

2. Vnitřní struktura a vývoj Slunce

Sluneční fyzika
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Slunce:

- $M=(1,9891\pm 0,0012)\times 10^{30}$ kg
- $L=3,86\times 10^{26}$ W
- $R=695\,980$ km
- $\langle\rho\rangle=1400$ kg m⁻³
- $g=27,4$ m s⁻²
- $T_{\text{eff}}=(5785\pm 10)$ K
- 1"=726 km ve vzdálenosti 1 AU
- Věk $\sim 4,5\times 10^9$ let
- $v_{\text{esc}}=6,17\times 10^5$ m s⁻¹
- $\mathcal{L}=1,7\times 10^{41}$ kg m⁻² s⁻¹

Rovnice vnitřní struktury

$$\frac{dm}{dr} = 4\pi\rho r^2$$

$$\frac{dP}{dr} = \frac{-Gm\rho}{r^2}$$

$$\frac{dL}{dr} = 4\pi\rho r^2(\epsilon + \text{korekce})$$

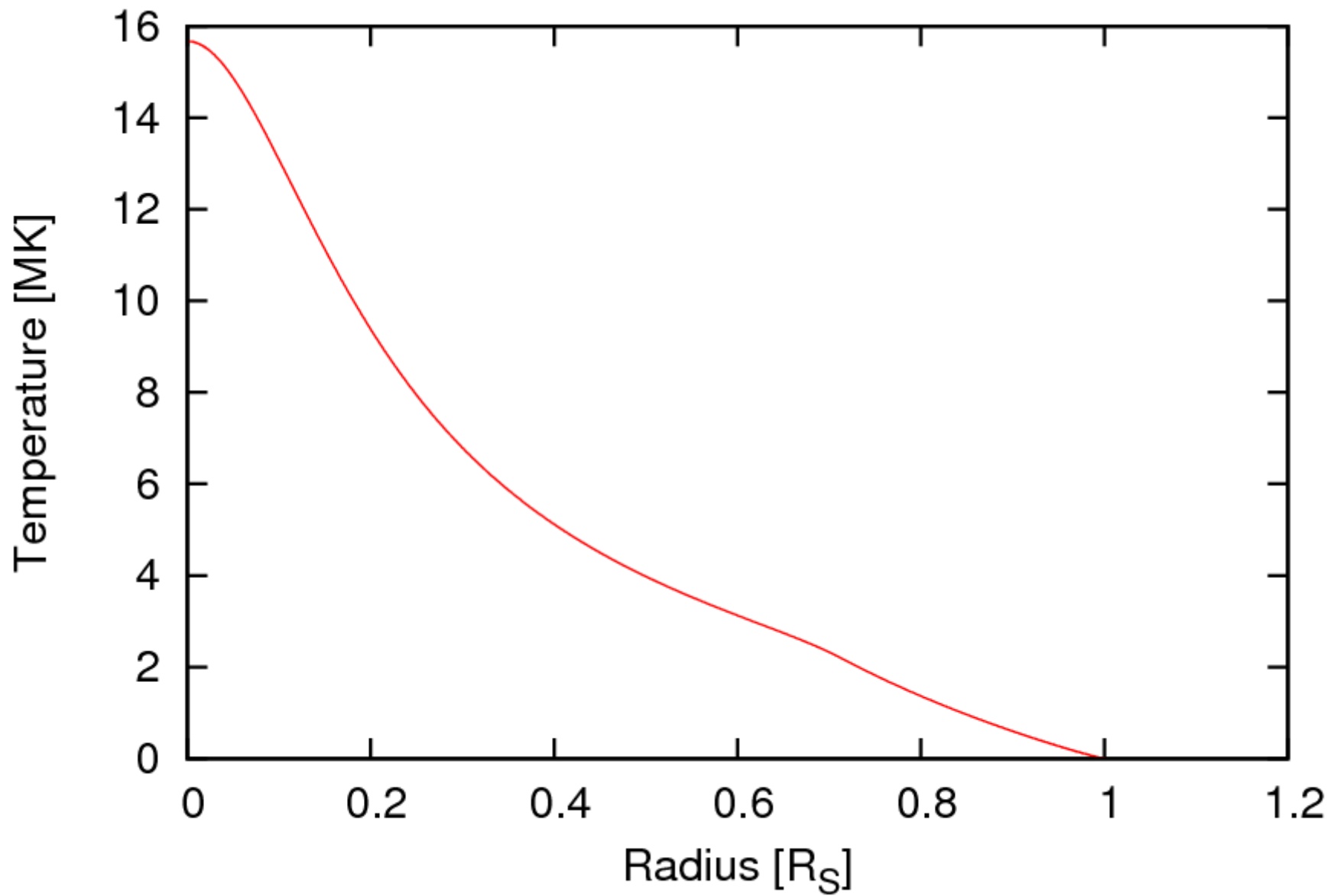
$$\frac{dT}{dr} = \frac{-GmT\rho}{r^2 P} \nabla \leftarrow \begin{array}{l} \nabla_{\text{rad}} = \frac{3\kappa P L}{16\pi ac Gm T^4} \\ \nabla_{\text{ad}} = \frac{\delta Gm}{c_p r^2} \end{array}$$

