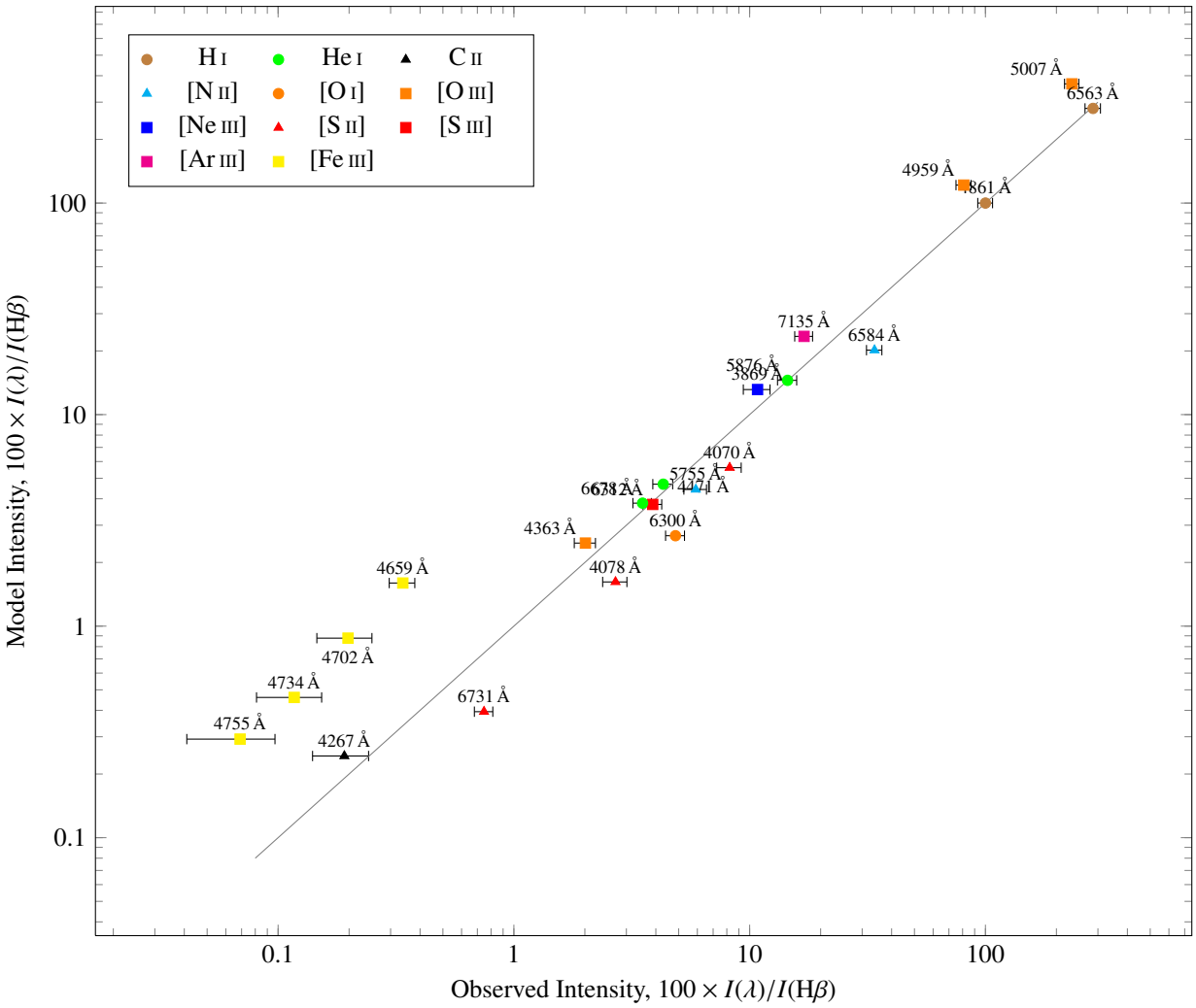
Model A: Baseline model

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.50$

Abundance set Cloudy Orion



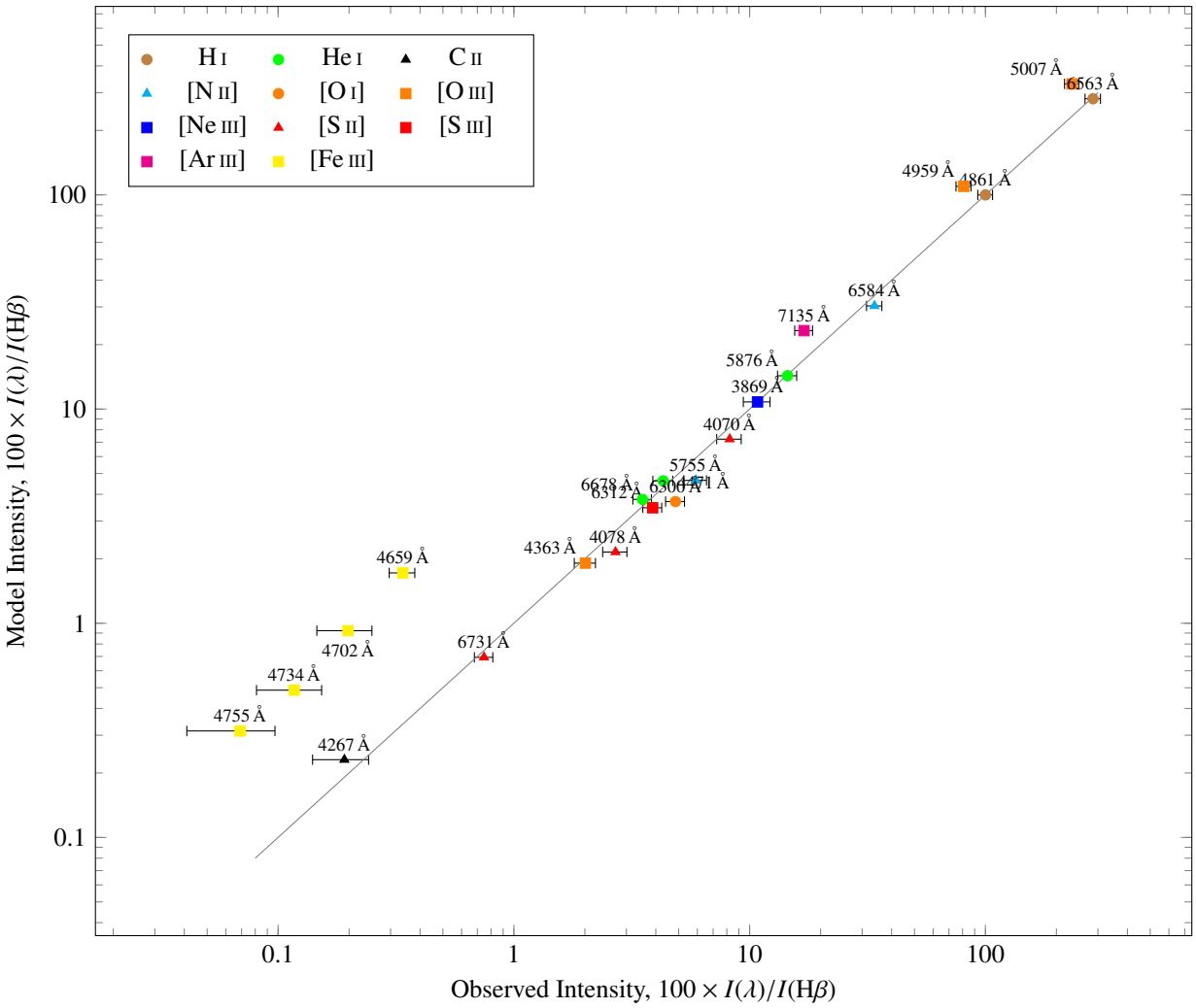
- Significant disagreement with observations
- Low ionization lines are too weak; high ionization lines are too strong
- Iron lines are far too strong – presumably due to abundance
- Same for Argon line

