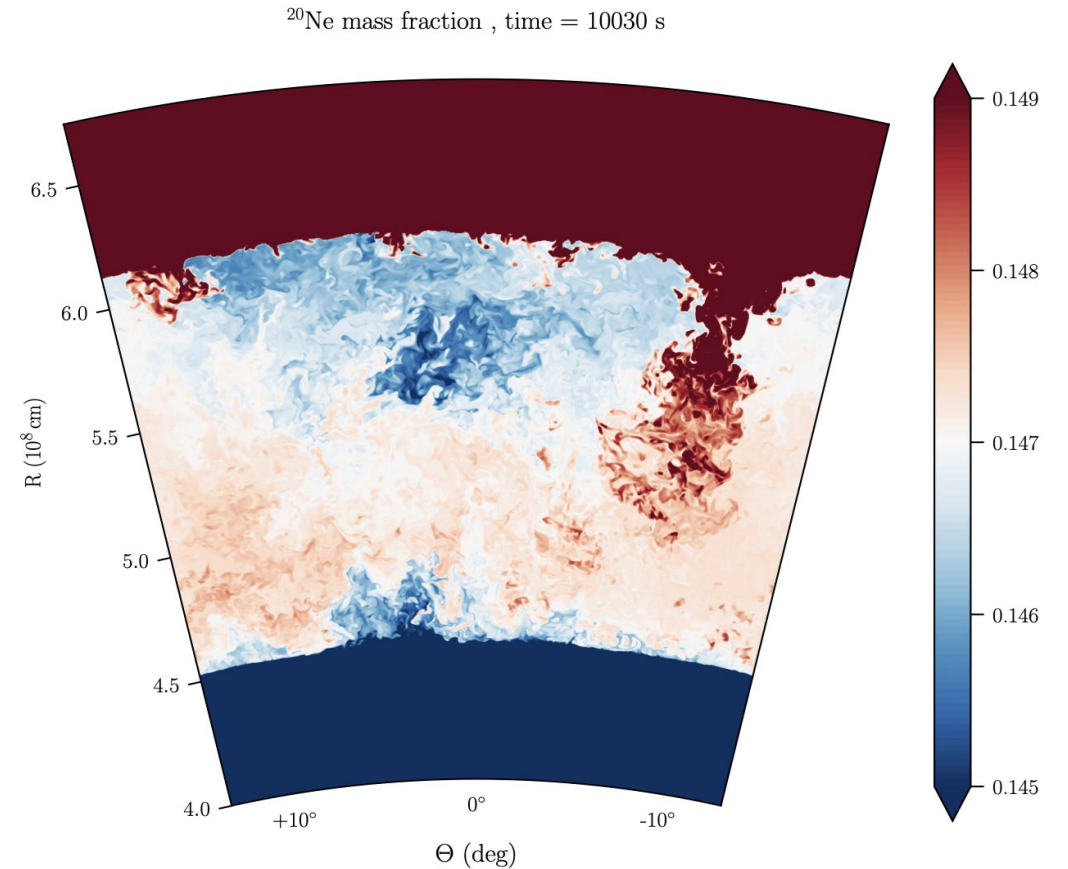


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National Centre for HPC, Big Data and Quantum Computing