$$P = \frac{\mathfrak{R} \rho T}{\mu}, \quad \mu = \frac{1}{2X + \frac{3}{4}Y + \frac{1}{2}Z}$$

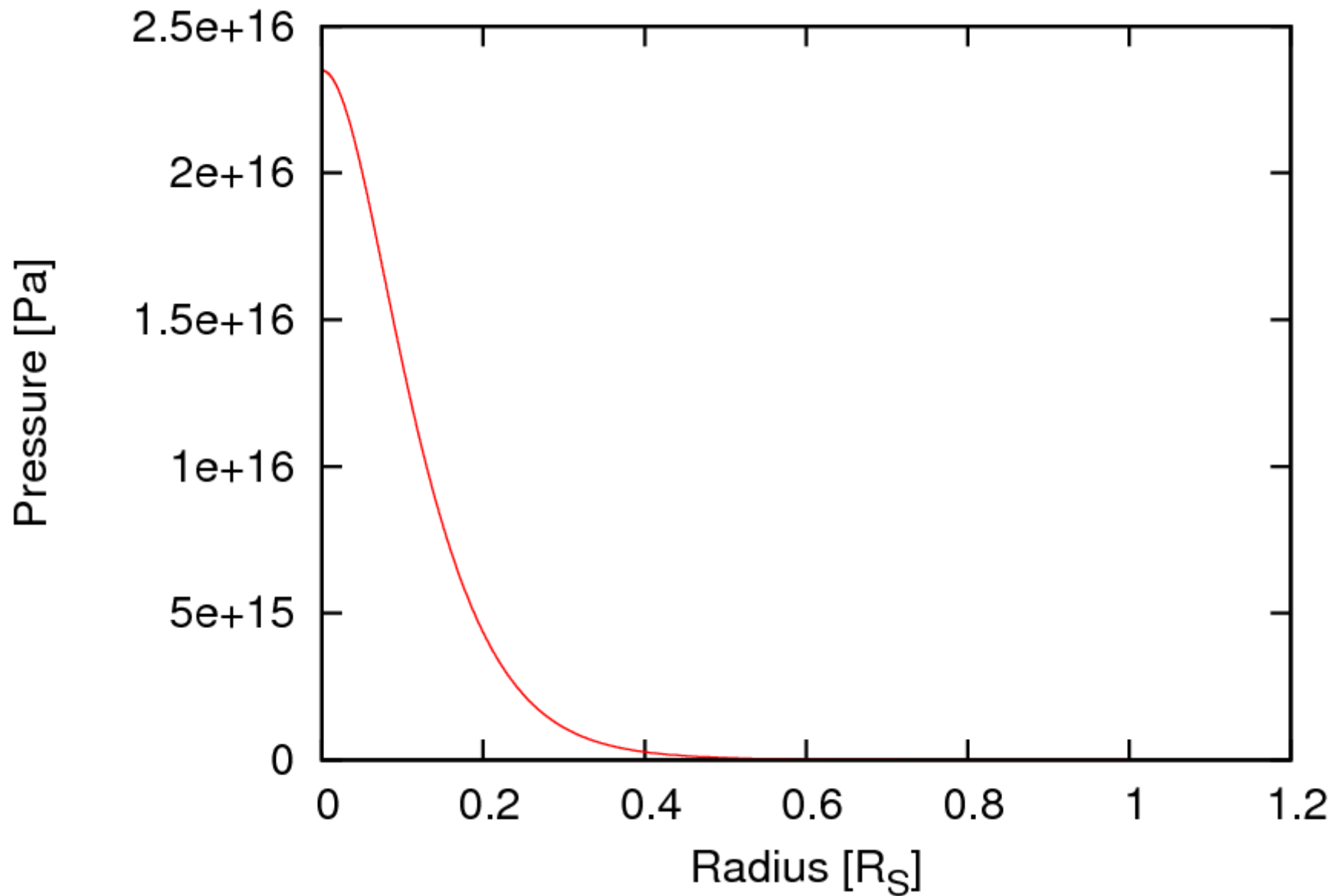
