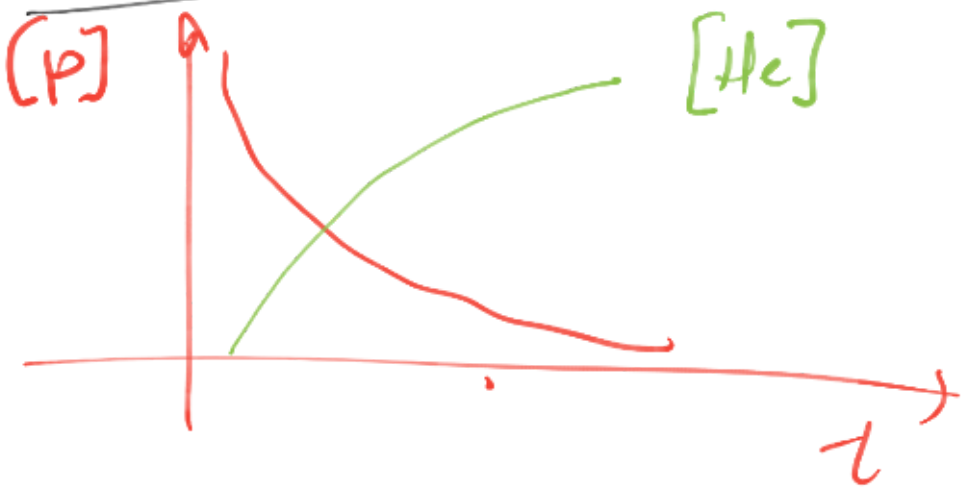
$4\,{}^{1}H \rightarrow {}^{4}He + 2e^{+} + 2\nu_e + 25{,}7\,MeV$