Improving Physical Inputs

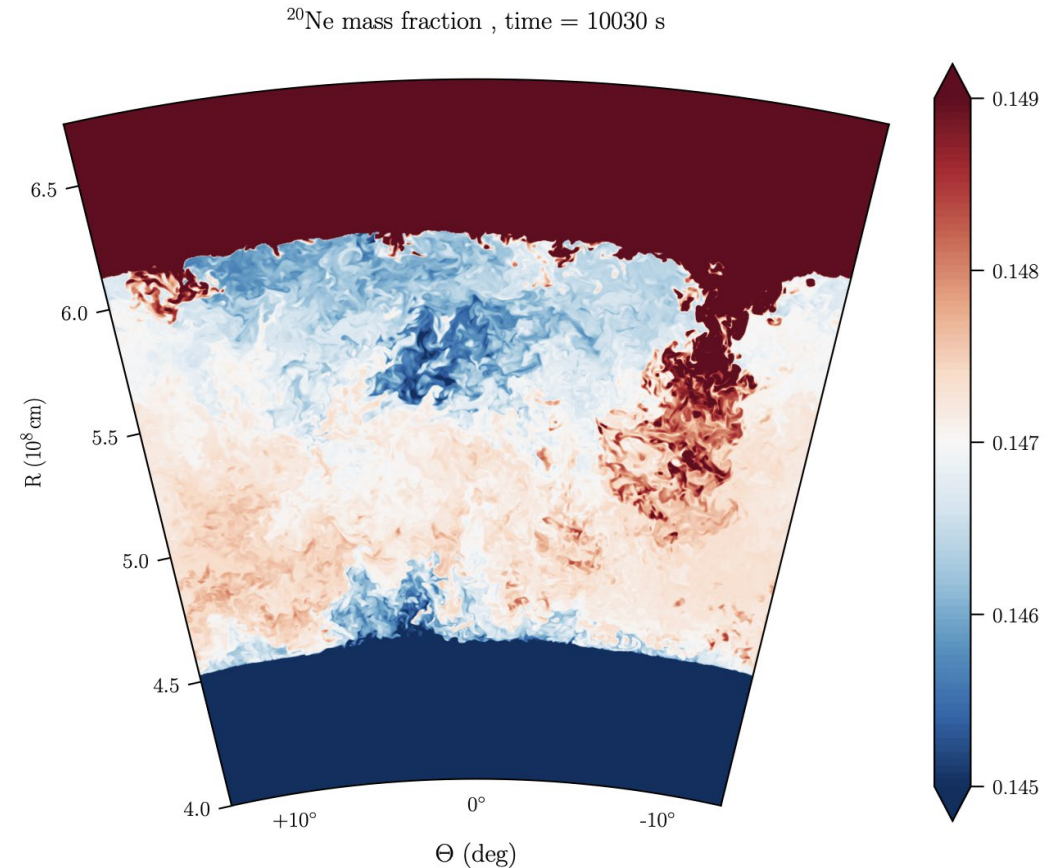
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3D simulations will be used to inform 1D model

More accurate 1D computation

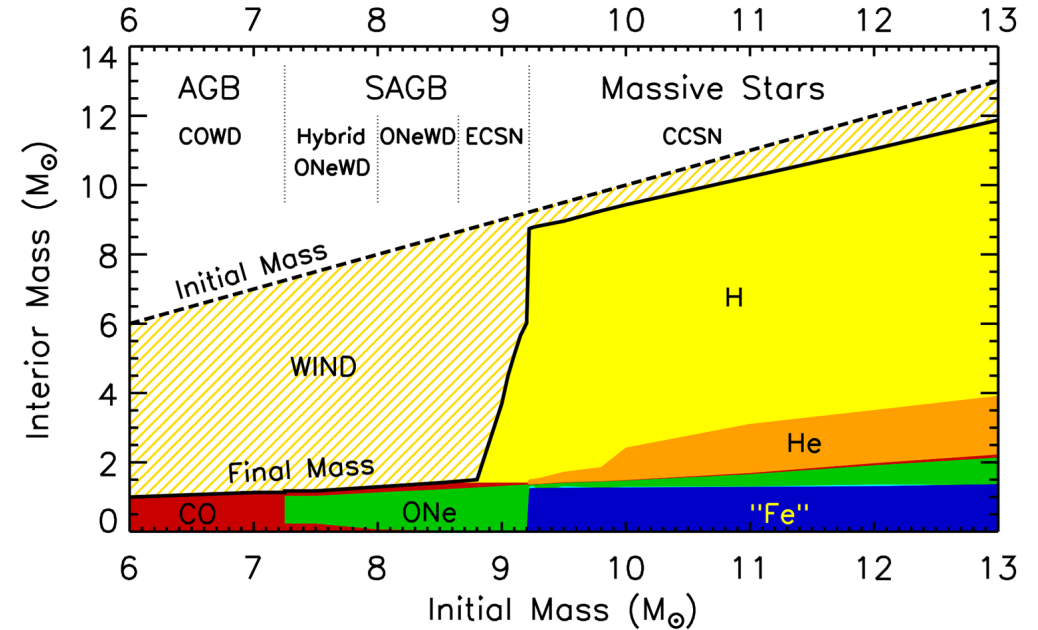


Improving Physical Inputs

- Understanding the physical mechanisms driving mass loss in different evolutionary phases

