**Some atrophysical quantities implemented in ransX**

$\nabla_{sim} = +(dlnT/dlnP)$ [Weiss et al., 2004] p.381
$\nabla_{ad} = +(dlnT/dlnP)_{ad} = (\Gamma_2 - 1)/\Gamma_2$ [Weiss et al., 2004] p.382
$\nabla_{\mu} = +(\partial ln\mu/\partial lnP)_S$ [Weiss et al., 2004] p.375

$\nabla = +(dlnT/dlnP)_s$ [Kippenhahn and Weigert, 1994] p.39
$\nabla_e = +(dlnT/dlnP)_e$ [Kippenhahn and Weigert, 1994] p.39
$\nabla_{\mu} = +(dln\mu/dlnP)_s$ [Kippenhahn and Weigert, 1994] p.39

$\alpha = +1/\chi_{\rho}$
$\delta = -\chi_T/\chi_{\rho}$
$\varphi = +\chi_{\mu}/\chi_{\rho}$

$N^2 = +\frac{g\delta}{H_p}\left(\nabla_{ad} - \nabla + \frac{\varphi}{\delta}\nabla_{\mu}\right)$ [Kippenhahn and Weigert, 1994] p.42
$b(r) = \int_{ri}^{r} N^2 dr$ [Meakin and Arnett, 2007]

$R_{ib} = \Delta bL/\sigma^2$ [Meakin and Arnett, 2007]
$c_P = (dQ/dT)_P$ [Weiss et al., 2004] p.221
$c_V = (dQ/dT)_V$ [Weiss et al., 2004] p.221
$\mu = \overline{A} = 1/\sum_k (X_k/A_k)$ [Weiss et al., 2004] p.439
$\psi =$ degeneracy parameter
$H_P = -dr/(dlnP) = -P(dr/dP)$ [Kippenhahn and Weigert, 1994] p.38
$H_P =$

$\alpha = +(\partial ln\rho/\partial lnP)_{T,\mu}$ [Kippenhahn and Weigert, 1994] p.38
$\delta = -(\partial ln\rho/\partial lnT)_{P,\mu}$ [Kippenhahn and Weigert, 1994] p.38
$\varphi = +(\partial ln\rho/\partial ln\mu)_{P,T}$ [Kippenhahn and Weigert, 1994] p.38

$\chi_{\rho} = +(\partial lnP/\partial ln\rho)_{T,\mu}$ [Weiss et al., 2004] p.369
$\chi_T = +(\partial lnP/\partial lnT)_{\rho,\mu}$ [Weiss et al., 2004] p.369
$\chi_{\mu} = +(\partial lnP/\partial ln\mu)_{\rho,T}$ [Weiss et al., 2004] p.369

$\Gamma_1 = +(dlnP/dln\rho)_{ad}$ [Weiss et al., 2004] p.226
$\Gamma_2/(\Gamma_2 - 1) = +(dlnP/dlnT)_{ad}$ [Weiss et al., 2004] p.226
$\Gamma_3 - 1 = +(dlnT/dln\rho)_{ad}$ [Weiss et al., 2004] p.226

$dq = du + Pdv$ [Kippenhahn and Weigert, 1994] p.19
$dq$ heat added per unit mass to internal energy $u$ and $v = 1/\rho$

$\partial_m l = \epsilon - \partial_t u - P\partial_t v$ [Kippenhahn and Weigert, 1994] p.22
$\partial_m l = \epsilon - \partial_t u + (P/\rho^2)\partial_t \rho$ [Kippenhahn and Weigert, 1994] p.22
$\partial_m l = \epsilon - c_P \partial_t T + (\delta/\rho)\partial_t P$ [Kippenhahn and Weigert, 1994] p.22

$\beta_T = -(dln\rho/dlnT)$ [Meakin and Arnett, 2007]
$H_{\rho} = -dr/(dln\rho) = -\rho dr/d\rho$

# Bibliography

R. Kippenhahn and A. Weigert. *Stellar Structure and Evolution*. 1994.

C. A. Meakin and D. Arnett. Turbulent Convection in Stellar Interiors. I. Hydrodynamic Simulation. *Apj*, 667:448–475, September 2007. doi: 10.1086/520318.

A. Weiss, W. Hillebrandt, H.-C. Thomas, and H. Ritter. *Cox and Giuli's Principles of Stellar Structure*. 2004.