Intro to MesaScript

MESA Summer School 2016
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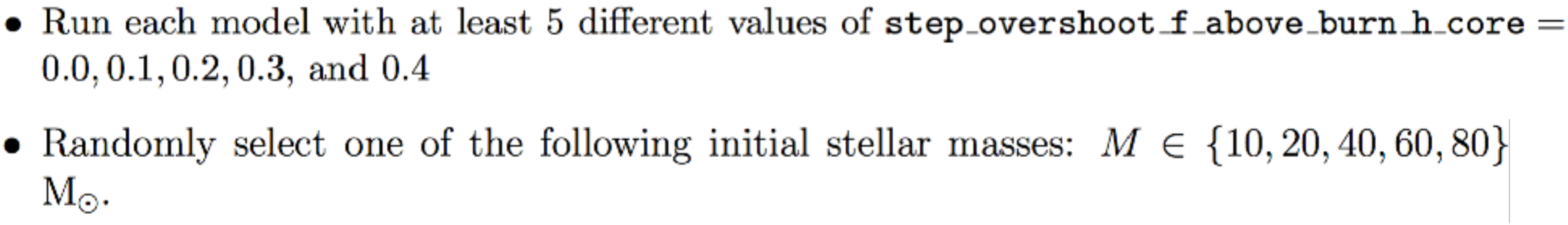
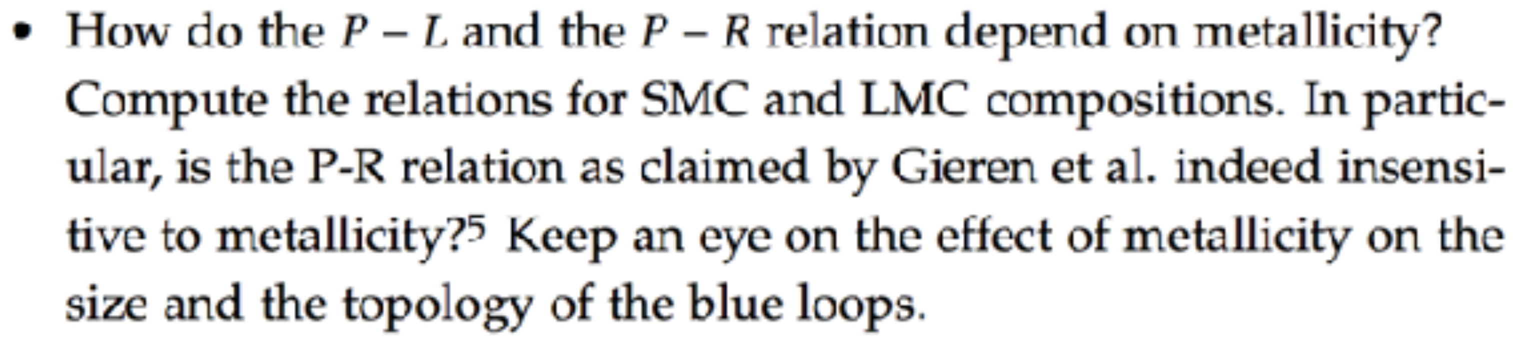
The Use Case

- You need to do many MESA star runs while changing only a few parameters
- You don’t like sed
- You think run_star_extras.f would be overkill
- Example: isochrones (evolve many models to the same age)

In real life



- Run each model with at least 5 different values of `step_overshoot_f_above_burn_h_core` = 0.0, 0.1, 0.2, 0.3, and 0.4
- Randomly select one of the following initial stellar masses: $M \in \{10, 20, 40, 60, 80\}$ $M_\odot$.



- How do the $P - L$ and the $P - R$ relation depend on metallicity? Compute the relations for SMC and LMC compositions. In particular, is the P-R relation as claimed by Gieren et al. indeed insensitive to metallicity?[5] Keep an eye on the effect of metallicity on the size and the topology of the blue loops.

{and the entire premise of today's labs}

THERE’S GOT TO BE A BETTER WAY!

What is MesaScript?

- A **D**omain **S**pecific **L**anguage built on top of Ruby
- Uses inlist-like syntax to mass-produce inlists
- Brings **variables, conditionals, loops,** and **functions** to inlists
- Sensibly organizes and typechecks inlists

Common Workflow (for me)

- Identify key parameters that need to be varied
- Code up a method that takes those parameters as arguments and creates an inlist
- Executing file (`ruby my_script.rb`) iterates through parameter values, firing off MESA runs for each combination

Demo: Overshoot Labs

Key Syntax

- `require ‘mesa_reader’`: tells ruby to actually load mesa_script (makes the `Inlist` class available)
- `Inlist.make_inlist`: Creates a named file based on the code that follows (inside `do…end`)
- NO namelists! MesaScript figures that out.
- Ruby literals, not fortran literals (`true`, not `.true.`)

Assignments

- *Scalars:* `initial_mass 2.333` *or*
  `initial_mass(2.333)`
  (parens optional in ruby calls if unambiguous)
  NOT `initial_mass = 2.333`
  (simply a declaration)

- *Vectors:*
  `xa_central_lower_limit[1] = 1e-3` *or*
  `xa_central_lower_limit(1, 1e-3)` *or*
  `xa_central_lower_limit(1, 1e-3)`
  NOT `xa_central_lower_limit(1) = 1e-3`

Get Started Quick!

- Rarely start an inlist from scratch
- Instead, start with existing inlist and tweak it
- Convert an inlist to mesascript quickly with included
  ```
  inlist2mesascript INLIST_FILE MESASCRIPT_FILE
  ```
- Resulting file, when executed, recreates the original inlist, but clean up and with no comments

FAQ

- Q: “Why didn’t you write this in python?”

  A: “Python isn’t so good at metaprogramming and has inflexible syntax, but I’m looking into it… slowly.”

- Q: “Seriously, I’d like to use this on my cluster, but they don’t have ruby installed, so… Python version?”

  A: “Check out `rvm.io`. RVM (**r**uby **v**ersion **m**anager) is… a ruby version manager (think anaconda for ruby) that doesn’t require root privileges”.

How can I get this?

- `gem install mesa_script`
- that's it…
- Fuller documentation/installation instructions at http://wmwolf.github.io/MesaScript/
- It's technically extensible to other namelist-y things, so you could **very** easily make minor changes to make this work with **`binary`**… perhaps even **`GYRE`**