Initial-to-final mass relation

Yields from stars in the full range of mass



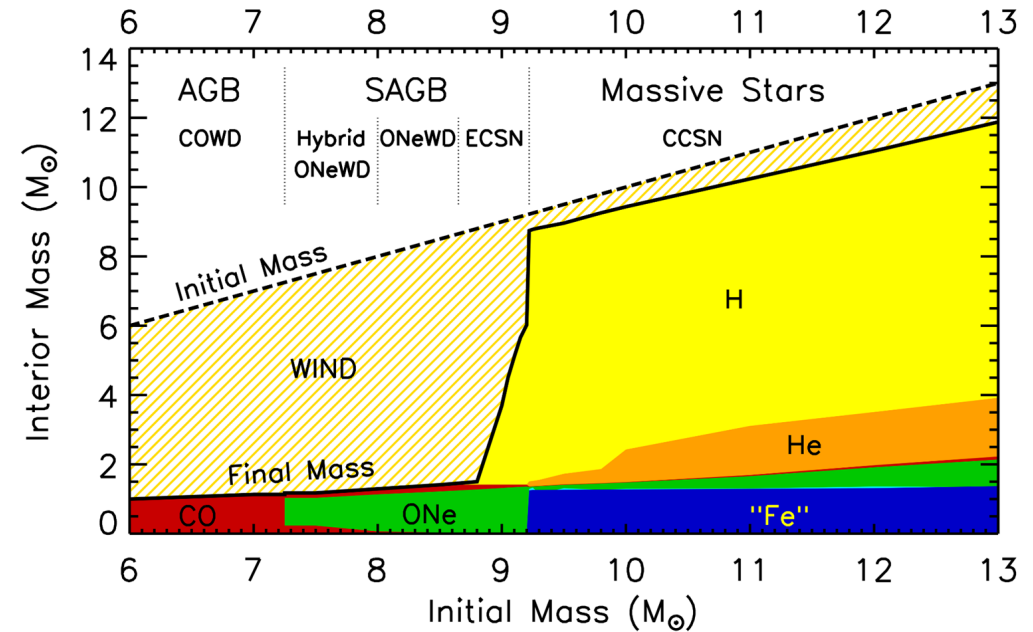
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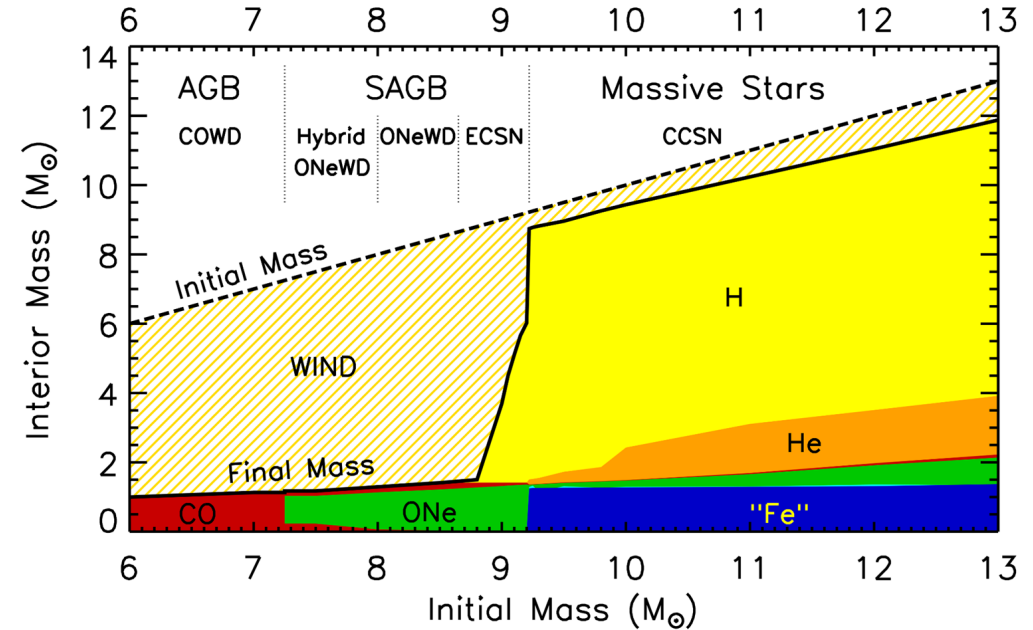
Yields from stars in the full range of mass

→ Chemical evolution of galaxies

IR, millimeter and radio observations of AGB and RGB stars, pulsating stars, O-type stars in MS

