In[7]:=
```
Clear["Global`*"]
G = 6.67 × 10^-8;
c = 3 × 10^10;
σ = 5.67 × 10^-5;
kb = 1.38 × 10^-16;
mp = 1.67 × 10^-24;
Msun = 2 × 10^33;
M = 10^7 Msun;
μe = 1;
μ0 = 0.615;
κes = 0.4 μe;
Rs = 2 G M/c^2;
```

In[41]:=
```
G M/(500 Rs)^3
```

Out[41]= 4.09653×10^{-13}

In[19]:=
```
SetDirectory[NotebookDirectory[]]
myFiles = FileNames["profile-*"];
myFilesP = ToExpression[StringSplit[#, "-"] & /@ myFiles];
myFilesR = #[[4]] & /@ myFilesP;
order = Ordering[myFilesR];
myFiles = myFiles[[order]];

myo = CharacterRange["a", "z"];
myo = myo[[ ;; Length[myFiles]]];
```

Out[19]= /home/aleksey/Dropbox/First_Year_Project

In[76]:=
```
8. × 10^-13 // ToString
```

Out[76]=
```
8. 10^-13
```

In[27]:=
```
SetOptions[ListLinePlot, ImageSize → Medium];

Tss[Tc_, u_, Σ_] := Tc (1 - 4 (u/Σ)^2)^(1/4);

toprofile[MyFile_, myo_] := Module[{MyFileP, R, Mdot, Σ, ν, Ω, cs0, Teff,
   t1, t2, t4, t3, Tc, u0, thigh, tlow, profile, umax, ustar, myustar, Q},
  MyFileP = StringSplit[MyFile, "-"] // #[[2 ;;]] &;
  MyFileP = ToExpression /@ MyFileP;
  Σ = MyFileP[[1]];
  Mdot = MyFileP[[2]] 10 × 4 π G M/(c κes);
  R = MyFileP[[3]] 2 G M/c^2;
  (*Kinematic viscosity*)
  ν = Mdot/(3 π Σ);
  (*Keplerian angular velocity*)
  Ω = Sqrt[G M/R^3];
  Q = Ω^2;
  (*Central sound speed*)
  cs0 = Sqrt[kb Tc/(μ0 mp)];

  Teff = ((9/8 ν Σ) Ω^2/σ)^0.25;

  ustar = Σ/2 Sqrt[1 - 8/((3 / 2) κes Σ)];

  profile = Import[NotebookDirectory[] <> MyFile, "Table"];
  (*Finding the points which bracket the effective temperature*)
  tlow = (Position[profile[[All, 4]], x_ /; x < Teff]);
  thigh = (Position[profile[[All, 4]], x_ /; x > Teff]);
  If [(Length [thigh] ≠ 0) && (Length[tlow] ≠ 0),
```

```
 myustar = Mean[Extract[profile[[All, 1]], {thigh[[-1]], tlow[[1]]}]], myustar = -1];


 (*Extract[profile[[All,1]],{thigh, tlow}];*)
 u0 = profile[[All, 1]] // Min;
 umax = profile[[All, 1]] // Max;
 Tc = profile[[1, 4]];
 t1 = ListLinePlot[profile[[All, {1, 4}]], PlotRange → All,
   AxesOrigin → {0, 0}, PlotRange → All, AxesLabel → {"u", "T"} ];
 t2 = Plot[Tss[Tc, u, Σ], {u, 0, umax}, PlotStyle → Directive[Red], AxesOrigin → {0, 0}];
 t3 = Plot[Teff, {u, 0, umax}, AxesOrigin → {0, 0}];
 t4 = ListLinePlot[profile[[All, {2, 4}]], PlotRange → All,
   AxesOrigin → {0, 0}, PlotRange → All, AxesLabel → {"z", "T"} ];
 (*Print[Mean[Extract[profile[[All,1]],{thigh[[-1]], tlow[[1]]}]]]*)
 Export["plot-" <> myo <> ".pdf", Labeled[GraphicsGrid
    [{{ListLinePlot[profile[[All, {1, 3}]], AxesLabel → {"u", "ρ"}, PlotRange → All],
      Show[t2, t1, t3]}, {t4,
      ListLinePlot[Transpose[{profile[[All, 1]], (profile[[All, 6]] - profile[[All, 7]])}],
       AxesOrigin → {0, 0}, AxesLabel → {"u", "∇ad-∇rad"}, PlotRange → All]}}
    , Frame → All], "r=" <> ToString[MyFileP[[3]]] <> " ustar=" <> ToString[ustar] <> " " <>
    ToString[myustar] <> " Teff=" <> ToString[Teff] <> " Log[Q]=" <> ToString[Log[10, Q]]]]

]
```

In[30]:=

```
tmp = Thread[f[myFiles, myo]]
tmp /. (f → toprofile)
```

Out[30]= {f[profile-139475-0.1-100, a], f[profile-92019-0.1-200, b],
 f[profile-72148-0.1-300, c], f[profile-60710-0.1-400, d], f[profile-53102-0.1-500, e],
 f[profile-47600-0.1-600, f], f[profile-43395-0.1-700, g], f[profile-40054-0.1-800, h],
 f[profile-37321-0.1-900, i], f[profile-35035-0.1-1000, j], f[profile-33087-0.1-1100, k],
 f[profile-31404-0.1-1200, l], f[profile-29932-0.1-1300, m],
 f[profile-28630-0.1-1400, n], f[profile-27469-0.1-1500, o], f[profile-26426-0.1-1600, p],
 f[profile-25482-0.1-1700, q], f[profile-24623-0.1-1800, r], f[profile-23837-0.1-1900, s]}

Out[31]= {plot-a.pdf, plot-b.pdf, plot-c.pdf, plot-d.pdf, plot-e.pdf, plot-f.pdf,
 plot-g.pdf, plot-h.pdf, plot-i.pdf, plot-j.pdf, plot-k.pdf, plot-l.pdf,
 plot-m.pdf, plot-n.pdf, plot-o.pdf, plot-p.pdf, plot-q.pdf, plot-r.pdf, plot-s.pdf}