pp I

$p + p \rightarrow {}^{2}H + e^{+} + \nu_e + Q_1$

${}^{2}H + p \rightarrow {}^{3}He + Q$

${}^{3}He + {}^{3}He \rightarrow {}^{4}He + p + p + Q$




${}^{4}He + {}^{4}He \rightarrow {}^{8}Be + Q$

${}^{8}Be + {}^{4}He \rightarrow {}^{12}C + Q$

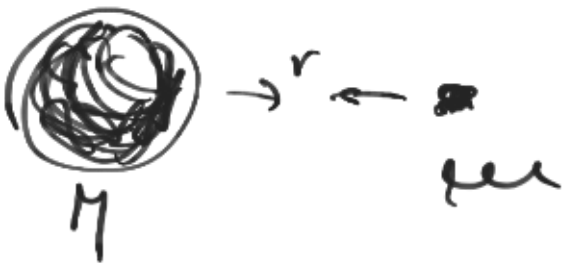
$3M_\odot$ → Energía

99% → Neutrinos

$p^+ + e^- \rightarrow n^\circ + \nu_e$

SN 1987 A → Nubes de Magallanes

$$F_G = \frac{G m M}{r^2}$$



Fuerza centrífuga

Movimiento gravitacional

$$\frac{GMm}{r^2} = \frac{mv^2}{r} \qquad v = a$$

$$\frac{GM}{r} = v^2 \Rightarrow r_0 = \sqrt{\frac{GM}{r}}$$

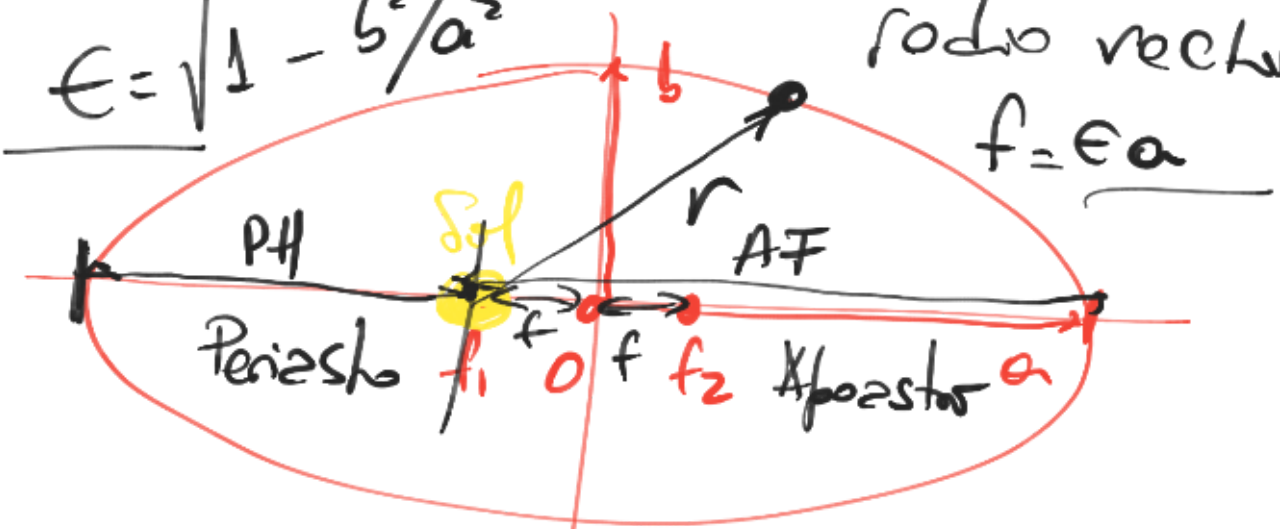
$$\frac{2\pi r}{T} = r_0 = \sqrt{\frac{GM}{r}}$$

$$\frac{4\pi^2 r^2}{T^2} = \frac{GM}{r} \Rightarrow \frac{4\pi^2}{GM} = \frac{T^2}{r^3}$$

$$\boxed{T^2 = K r^3}$$

$\langle r \rangle = a$

$$\epsilon = \sqrt{1 - b^2/a^2}$$




$f = \epsilon a$

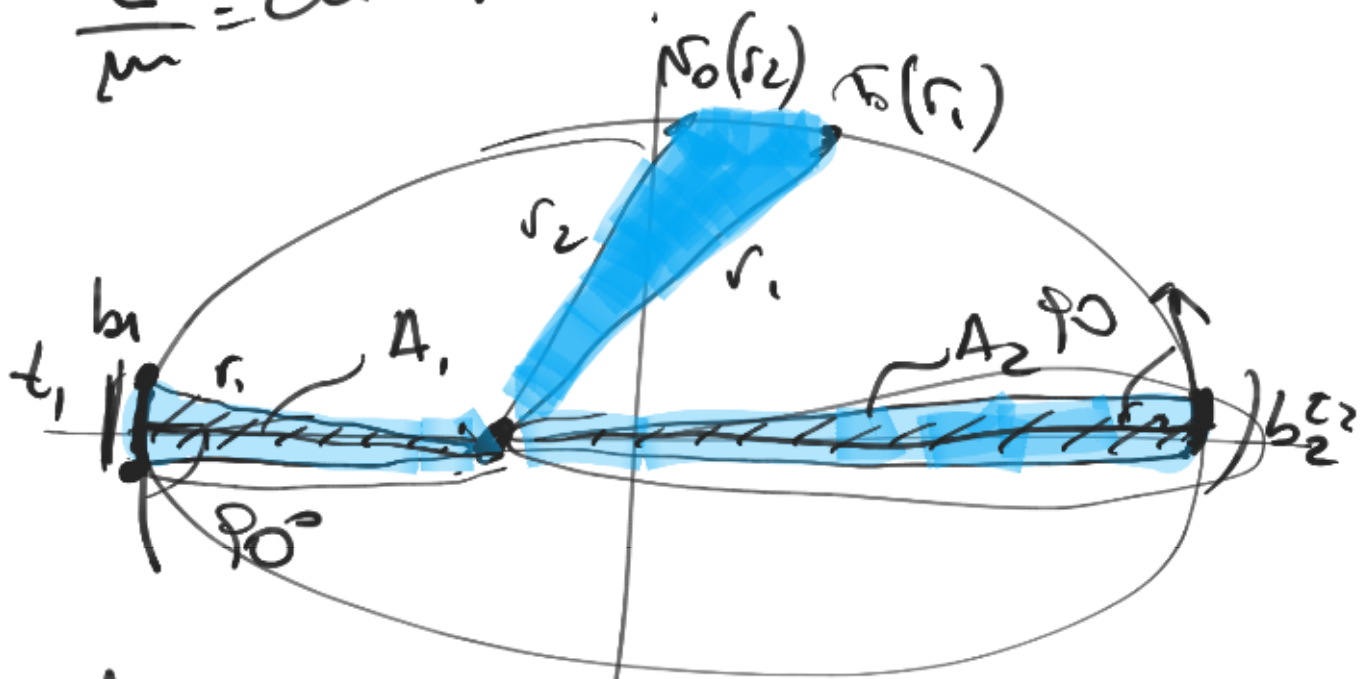
$$T^2 = K a^3 \qquad K = \frac{4\pi^2}{GM}$$