$$\epsilon = \epsilon_0 X^2 \rho T^4$$

$$\kappa = \kappa_0 (X + 1) Z \rho T^{-3.5}$$

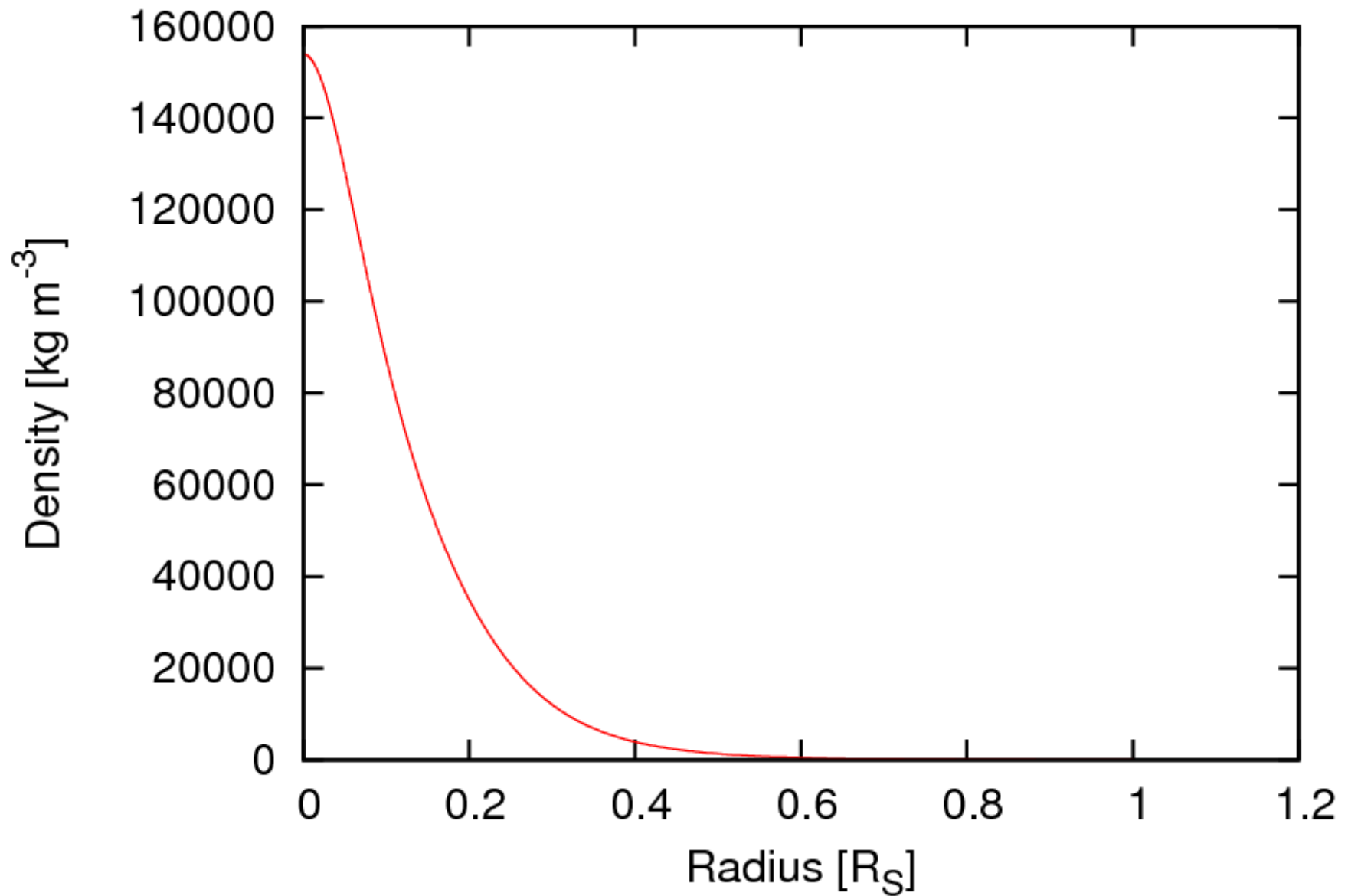
Model S (Christensen-Dalsgaard et al. 1996)