Model B: Lower flux

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.20$

Abundance set Cloudy Orion



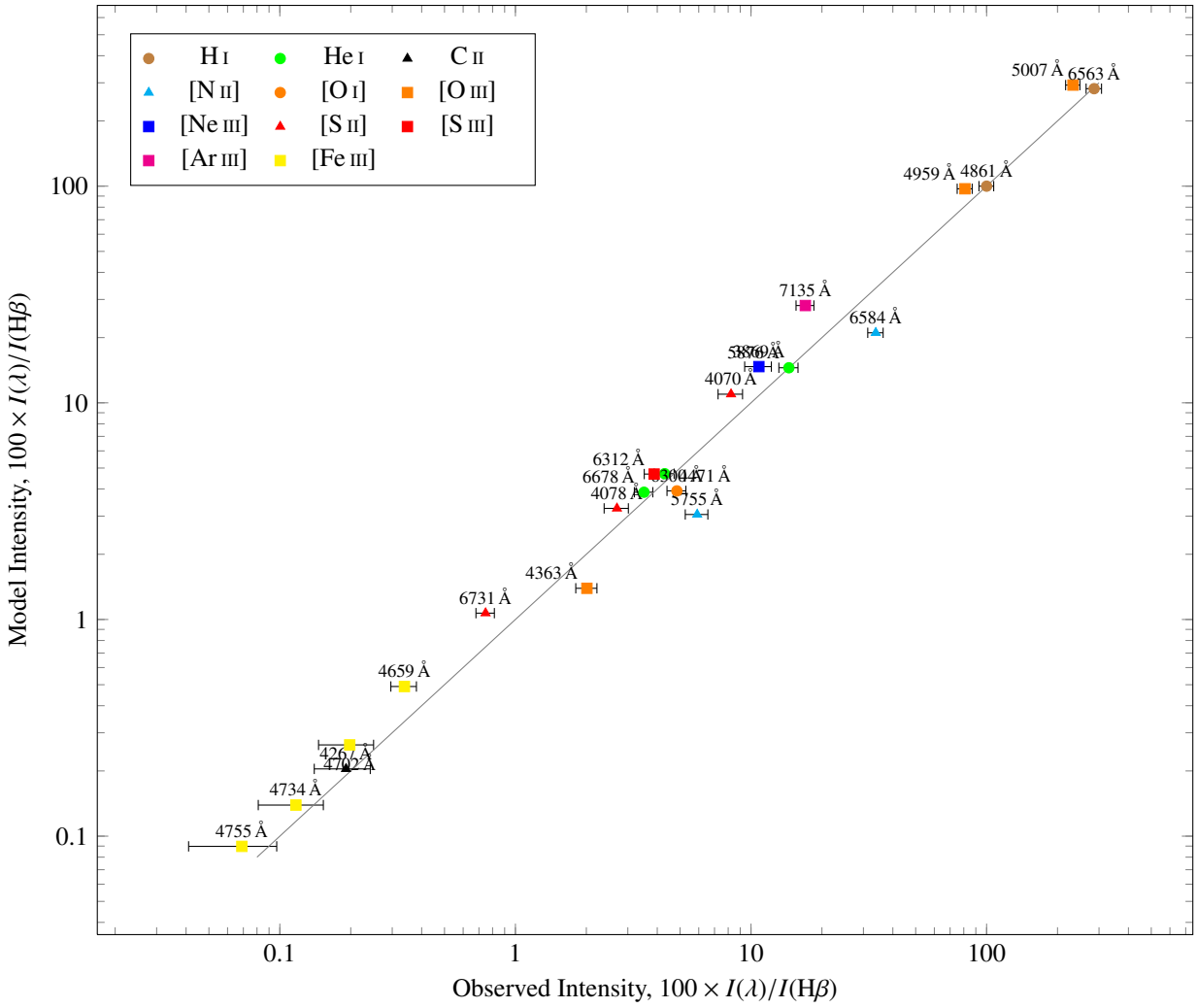
- Much better agreement, but still some differences
- [O I] is 30% (0.11 dex) too weak; [O III] nebular lines are 30% too strong (but auroral line is OK)
- [N II], [S II], and [S III] are all marginally too weak by 10–20%
- Iron and Argon are the same as in A