Sol

$$\left(\frac{PH + AF}{2}\right) = a \qquad r_0 = \sqrt{\frac{GM}{r}}$$

$$L = cte \rightarrow L = m\,r\,v \qquad rv = cte$$

$$\frac{L}{m} = cte = r \cdot v$$




$$\frac{\Delta A_1}{\Delta t} = \frac{\Delta A_2}{\Delta t}$$

$$\Delta A_1 = \frac{b_1 \cdot r_1}{2} \qquad \Delta A_2 = \frac{b_2 \cdot r_2}{2}$$

$$\frac{b_1 \cdot r_1}{2\Delta t} = \frac{b_2 \cdot r_2}{2\Delta t}$$

$$\frac{v_0(r_1) \cdot \Delta t \, r_1}{2\Delta t} = \frac{v_0(r_2) \cdot \Delta t \cdot r_2}{2\Delta t}$$

$$v_0(r_1) \cdot r_1 = v_0(r_2) \cdot r_2$$

$$\underbrace{m\, v(r_1) \cdot r_1}_{L_1} = \underbrace{m\, v(r_2) \cdot r_2}_{L_2}$$

$$L_1 = L_2 = \text{const.}$$

$$\frac{T^2}{a^3} = \frac{4\pi^2}{GM_\odot} = K_\odot$$

$$[K_\odot] = s^2/m^3$$

$$\left(\frac{T^2}{4\pi^2}\right)/_{a^3} = \left(K_\odot / 4\pi^2\right)$$

$$\left(\frac{T^2}{\text{ano}^2}\right) \cdot \frac{UA^3}{a^3} = \frac{K_\odot}{2\pi} \cdot UA^3$$

$$\left(\frac{T}{\text{ano}}\right)^2 \Big/ \left(\frac{a}{UA}\right)^3 = \underbrace{\frac{K_\odot}{2\pi}(UA)^3}_{1}$$

$$T_\oplus = 1 \text{ ano}$$

$$a_\oplus = 1 UA$$

$$\left(\frac{1\text{ano}}{1\text{ano}}\right)^2 \Big/ \left(\frac{1\,UA}{1\,UA}\right)^3 = 1 = \frac{K_\odot}{2\pi}(UA)^3$$

$$\frac{4\pi^2}{G M_\odot} \frac{(1UA)^3}{(1\text{ano})^2}$$

$$\begin{array}{ll} 1 & M \quad M_\odot \\ & 1 \quad K \end{array}$$

$$\frac{T_{año}^2}{a_{UA}^3} = \left(\frac{M_\odot}{M}\right) = \frac{1}{M_{M_\odot}}$$