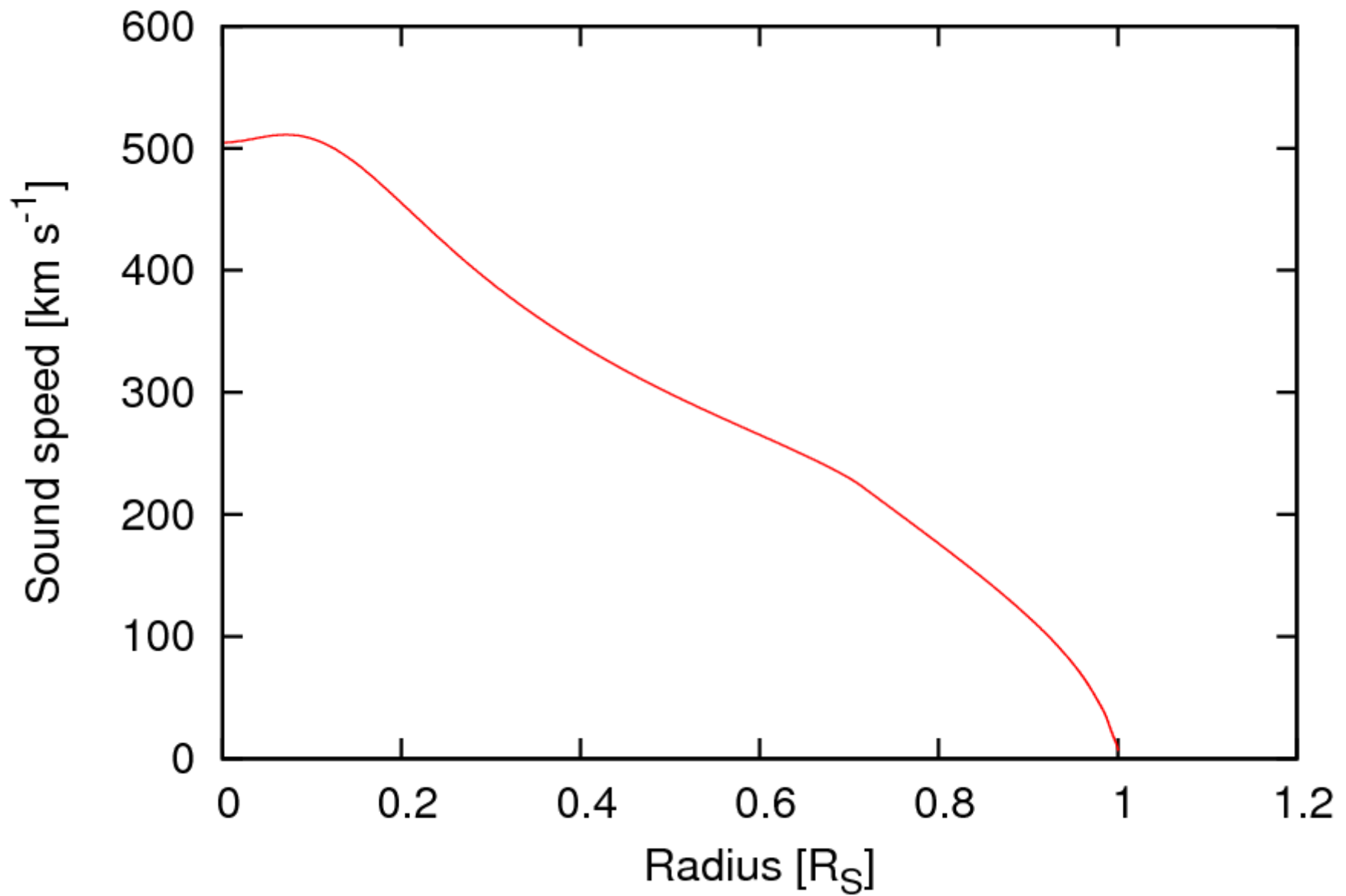
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