

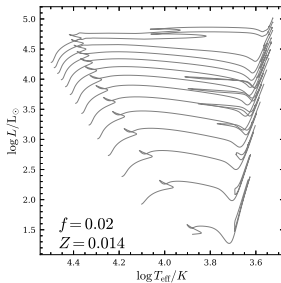
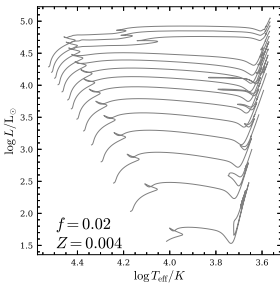
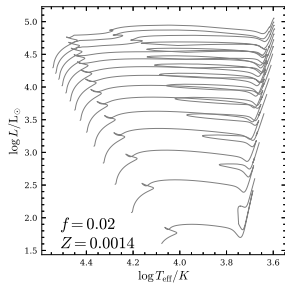
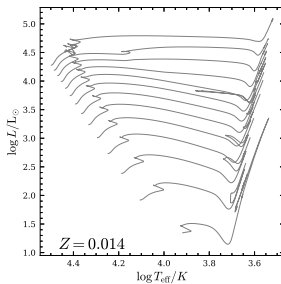
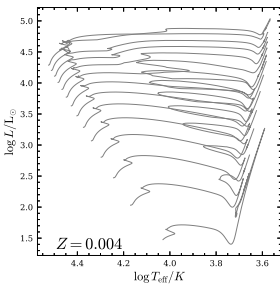
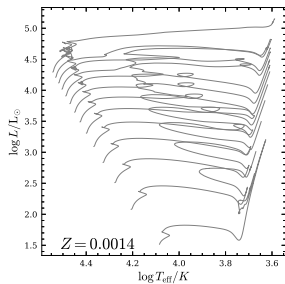
CAMK Annual Meeting 2024

Oliwia Ziólkowska
4th year PhD student

supervisor: Radek Smolec

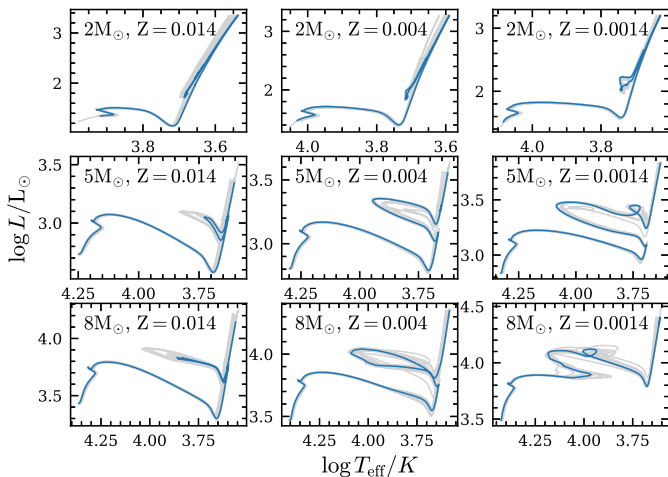


Uncertainties in the evolutionary tracks of medium-mass stars with MESA



Uncertainties in the evolutionary tracks of medium-mass stars with MESA

For each M , Z we have a [reference model](#) (blue) and 22 other models (grey) from various sets.