UV and X observations of material around exploding massive stars

JWST, ALMA, SKA, ELT, Spitzer, VLT, Rubin-LSST, SOXS, NTE, Athena



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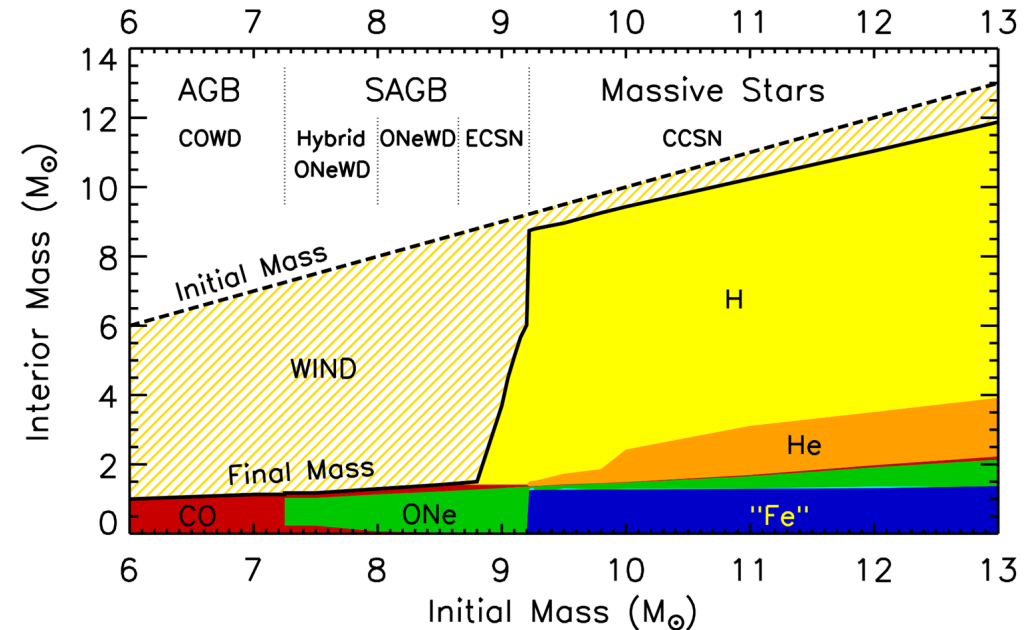
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Improving dust formation codes on the base of observations of dusty environments

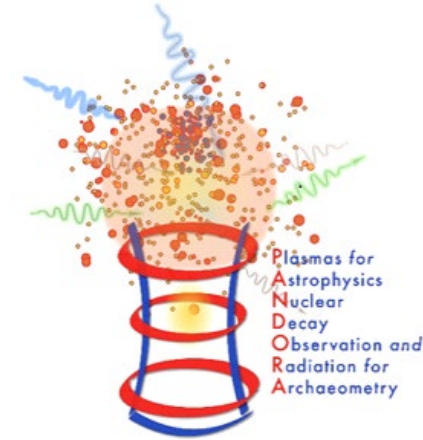


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Improving Physical Inputs

- Improving the description of stellar atmosphere

Optical properties of highly ionized species



Evaluation of more accurate boundary conditions for stellar models

Future Challenges

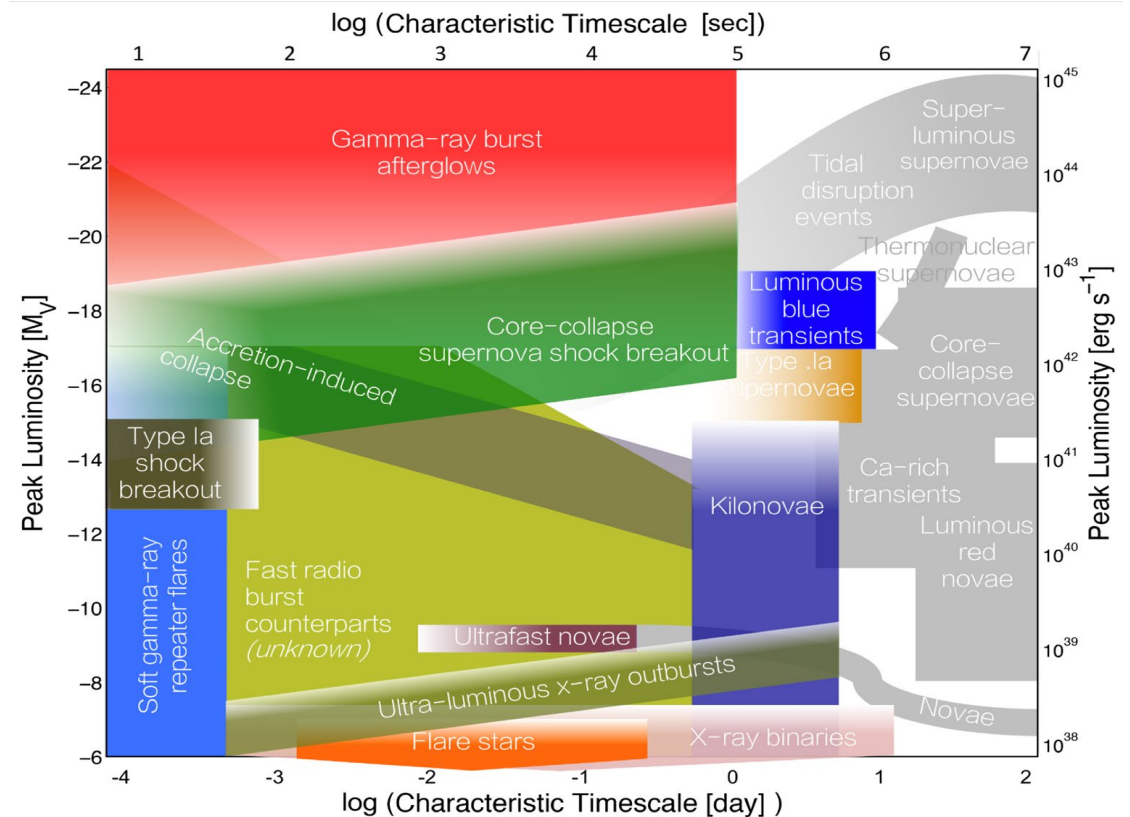
Large synoptic surveys, such as Rubin-LSST, will discover new classes of transient phenomena