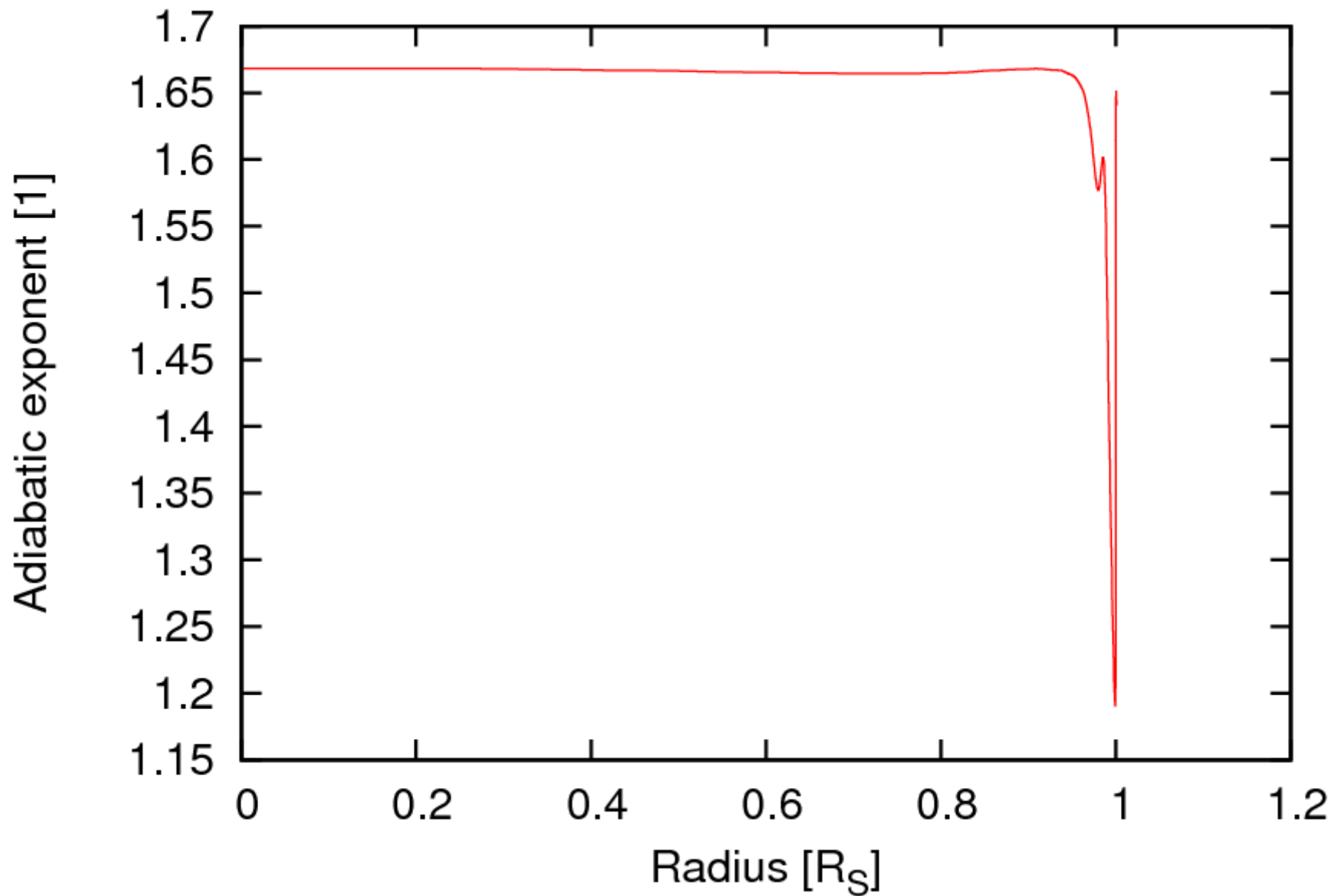