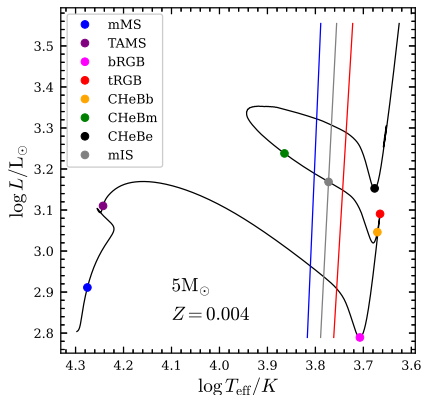


Set	Varied options
RES_A	time_delta_coeff = 0.50 + mesh_delta_coeff = 0.50
RES_B	time_delta_coeff = 0.25 + mesh_delta_coeff = 0.50
RES_C	time_delta_coeff = 0.50 + mesh_delta_coeff = 0.25
RES_D	time_delta_coeff = 0.25 + mesh_delta_coeff = 0.25
RES_E	time_delta_coeff = 1.00 + mesh_delta_coeff = 1.00 + default MESA resolution controls
MLT_A	Heney (Heney et al. 1965)
MLT_B	ML1 (Böhm-Vitense 1958)
MLT_C	Cox (Cox & Giuli 1968)
MLT_D	Mihalas (Mihalas 1978)
ATM_A	model atmosphere tables (Hauschildt et al. 1999a,b; Castelli & Kurucz 2003)
ATM_B	$T - \tau$ relation Eddington
ATM_C	$T - \tau$ relation Krishna_Swamy (Krishna Swamy 1966)
ATM_D	$T - \tau$ relation solar_Hopf (Paxton et al. 2013)
ATM_E	$T - \tau$ relation Trampedach_solar (Ball 2021; Trampedach et al. 2014)
NET_A	$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ from Kunz et al. (2002) + $^{14}\text{N}(\alpha, \gamma)^{15}\text{O}$ from Cyburt et al. (2010) + pp_and_cno_extras.net
NET_B	$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ from Kunz et al. (2002) + $^{14}\text{N}(\alpha, \gamma)^{15}\text{O}$ from Cyburt et al. (2010) + mesa49.net
NET_C	$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ from Angulo et al. (1999) + $^{14}\text{N}(\alpha, \gamma)^{15}\text{O}$ from Cyburt et al. (2010) + pp_and_cno_extras.net
NET_D	$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ from Kunz et al. (2002) + $^{14}\text{N}(\alpha, \gamma)^{15}\text{O}$ from Angulo et al. (1999) + pp_and_cno_extras.net
NET_E	$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ from Angulo et al. (1999) + $^{14}\text{N}(\alpha, \gamma)^{15}\text{O}$ from Angulo et al. (1999) + pp_and_cno_extras.net
CONV_A	Predictive Mixing + Schwarzschild criterion
CONV_B	Predictive Mixing + Ledous criterion
CONV_C	Sign Change + Schwarzschild criterion
CONV_D	Predictive Mixing + Schwarzschild criterion + including predictive mixing in the envelope
MIX_A	Asplund et al. (2009)
MIX_B	Grevesse & Sauval (1998)
MIX_C	Grevesse & Noels (1993)
DIFF_A	atomic diffusion off
DIFF_B	atomic diffusion on
INT3_A	cubic interpolation of opacity tables off
INT3_B	cubic interpolation of opacity tables on

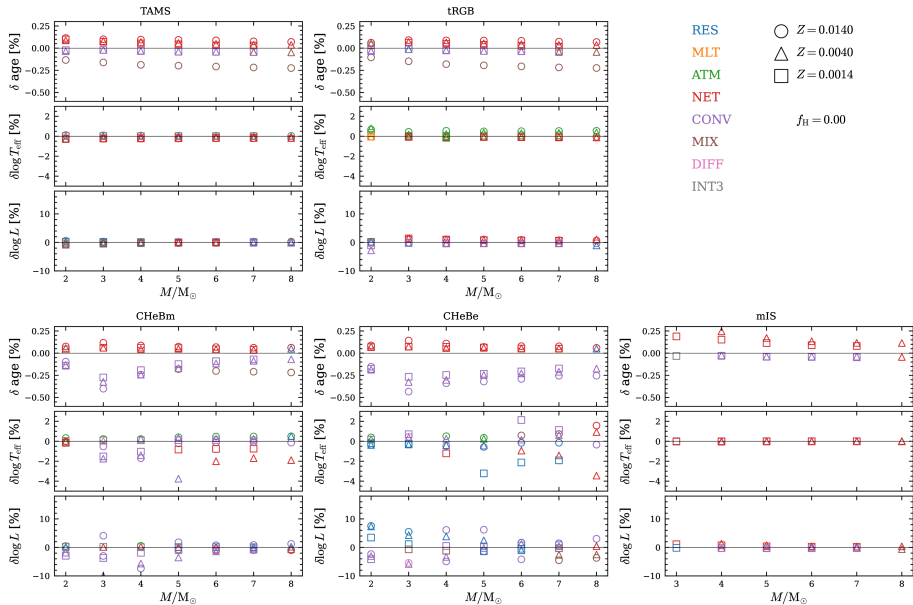
Benchmark points

We estimate uncertainties at 8 specific stages of evolution:

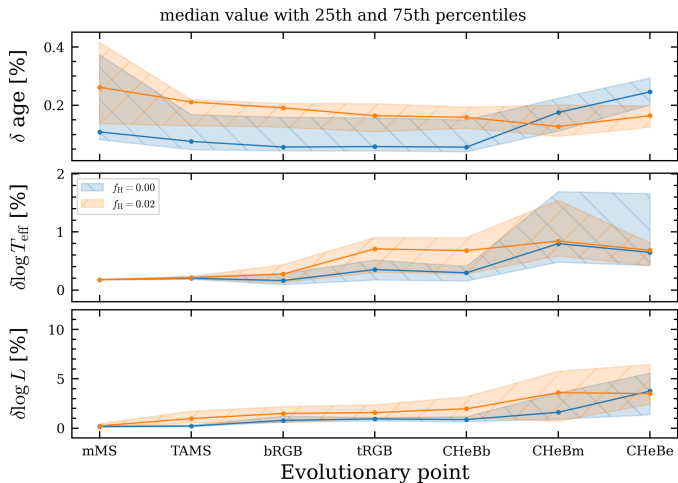
- ★ mMS (middle of Main Sequence)
- ★ TAMS (Terminal Age Main Sequence)
- ★ bRGB (base RGB)
- ★ tRGB (tip RGB)
- ★ CHeBb (Core Helium Burning, begin)
- ★ CHeBm (Core Helium Burning, middle)
- ★ CHeBe (Core Helium Burning, end)
- ★ mIS (middle of Instability Strip)



Uncertainties at various stages of evolution



Median from all masses and metallicities overshooting vs. canonical



Other activities

- ★ Poster presented on the 41th Polish Astronomical Society Meeting in Toruń
- ★ Talk during student conference KSAKN in Kraków
- ★ Organising a summer practice on stellar evolution in MESA for Warsaw University student Zofia Piszczek

Evolution and pulsation of cepheids in eclipsing binaries

