

# Minilab 3: Brown Dwarf Edge

## 1 Standard Abundances

We are now going to look at a narrower mass range than before. Generate a random number between  $M = 0.06 M_{\odot}$  and  $M = 0.10 M_{\odot}$ , and change the initial mass in your inlist:

---

```
initial_mass = <your random mass between 0.06,0.10>
```

---

Change the maximum age to 1 Gyr:

---

```
max_age = 1d9
```

---

Report the luminosity at the end of the run on the spreadsheet. Now change the maximum age to 10 Gyr:

---

```
max_age = 10d9
```

---

Restart from a recent photo, and again report the luminosity on the spreadsheet when the run finishes. We should now have

- Mass
- Luminosity at 1 Gyr
- Luminosity at 10 Gyr

## 2 Helium Rich

Now let's change the initial abundances and see what changes. This time we'll start with models that are helium enriched ( $Y = 0.38$ ) and somewhat hydrogen depleted ( $X = 0.60$ ). Add this to the `&controls` section of your inlist:

---

```
initial_y = 0.38
```

---

MESA will automatically adjust the hydrogen abundance to account for the increased presence of helium. You'll notice that your inlist also specifies `initial_z = 0.02`, which sets the total metal abundance to  $Z = Z_{\odot}$  with solar ratios. The hydrogen mass fraction that MESA will set is then

$$X = 1.0 - Y - Z$$

Repeat the steps from the previous part, and once again report on the spreadsheet

- Mass
- Luminosity at 1 Gyr
- Luminosity at 10 Gyr