Model C: Esteban abundances

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.50$

Abundance set Esteban et al. (2004), M42, $t^2 = 0.002$



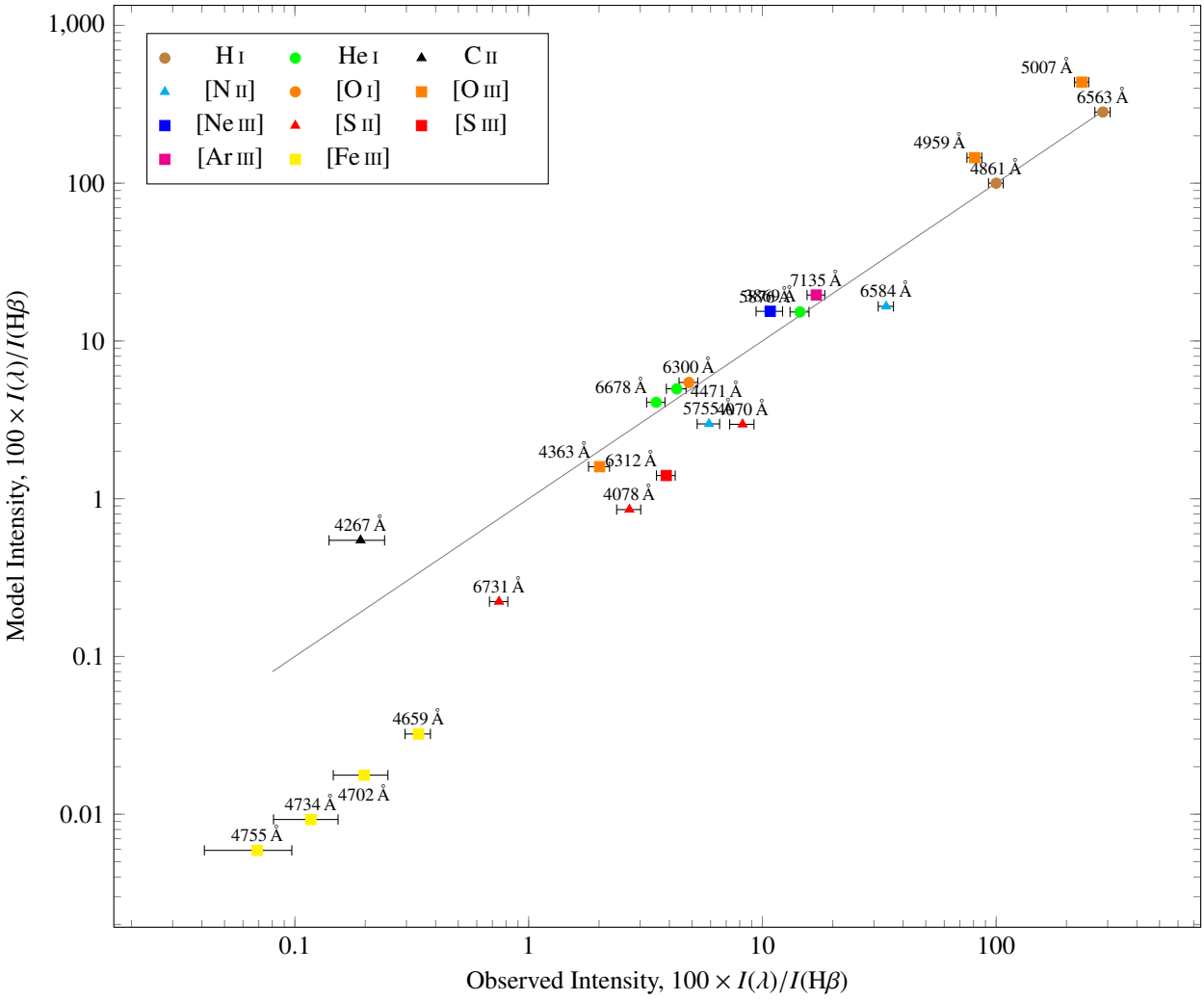
- Slightly better than A in some respects, but worse in others
- [Fe II] is now much better, but Argon and Neon are worse because the abundance went up
- [O III] still has the nebular lines too strong, but now the auroral line is too weak as well. The temperature in the high-ionization zones is obviously too high
- Nitrogen is now too weak, and sulphur too strong, which can be directly ascribed to the changed abundances

Model D: Tsamis abundances

Spectrum WMBasic, 39 000 K

Flux $\log_{10}\Phi = 13.50$

Abundance set Tsamis et al. (2011), LV2



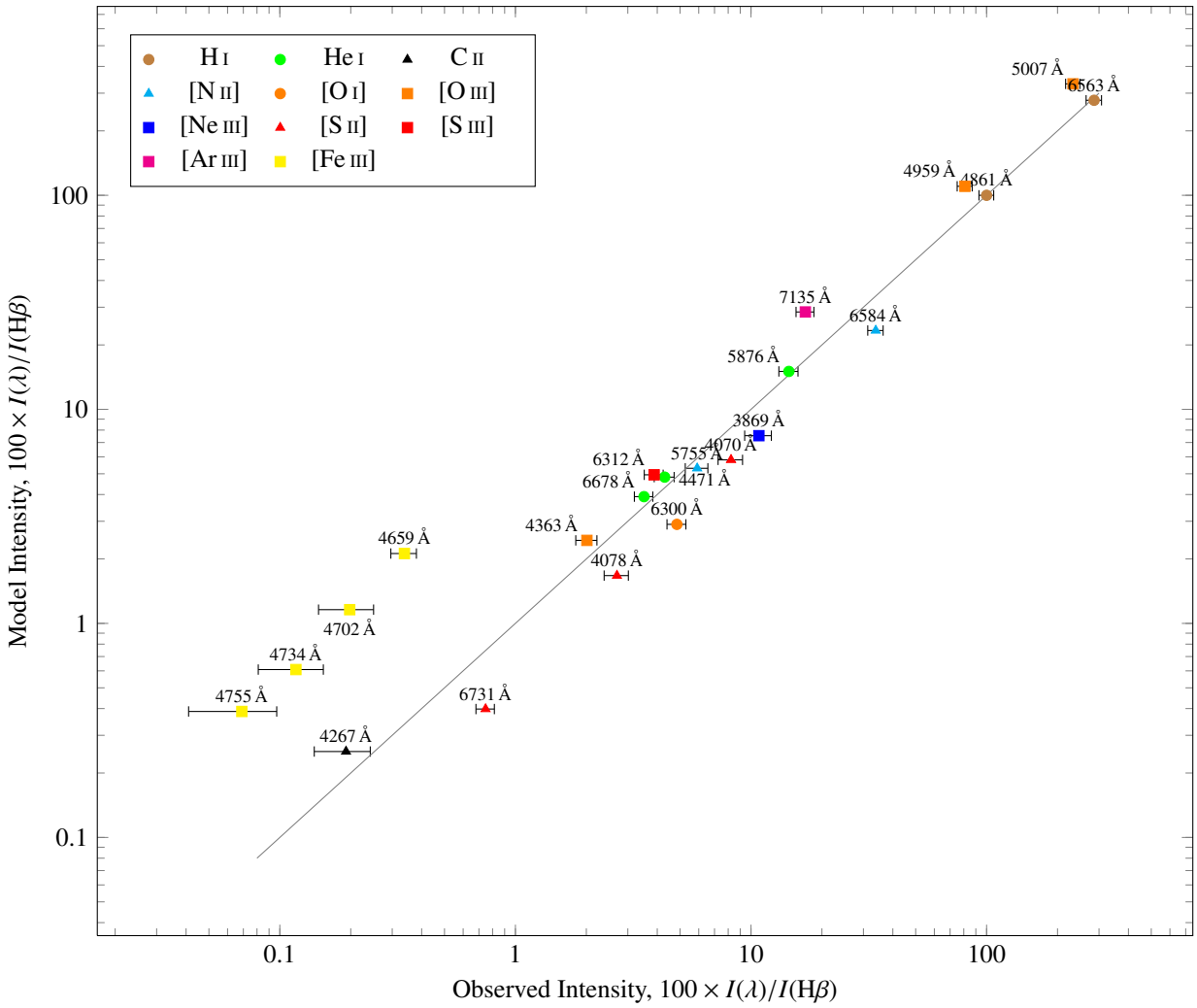
- This is all over the place. These abundances can definitely be ruled out.
- Iron, Sulphur, and Nitrogen are too weak
- Carbon is too strong, due to increased abundance
- However, Argon is much improved, as is [O I]
- The [O III] auroral/nebular ratio is still too small

