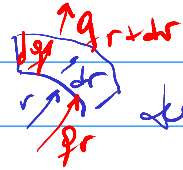
Recordem: $\propto M^x$; $3<x<4$. Consideremos una estrella $M_s \sim 50 M_\odot \Rightarrow$

$$\frac{L_s}{L_\odot} = \left(\frac{M_s}{M_\odot}\right)^4 \Rightarrow L_s = \left(\frac{M_s}{M_\odot}\right)^4 \cdot L_\odot$$ si $M_s = 50 M_\odot \Rightarrow (M_s/M_\odot)^4 = 50^4 = 6{,}25\times10^6$

$$\Rightarrow \boxed{L_s = 6{,}25\times10^6 \, L_\odot}$$ o bien $L_s \simeq 2{,}4\times10^{33}$ J/s

Flujo perdido por Absorción

Recordando la clase anterior en un volumen 

teníamos: $dq = -k_r q_r \rho_r dr \to q_{r+dr} < q_r$

Luego puesto que este flujo de energía está formado por fotones $\Rightarrow E_\gamma = h\nu$ y $p_\gamma = h\nu/c$

$$dq = E_\gamma \frac{dN}{dt} \Rightarrow \frac{dq}{dr} = -k_r q_r \rho_r \to \frac{dN}{dt} = -\frac{k_r q_r \rho_r dr}{E_\gamma} = -\frac{k_r q_r \rho_r}{\underbrace{h\nu}_{p_\gamma}} \cdot \frac{c}{c} dr \Rightarrow \frac{dN}{dt} = \frac{-k_r q_r \rho_r}{p_\gamma c} dr$$

$$\frac{d}{dt}(N p_\gamma) = -\frac{k_r q_r \rho_r}{c} dr \Rightarrow \frac{d}{dt}(N p_\gamma) = \boxed{F_\gamma = -\frac{k_r q_r \rho_r}{c} dr}$$ Fuerza ejercida por la radiación - Hacia Afuera.

Recordando: $F_G = -\frac{G M_r \rho_r}{r^2} dr$ Fuerza de Gravedad (Hacia Adentro)

$$F_\gamma = F_G \Rightarrow +\frac{G M_r \cancel{\rho_r}}{r^2} \cancel{dr} = +\frac{k_r q_r \cancel{\rho_r}}{c} \cancel{dr}$$ y para $r = r_s \Rightarrow \frac{G M_s^*}{R_s^2} = \frac{k q}{c}$ y $q = \frac{L}{A} = \frac{L}{4\pi R^2}$

$$\Rightarrow \frac{G M_s^*}{\cancel{R_s^2}} = \frac{k L}{4\pi c \cancel{R_s^2}} \Rightarrow \boxed{M_s^* = \frac{k L}{4\pi c G}}$$ Límite de Eddington. Si $M_s > M_s^*$ la Rad. Supera a la Gravedad

De igual forma: $L^* = \frac{4\pi G M_s c}{k}$. Si tenemos un gas Hidrogenizado $\Rightarrow k = \sigma_T/m_p = \frac{8}{3}\pi r_e^2/m_p \Rightarrow$

$$\Rightarrow L = \frac{4\pi G c M_s m_p}{\sigma_T} \simeq 3{,}2\times 10^4 \left(\frac{M}{M_\odot}\right) L_\odot$$

Finalmente, si $\frac{L}{L_\odot} = \left(\frac{M}{M_\odot}\right)^x \Rightarrow L = (M/M_\odot)^x L_\odot \Rightarrow M_s = \frac{K M_s^x L_\odot}{4\pi c G M_\odot^x}$

$$\Rightarrow \frac{M_s}{M_s^x} = \frac{K}{4\pi c G}\frac{L_\odot}{M_\odot^x} \Rightarrow M_s^{1-x} = \frac{K}{4\pi cG}\frac{L_\odot}{M_\odot M_\odot^{x-1}} \Rightarrow \frac{M_\odot^{x-1}}{M_s^{x-1}} = \frac{K}{4\pi G c}\frac{L_\odot}{M_\odot}$$

Invirtiendo:

$$\boxed{\left(\frac{M_s}{M_\odot}\right)^{x-1} = \frac{4\pi G c}{K}\left(\frac{M_\odot}{L_\odot}\right)}$$

Si $x = 4 \Rightarrow \frac{M_s^3}{M_\odot^3} = \frac{4\pi G c}{K}\frac{M_\odot}{L_\odot} \Rightarrow M_s = \sqrt[3]{\frac{4\pi c G M_\odot}{L_\odot}}\, M_\odot$

$$\Rightarrow \boxed{M_s^x \simeq 110\, M_\odot}$$

Límite de Eddington

Stars 80 $M_\odot$ or greater

Star name	Mass ($M_\odot$, Sun = 1)	Distance from Earth (ly)	Method used to estimate mass
R136a1	315	163,000	Evolutionary model
R136c	230	163,000	Evolutionary model
BAT99-98	226	165,000	Luminosity/atmosphere model
R136a2	195	163,000	Evolutionary model
Melnick 42	189	163,000	Luminosity/atmosphere model
R136a3	180	163,000	Evolutionary model
HD 15558 A	>152 ± 51	24,400	Binary
VFTS 682	150	164,000	Luminosity/atmosphere model
R136a6	150	157,000	Evolutionary model
Melnick 34 A	147	163,000	Luminosity/atmosphere model
LH 10-3209 A	140	160,000[10]	
Melnick 34 B	136	163,000	Luminosity/atmosphere model
NGC 3603-B	132 ± 13	24,700	Luminosity/atmosphere model
HD 269810	130	163,000	Luminosity/atmosphere model
P871	130		?
WR 42e	130 ± 5	25,000	Ejection in triple system
R136a4	124	157,000	Evolutionary model
Arches-F9	121 ± 10	25,000	Luminosity/atmosphere model
NGC 3603-A1a	120	24,700	Eclipsing binary
LSS 4067	120	9,500–12,700	Evolutionary model
NGC 3603-C	113 ± 10	22,500	Luminosity/atmosphere model
Cygnus OB2-12	110	5,220	Luminosity/atmosphere model
WR 25	110	10,500	Binary?
HD 93129 A	110	7,500	Luminosity/atmosphere model

https://en.wikipedia.org/wiki/List_of_most_massive_stars