2.

- NUMBER OF STARS BORN PER UNIT TIME: B
- NUMBER OF STARS BORN WITH MASS ON THE RANGE $m \rightarrow m+dm$: $IMF(m)\,dm\,dt\,B$ (IN dt TIME).
- NUMBER OF STARS BORN WITH MASS ON THE RANGE $m \rightarrow m+dm$ BETWEEN 0 & T:

$$\text{TOTAL BORN} = \int_0^T IMF(m)\,dm\,B\,dt$$

$$= IMF(m)\,dm\,T\,B$$

- WHICH SURVIVE TODAY? THOSE WHICH WERE BORN AFTER $T - t_{ms}(m)$. NUMBER OF STARS BORN WITH MASS ON THE RANGE $m \rightarrow m+dm$ BETWEEN $T - t_{ms}(m)$ & T:

$$\text{BORN \& SURVIVING TO TODAY} = \int_{T-t_{ms}(m)}^{T} IMF(m)\,dm\,B\,dt$$

$$= IMF\,dm\,B\,t_{ms}(m)$$

~~THIS WILL BE PDMF(m) dm. PROPORTIONAL TO~~

- PDMF(m) dm × TOTAL NUMBER OF STARS IS THE NUMBER OF STARS TODAY WITH MASS BTWN m & $m+dm$. IE WHAT WE HAVE ABOVE.

$$\Longrightarrow PDMF(m) \propto IMF(m) \cdot t_{ms}(m)$$

IN THE LOWER LIMIT OF OUR INTEGRAL, WE'VE WRITTEN:

$$T - t_{ms}(m)$$

The highest t_{ms} is $t_{ms}(m_{min})$.

We're told: $t_{ms}(m_{min}) < T$

$$\Rightarrow T - t_{ms} > 0 \ \forall \ m$$

Which is quite good.

How will PDMF change: it will not.
(it has no time dependence as seen on the functional form)

"Explain why"...

Total E in star $\propto m$

time it takes to radiate it $\propto t_{ms}(m)$

Being on the main sequence means luminosity is roughly constant.

$$\Rightarrow L = \frac{\text{energy radiated}}{\text{time it takes to radiate that energy}} \ \tilde{\propto} \ \frac{m}{t_{ms}(m)}$$

TOTAL LUMINOSITY BETWEEN m & $m + dm$ IN PDMF = LUMINOSITY OF EACH STAR WITH MASS m $\times$ NUMBER OF STARS W/ MASS m

↓ LET THIS BE

$P(m)\,dm$ WHERE $P(m)$ IS LUMINOSITY DENSITY.

$$\propto \frac{m}{t_{ms}(m)} \cdot \underbrace{PDMF(m)dm}_{\downarrow}$$

$$\propto \overline{IMF(m)\cancel{t_{ms}(m)}}\, dm \frac{m}{\cancel{t_{ms}(m)}}$$

$$\propto IMF(m)\, m\, dm$$

$\propto$ MASS OF STARS IN IMF BETWEEN m & $m + dm$

AS REQUIRED.

~~P(m)~~

FROM ABOVE, GET LUMINOSITY DENSITY:

$$P(m) \propto IMF(m)\, m$$

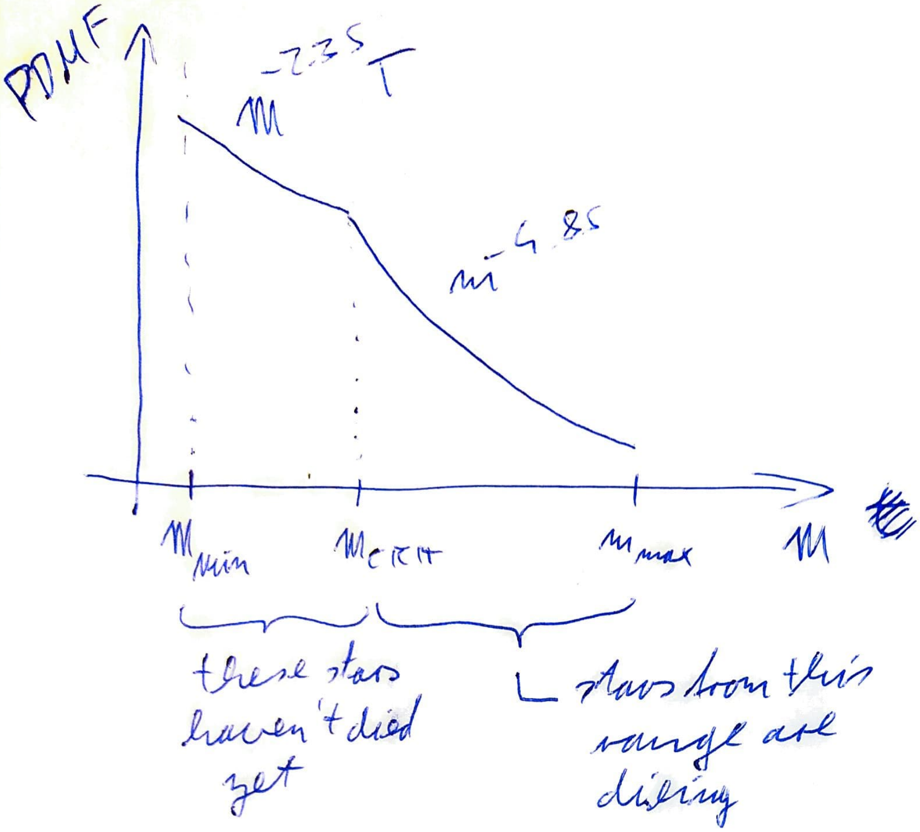
IF $IMF(m) \propto m^{-2.35} \Rightarrow P(m) \propto m^{-1.35}$

$\Rightarrow$ LOW MASS STARS DOMINATE TOTAL LIGHT DISTRIBUTION.

"NOW CONSIDER"

$$PDMF(m) \propto \begin{cases} IMF(m)\,T & \text{IF } t_{ms}(m) > T \\ IMF(m)\,t_{ms} & \text{IF } t_{ms}(m) \leq T \end{cases}$$

$$\propto \begin{cases} IMF(m)\,T \\ IMF(m)\,m^{-2.5} \end{cases} \propto \begin{cases} m^{-2.35}\,T \\ m^{-2.35}\,m^{-2.5} \end{cases} \propto \begin{cases} m^{-2.35}\,T \\ m^{-4.85} \end{cases}$$



For a galaxy of $T=10^8$ yrs..

We have concluded earlier that if $T > t_{ms}(m_{min})$, low mass stars dominate the luminosity budget. If $T < t_{ms}(m_{min})$, this is even more true: ~~more~~ less low mass stars died, so they ~~do~~ dominate over high mass stars which died anyway.