Model E: Tlusty atmosphere

Spectrum Tlusty, 39 000 K

Flux $\log_{10} \Phi = 13.50$

Abundance set Cloudy Orion

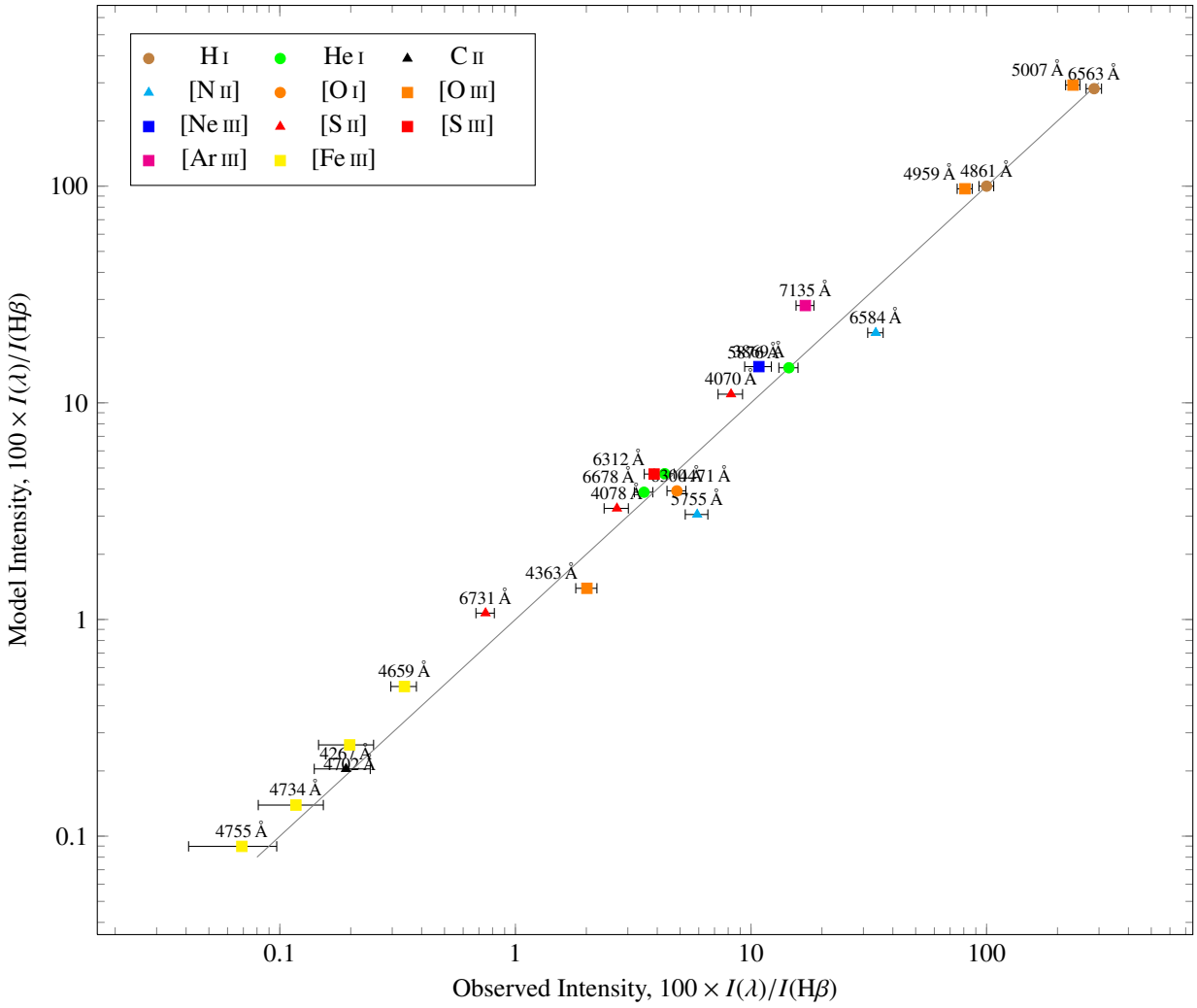


Model F: Lower flux and Esteban

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.20$

Abundance set Esteban et al. (2004), M42, $t^2 = 0.002$

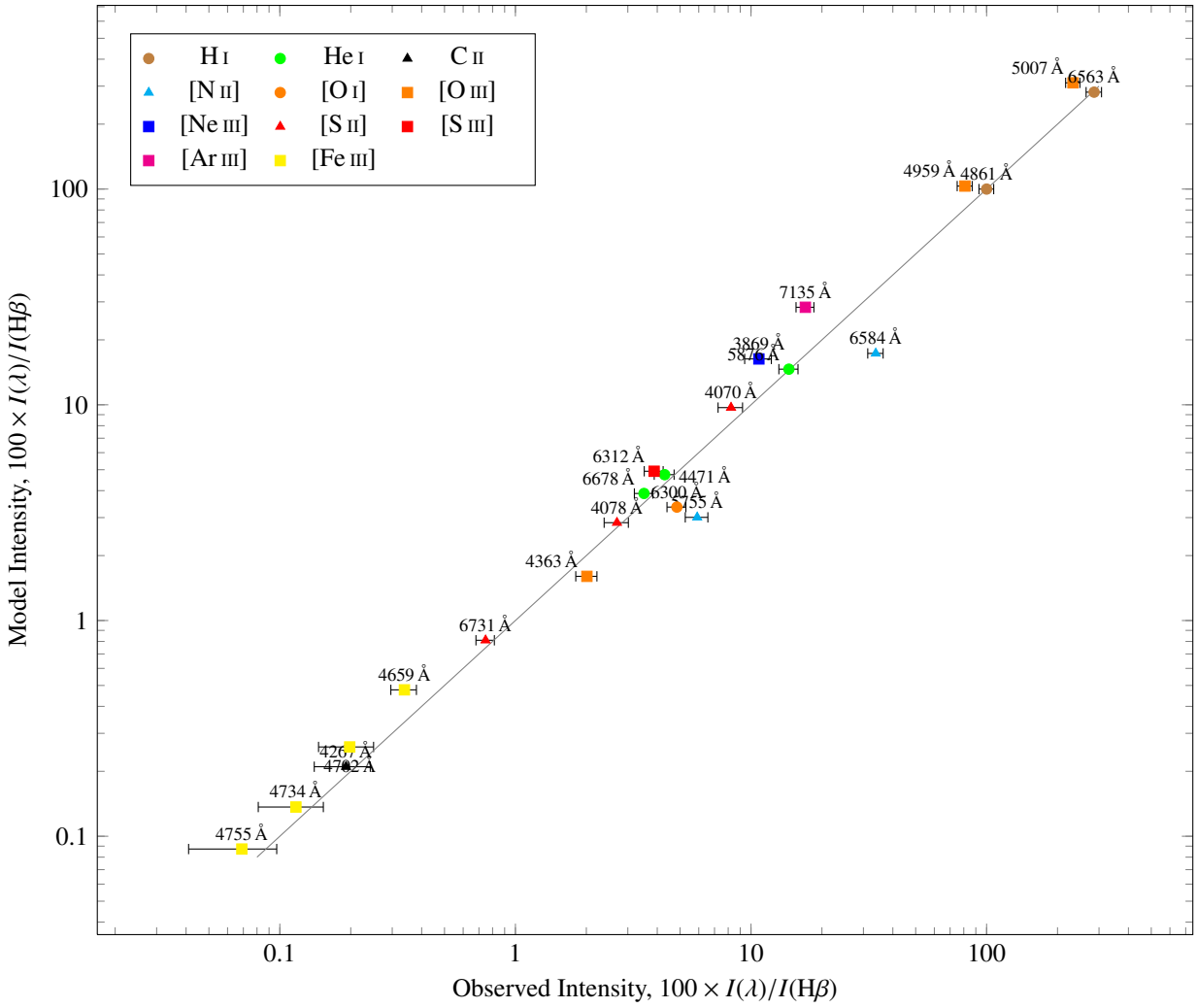


Model G: Intermediate flux and Esteban

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.35$

Abundance set Esteban et al. (2004), M42, $t^2 = 0.002$

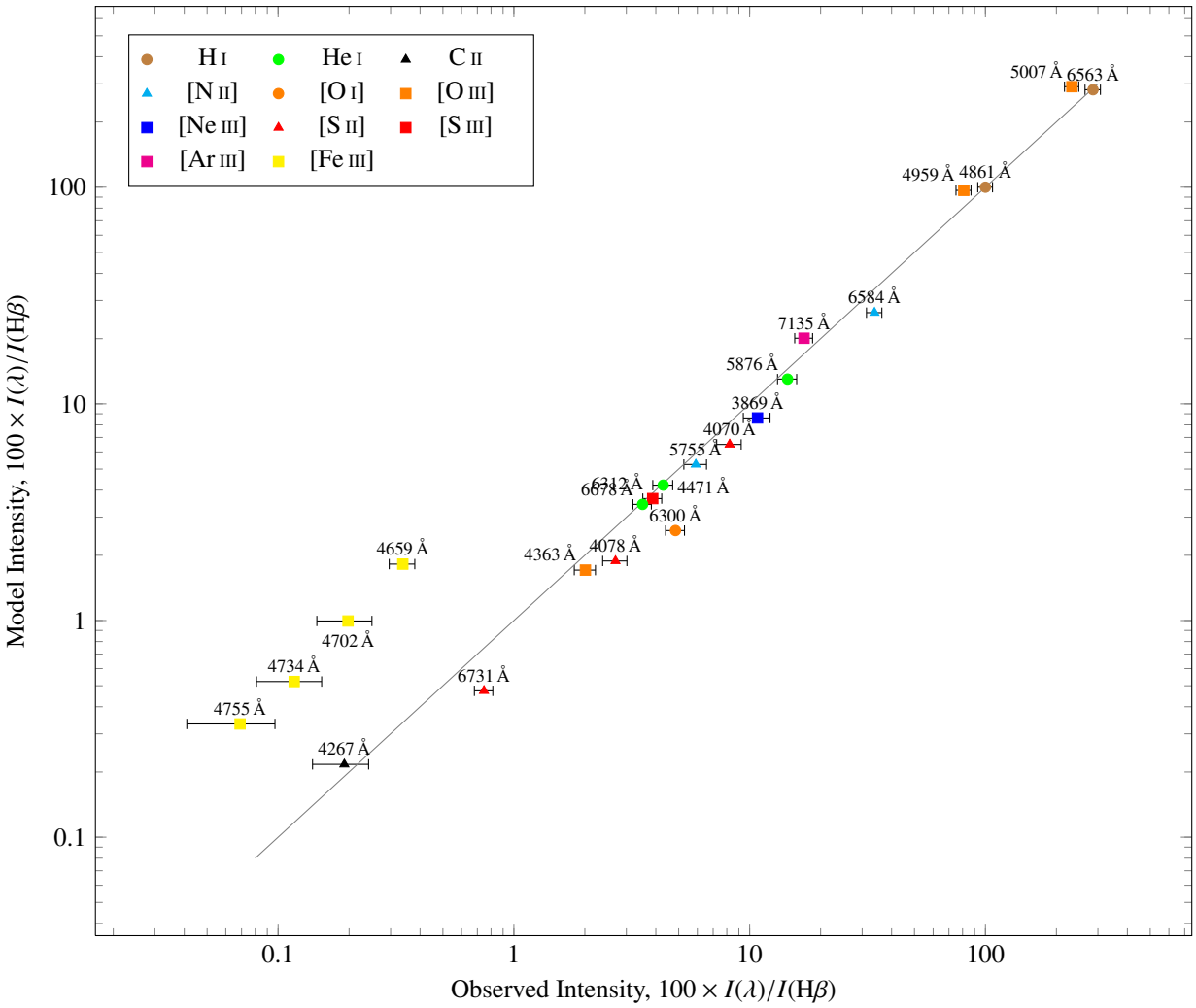


Model H: Cooler star

Spectrum WMBasic, 38 000 K

Flux $\log_{10} \Phi = 13.50$

Abundance set Cloudy Orion

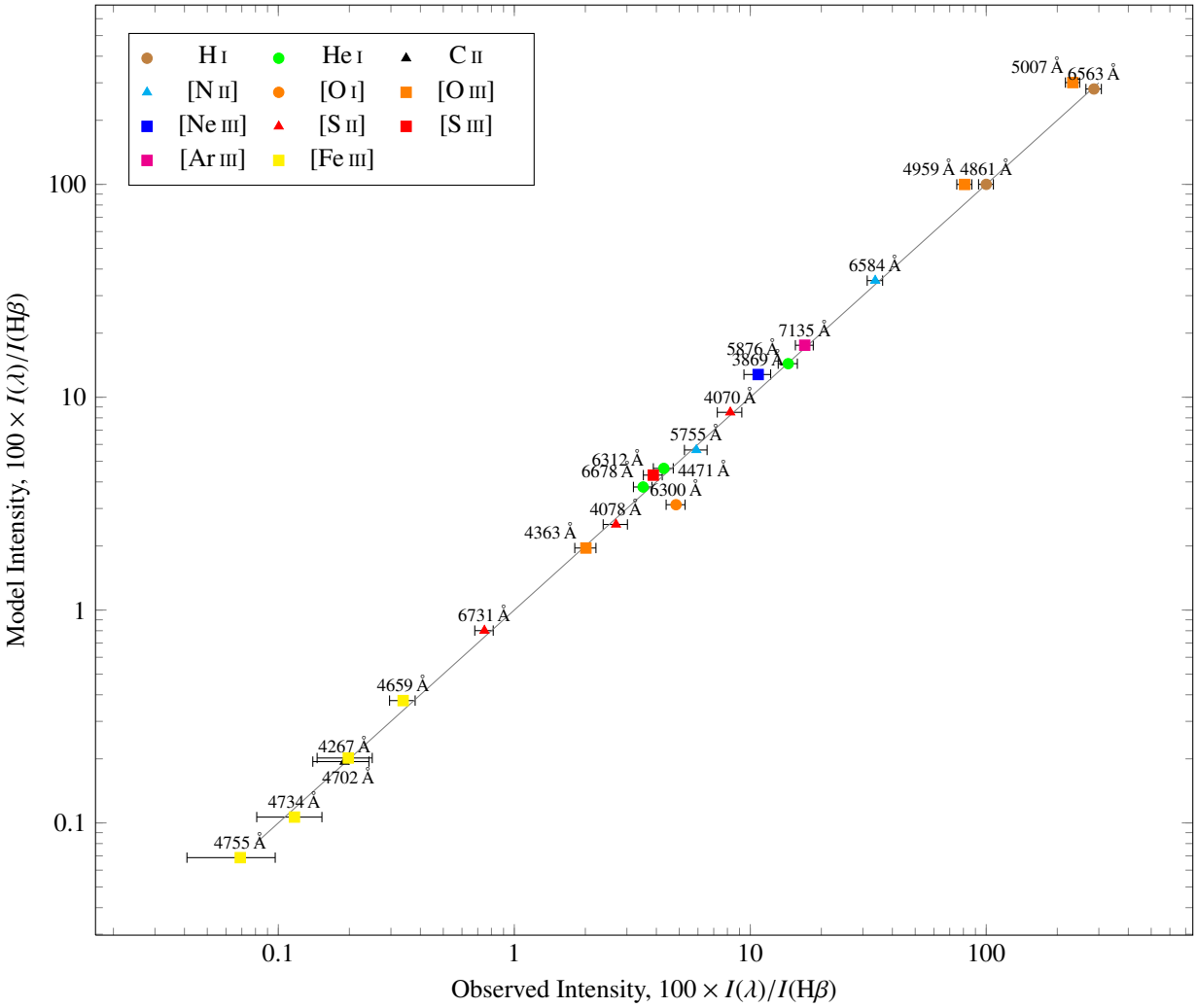


Model I: Bespoke abundances and lower flux

Spectrum WMBasic, 39 000 K