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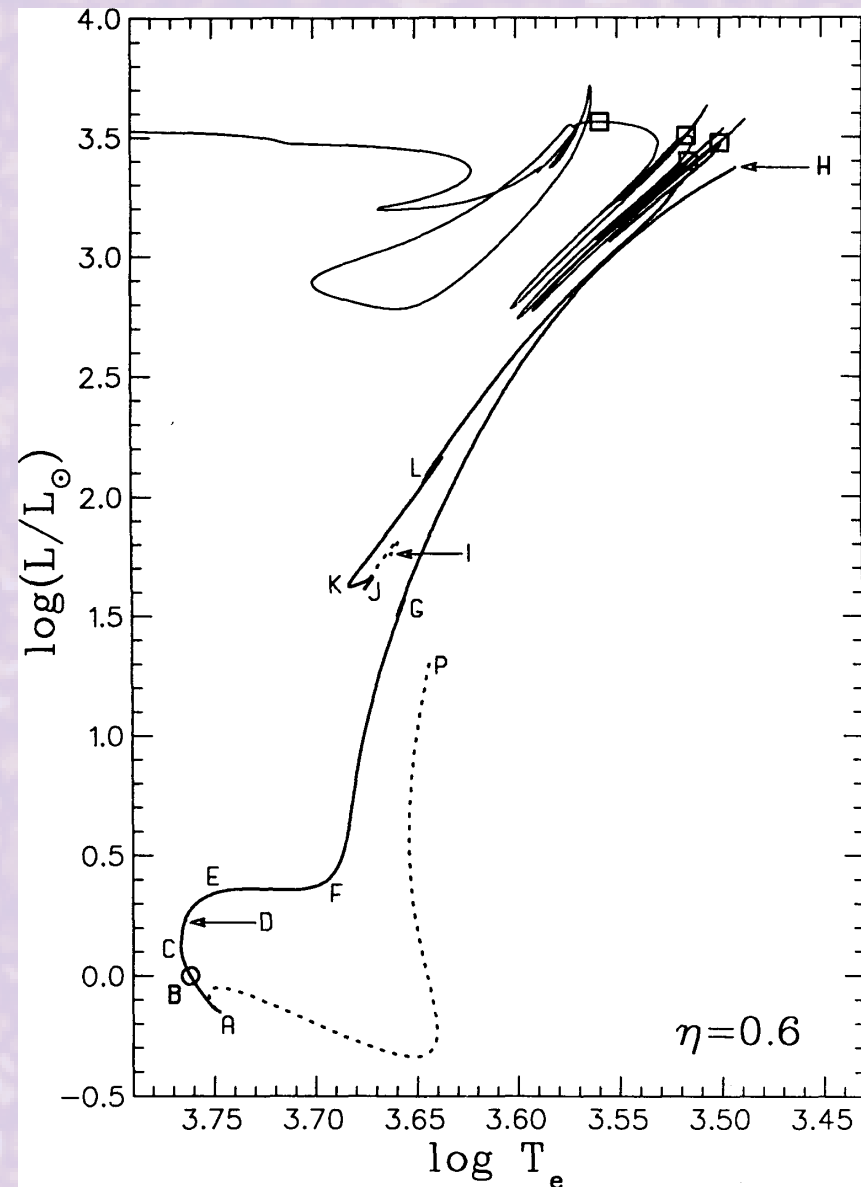


