2.5Mstar

February 25, 2026

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

[3]:
```
import pandas as pd

filename1 = "history.data"

# Find the line with the header (starts with #)
with open(filename1, "r") as f:
    for i, line in enumerate(f):
        if line.startswith("#"):
            header_line = i
            break
h1= pd.read_csv("history.data", delim_whitespace=True, comment="!", header=0)
```

```
/tmp/ipykernel_19714/609677372.py:11: FutureWarning: The 'delim_whitespace'
keyword in pd.read_csv is deprecated and will be removed in a future version.
Use ``sep='\s+'`` instead
  h1= pd.read_csv("history.data", delim_whitespace=True, comment="!", header=0)
```

[4]:
```
h1.head()
```

[4]:

	model_number	num_zones	star_age	log_dt	star_mass	log_xmstar	\
0	1	651	0.000010	-5.000000	2.5	33.696446	
1	5	651	0.000074	-4.683275	2.5	33.696446	
2	10	651	0.000260	-4.287369	2.5	33.696446	
3	15	651	0.000720	-3.891463	2.5	33.696446	
4	20	651	0.001867	-3.495556	2.5	33.696446	

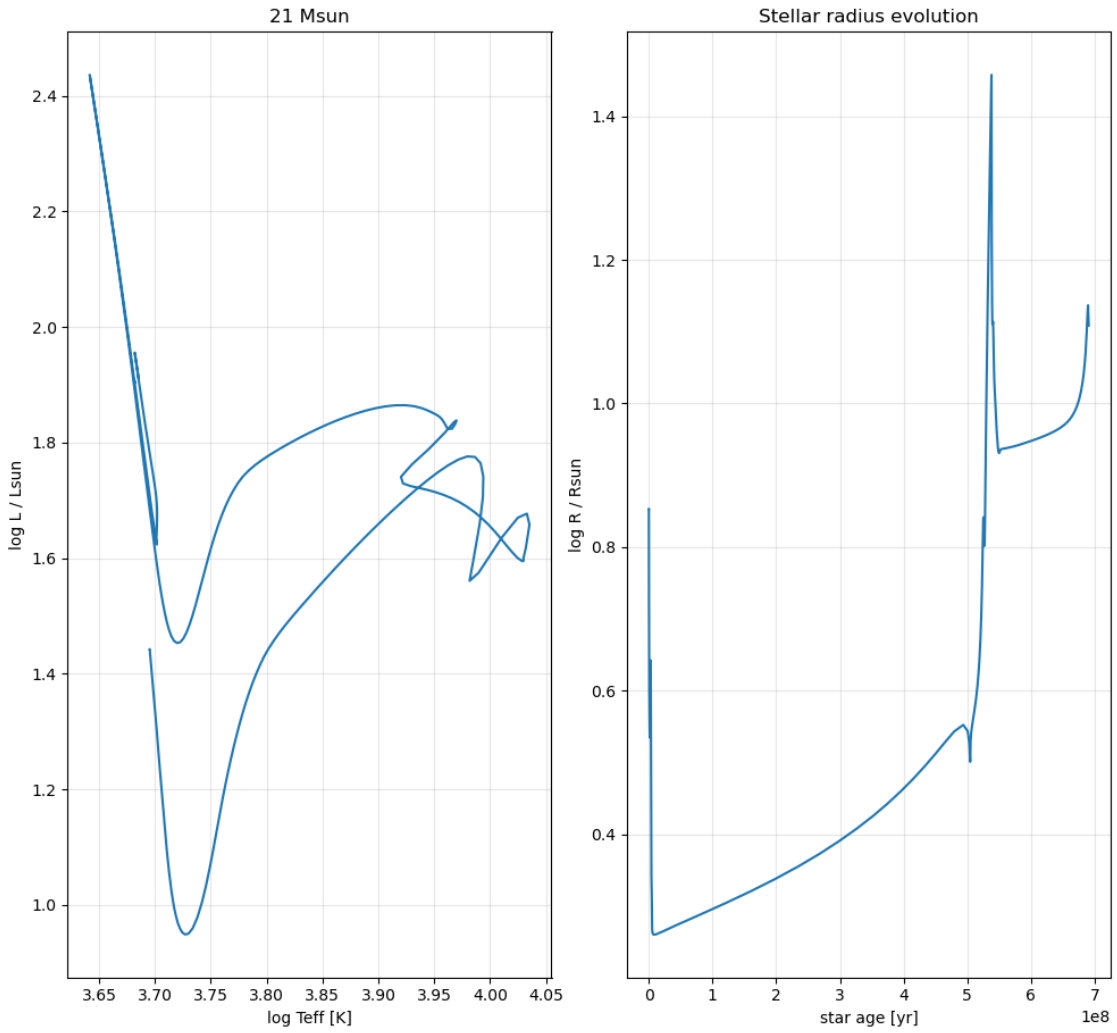
	log_abs_mdot	mass_conv_core	conv_mx1_top	conv_mx1_bot	…	center_h1	\
0	-99.0	0.0	1.0	0.002518	…	0.7	
1	-99.0	0.0	1.0	0.002105	…	0.7	
2	-99.0	0.0	1.0	0.002097	…	0.7	
3	-99.0	0.0	1.0	0.002082	…	0.7	
4	-99.0	0.0	1.0	0.002069	…	0.7	