Flux $\log_{10} \Phi = 13.20$

Abundance set Tweak01



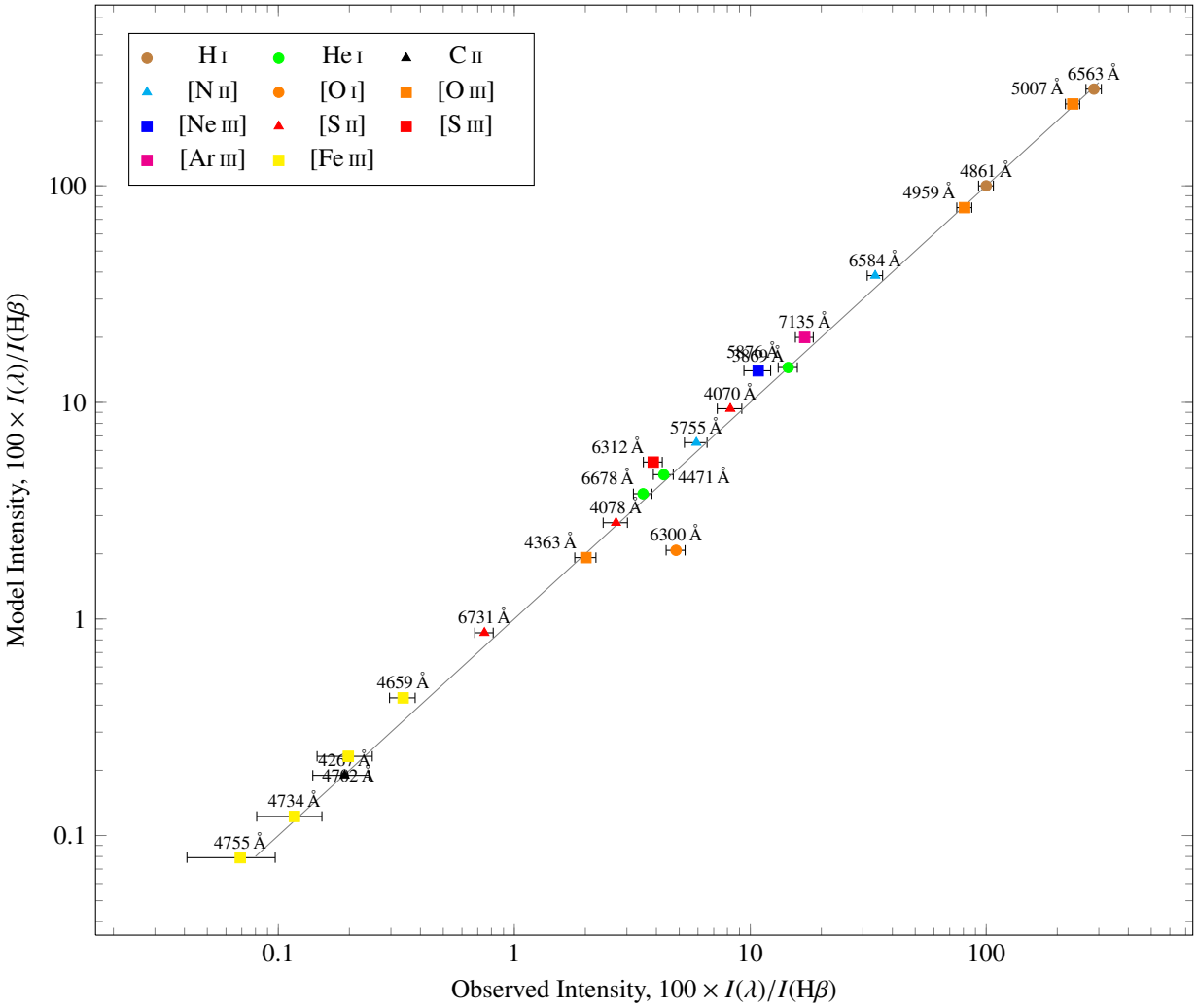
- This is the best one! Nearly everything is OK, except…
- …the nebular [O III] lines are 20–30% too strong (about 3σ)
- …and [O I] is too weak, but that does not matter, since there will be a contribution from OH dissociation in the neutral disk wind, which is not include in the model

Model J: Bespoke abundances (50% Oxygen) and lower flux

Spectrum WMBasic, 39 000 K

Flux $\log_{10}\Phi = 13.20$

Abundance set Tweak02

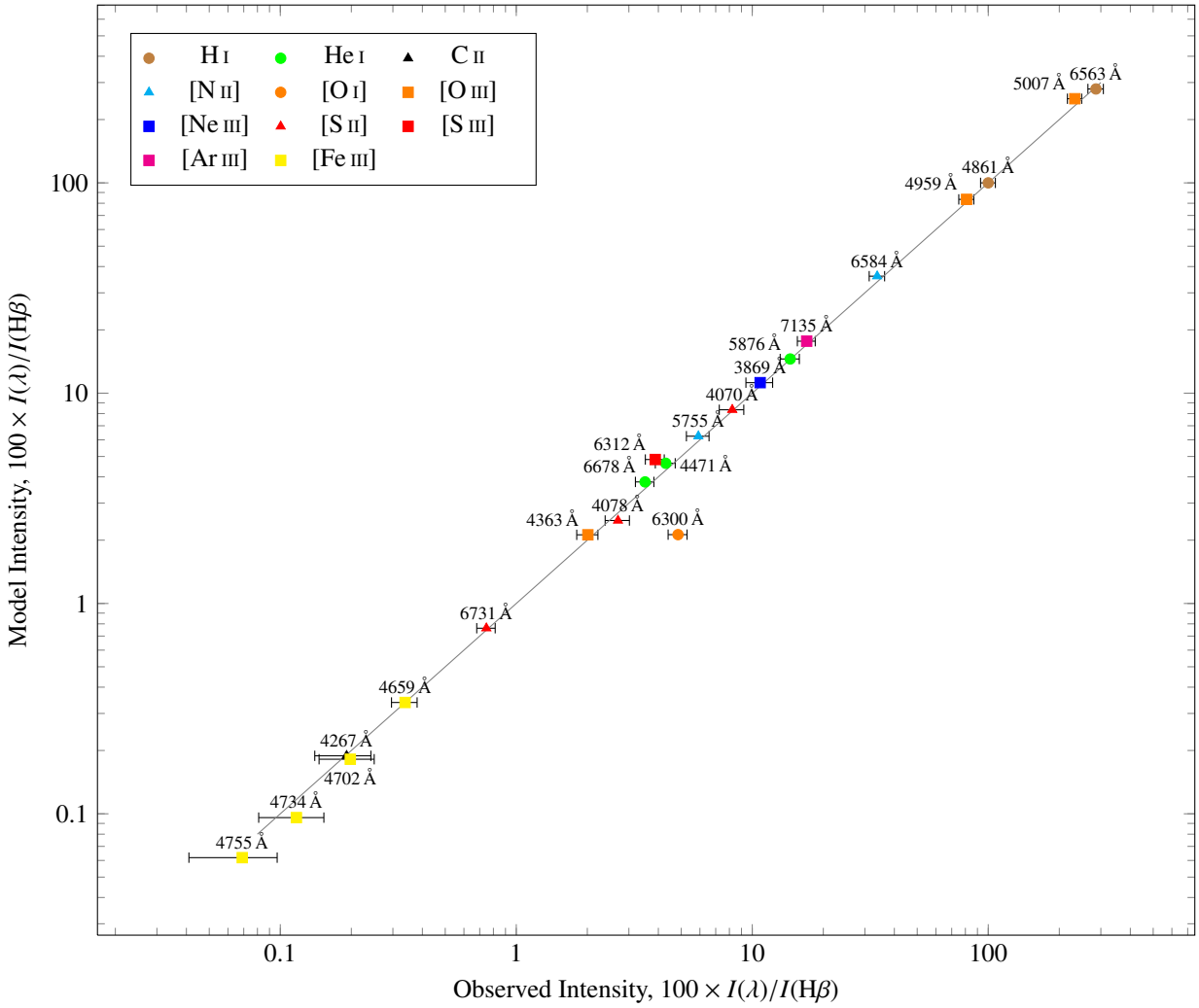


Model K: Further tweaked abundances (50% Oxygen) and lower flux

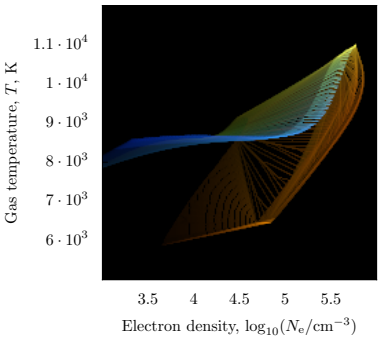
Spectrum WMBasic, 39 000 K

Flux $\log_{10}\Phi = 13.20$

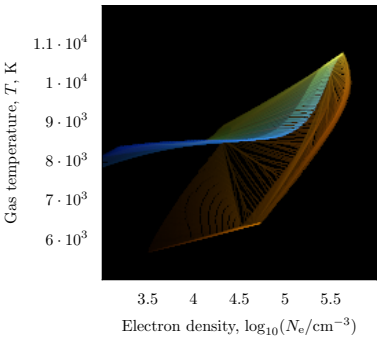
Abundance set Tweak03



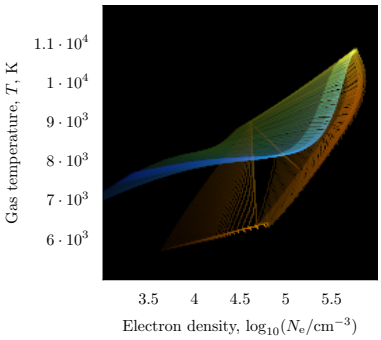
Model A – `WM039000-phi13.50-r15.28`



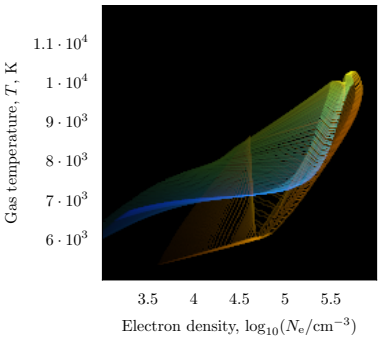
Model B – `WM039000-phi13.20-r15.28`



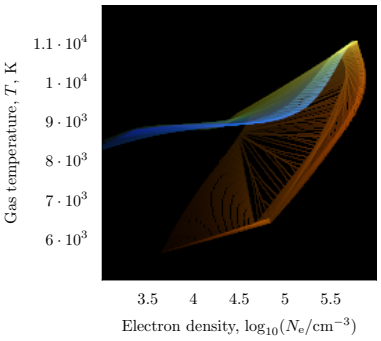
Model C – `WM039000-phi13.50-r15.28-ZE`



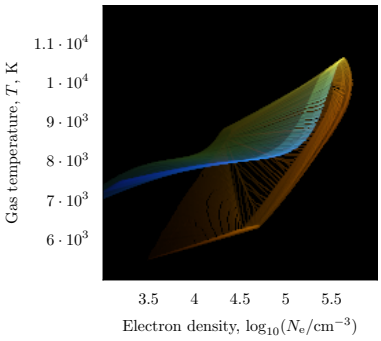
Model D – `WM039000-phi13.50-r15.28-ZT`



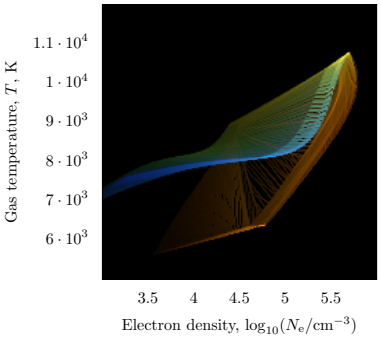
Model E – `TL039000-phi13.50-r15.28`



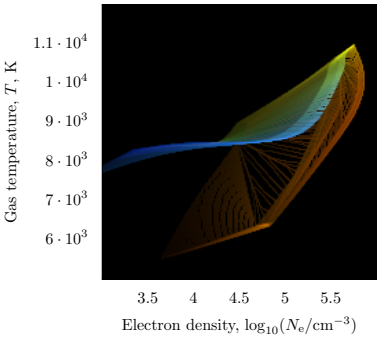
Model F – `WM039000-phi13.20-r15.28-ZE`



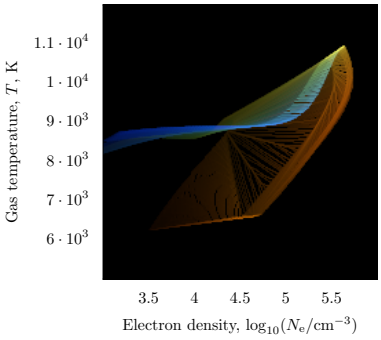
Model G – `WM039000-phi13.35-r15.28-ZE`



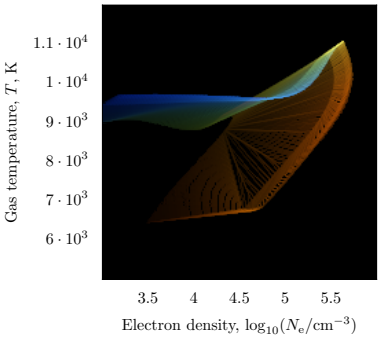
Model H – `WM038000-phi13.50-r15.28`



Model I – `WM039000-phi13.20-r15.28-ZZ`



Model J – `WM039000-phi13.20-r15.28-ZZ02`



Model K – `WM039000-phi13.20-r15.28-ZZ03`