Topics/Concepts

Opacity, convective vs. radiative zones, tropopause
Atmospheric collapse, critical core mass
Effective collision radius, critical capture density, enhanced growth rate

Equations

Radiative: \[ \frac{\sigma_s h T^4}{\kappa \rho} \frac{dT}{dr} \sim - \frac{L}{4\pi r^2} \] implying \( T \sim \frac{1}{r} \) and \( \rho \sim \frac{1}{r^3} \) and \( \rho \sim T^3 \)

Convective: \[ \frac{dT}{dt} \sim - \frac{g \mu}{C_p} \] Critical capture density: \( \rho_g \approx \frac{r_p}{r_H} \rho_p \)

Numbers

Solar luminosity \(3.8 \times 10^{26} \) W
Solar-composition opacities \(~10^{-3} \) cm\(^2\)/g, but this can vary by several OOM in either direction!

References