	center_he4	center_c12	center_o16	surface_c12	surface_o16	\

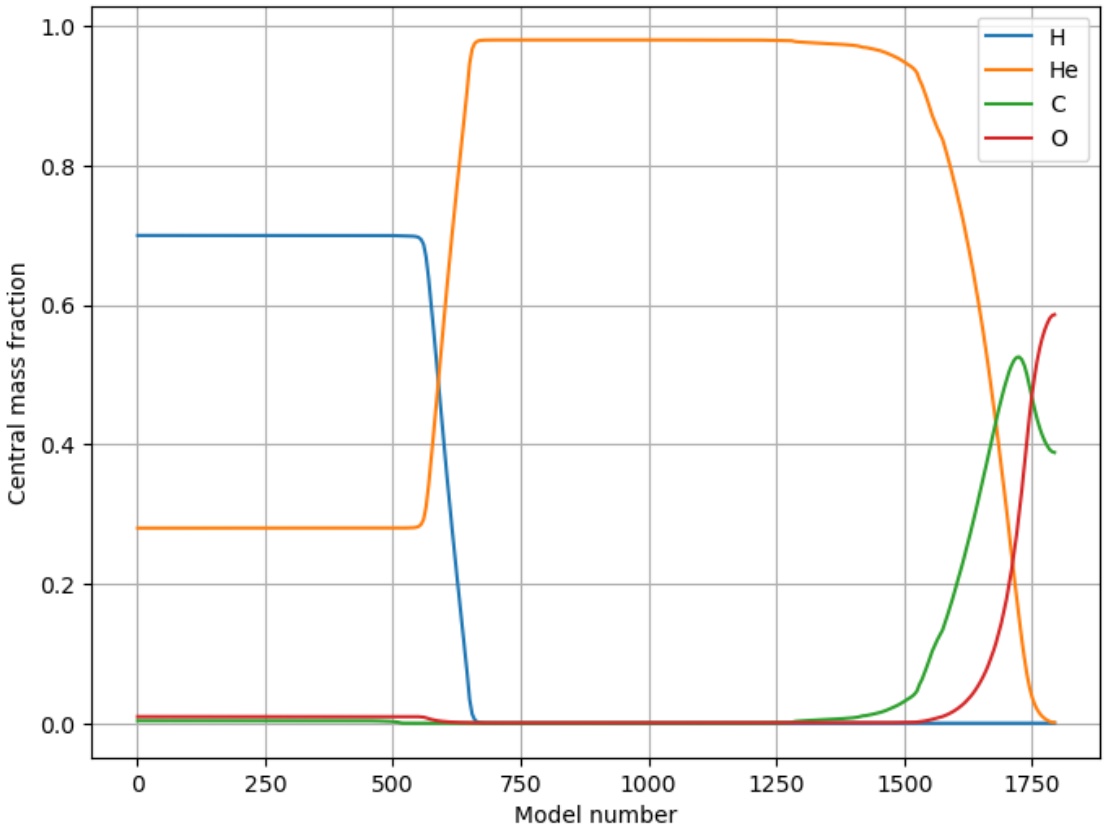
```
0     0.27997    0.003447    0.009381     0.003447     0.009381
1     0.27997    0.003447    0.009381     0.003447     0.009381
2     0.27997    0.003447    0.009381     0.003447     0.009381
3     0.27997    0.003447    0.009381     0.003447     0.009381
4     0.27997    0.003447    0.009381     0.003447     0.009381

   total_mass_h1  total_mass_he4  num_retries  num_iters
0           1.75        0.699926            0          2
1           1.75        0.699926            0          2
2           1.75        0.699926            0          2
3           1.75        0.699926            0          2
4           1.75        0.699926            0          2

[5 rows x 60 columns]
```

[7]:
```python
import matplotlib.pyplot as plt

fig, ax = plt.subplots(nrows=1, ncols=2, figsize=(10, 10))

# HR diagram (top-left)
ax[0].plot(h1['log_Teff'], h1['log_L'], linestyle='-')
ax[0].set_xlabel('log Teff [K]')
ax[0].set_ylabel('log L / Lsun')
ax[0].invert_xaxis()
ax[0].set_title('21 Msun')

# Radius evolution (top-right)
ax[1].plot(h1['star_age'], h1['log_R'], linestyle='-')
ax[1].set_xlabel('star age [yr]')          # or /1e9 for Gyr
ax[1].set_ylabel('log R / Rsun')
ax[1].set_title('Stellar radius evolution')



# Optional: overall title
fig.suptitle('2.5 Mstar  ', fontsize=14)

for a in ax.flat:
    a.grid(True, alpha=0.3)
    try:
        if 'Teff' in a.get_xlabel():
            a.invert_xaxis()
    except:
        pass

plt.tight_layout(rect=[0, 0, 1, 0.96])
plt.show()
```

2.5 Mstar



[6]:
```
fig2, ax2 = plt.subplots(figsize=(8,6))

ax2.plot(h1['model_number'], h1['center_h1'], label='H')
ax2.plot(h1['model_number'], h1['center_he4'], label='He')
ax2.plot(h1['model_number'], h1['center_c12'], label='C')
ax2.plot(h1['model_number'], h1['center_o16'], label='O')

ax2.set_xlabel('Model number')
ax2.set_ylabel('Central mass fraction')
ax2.legend()
ax2.grid(True)
plt.show()
```


H
He
C
O
Central mass fraction
Model number
0.0
0.2
0.4
0.6
0.8
1.0
0
250
500
750
1000
1250
1500
1750

[ ]: