

## Minilab 3: Evolution along the Main Sequence

### 1 Reporting Quantities near the TAMS

We now want to watch evolution along the Main Sequence. Previously, you saved a ZAMS model of your selected mass. Time to put that model to use!

Using the same `inlist_project`, `inlist_pgstar`, `history_columns.list`, and `run_star_extras`, modify the `&star_job` section of your `inlist_project` to tell the model not to start on the pre-main sequence, but rather to load in your saved model:

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```
create_pre_main_sequence_model = .false.  
load_saved_model = .true.  
saved_model_name = '<your selected mass between 3 and 100>ZAMS.mod'
```

---

and, for good measure, set

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```
save_model_when_terminate = .true.  
save_model_filename = '<your selected mass between 3 and 100>TAMS.mod'
```

---

so that you do not overwrite your ZAMS.mod file.

We want to observe evolution along the Main Sequence, so we will update the stopping condition:

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```
stop_near_zams = .false.
```

---

For consistency among our crowd-sourced runs, we will define our new stopping condition (in the `&controls` section of your `inlist`) as the time when the central hydrogen fraction of the model falls below 30%, setting:

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```
xa_central_lower_limit_species(1) = 'h1'  
xa_central_lower_limit(1) = 0.3
```

---

Run (`./rn`) the model, and at the end of the run, report all the same quantities as before in your row of the Bildsten tab of the MESA Summer School [Spreadsheet](#).

To reiterate, record the **surface luminosity** ( $L$ , luminosity) in units of  $L_{\odot}$ , **stellar radius** ( $R$ , radius) in units of  $R_{\odot}$ , **central temperature** ( $T_c$ , center\_T) in K, **central density**  $\rho_c$  ( $T_c$ , center\_Rho) in  $\text{g/cm}^3$  **mass of the convective core** ( $M_c$ , mass\_conv\_core) in  $M_{\odot}$ , for your selected mass model **when**  $X_c(h1) = 0.3$ . Also report the **ratio of the radiation pressure to the total pressure** ( $P_{\text{rad}}/P$ ) **at the half-mass coordinate** (which you calculate in `run_star_extras`), at the termination of your run when  $X_c(h1) = 0.3$  in your model.

**Also, stare at the HR diagram,  $P - \rho$ , and  $T - \rho$  pgstar profiles! What do you notice?**