What progenitors?

Physical properties

Explosive nucleosynthesis

Variability in binary systems



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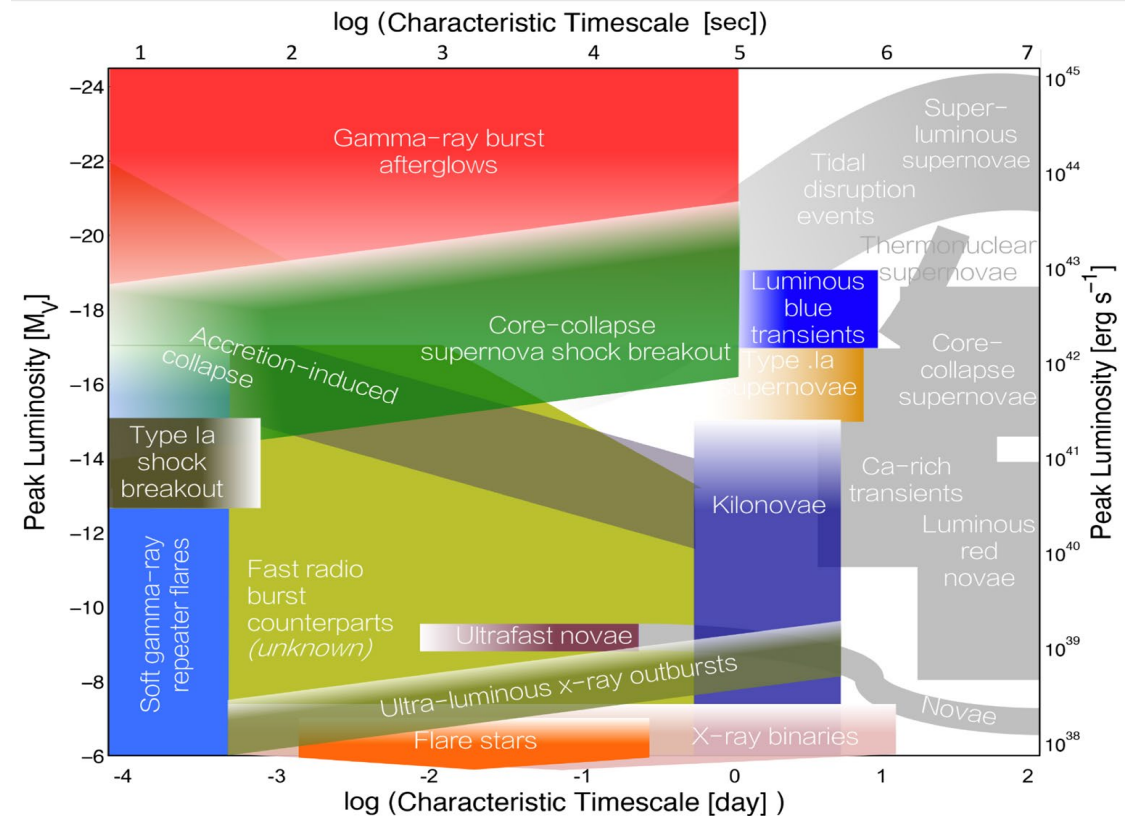
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Future instrumentations

Probing the reionization epoch



MeerKAT

ASKAP