Model S (Christensen-Dalsgaard et al. 1996)

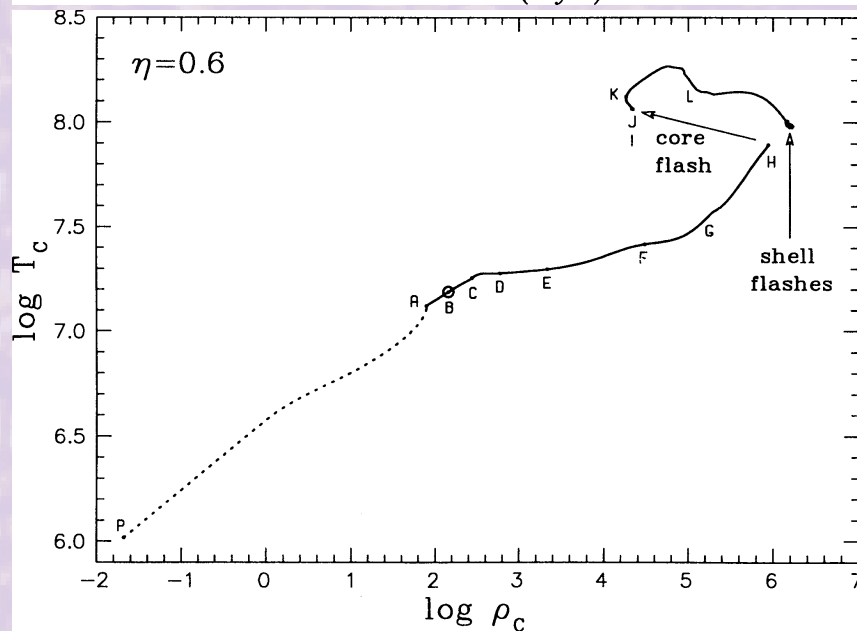
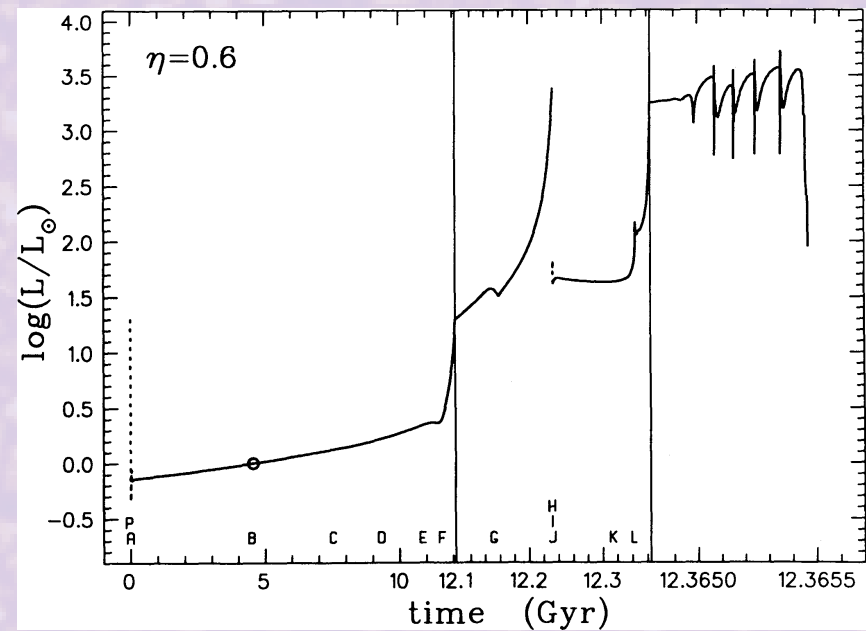
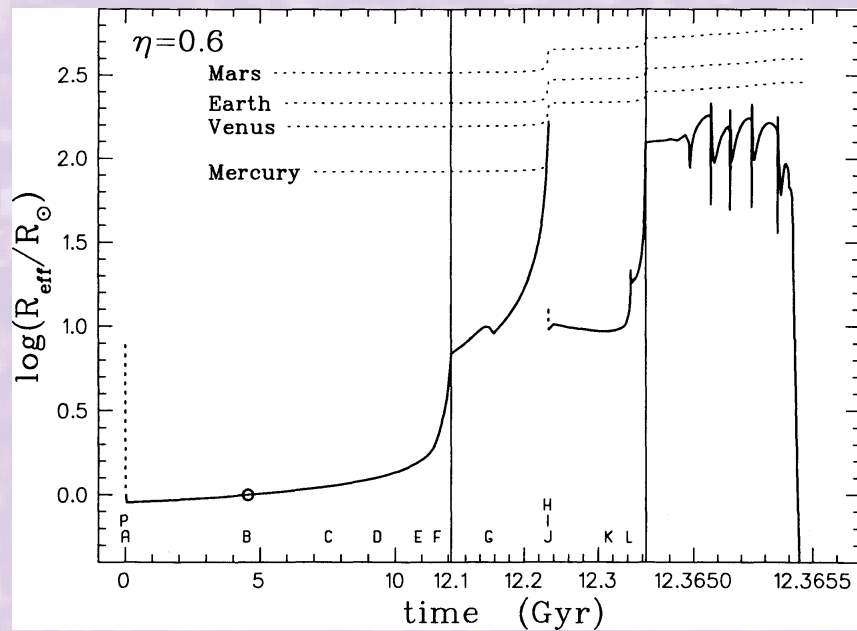


Slunce na H-R diagramu v budoucnosti

- Sackmann, I. J. (1993)
- P-A před MS
- A-E MS, B současné Slunce
- H-J heliový záblesk
- I-J před horizontální větví rudých obrů
- Čtverečky – záblesky slupek He na AGB
- MS ještě cca 6,4 Gy (celkově 11 Gy)
- RGB 0,6 Gy
- AGB 0,1204 Gy



Vývoj parametrů Slunce v čase



🔴 Téma seminárky?