$$T^2 = \frac{1}{M} a^3$$

$$\Rightarrow T = \sqrt{\frac{a^3}{M}}$$

$a = 1,31$ UA

$M = 0,99\ M_\odot$

$T = 1,51$ años

$$\frac{1}{4\pi\varepsilon_0}\frac{Qq}{r^2} = ma$$

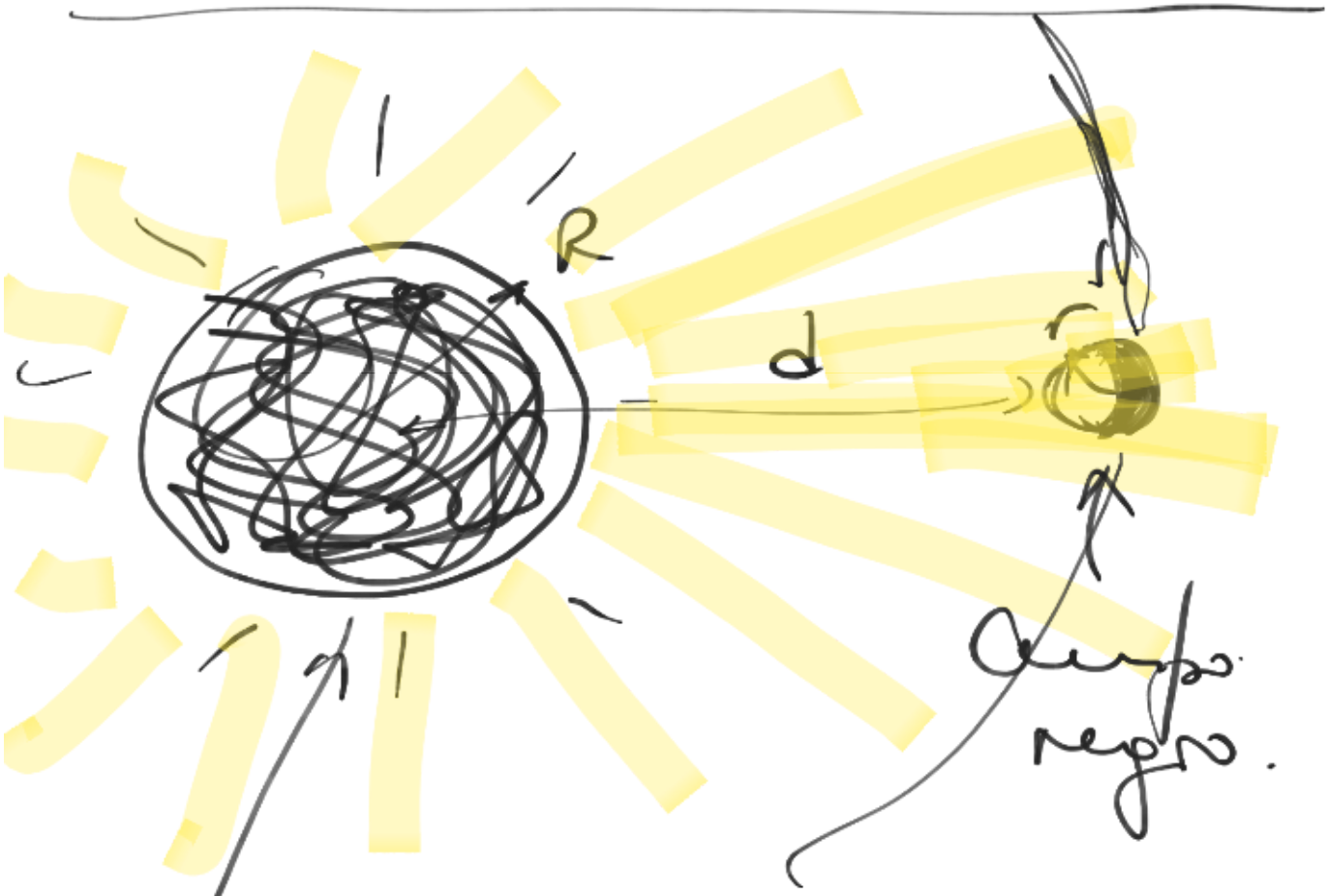
Movimiento posible

$$a = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{mr^2}$$

$$\frac{GM\cancel{m}}{r^2} = \cancel{m}a$$

Movimiento inercial

$$a \equiv g = \frac{GM}{r^2}$$




Campo negro

$$L = 4\pi\sigma R^2 T^4$$

dS

$$F = \frac{4\pi\sigma R^2 T^4}{4\pi d^2}$$

$\pi r^2$

$$E_{\oplus} = F \cdot A_{\oplus}$$

$$= \frac{4\pi\sigma R^2 T^4}{4\pi d^2} \cdot \pi r^2$$

$$E^r_{\oplus} = \frac{\sigma R^2 T^4 \cdot \pi r^2}{d^2}$$

$$E^e_{\oplus} = 4\pi r^2 \sigma \cdot T_{\oplus}^4$$

$$T_{\oplus} \Big| \quad E^r_{\oplus} = E^e_{\oplus}$$

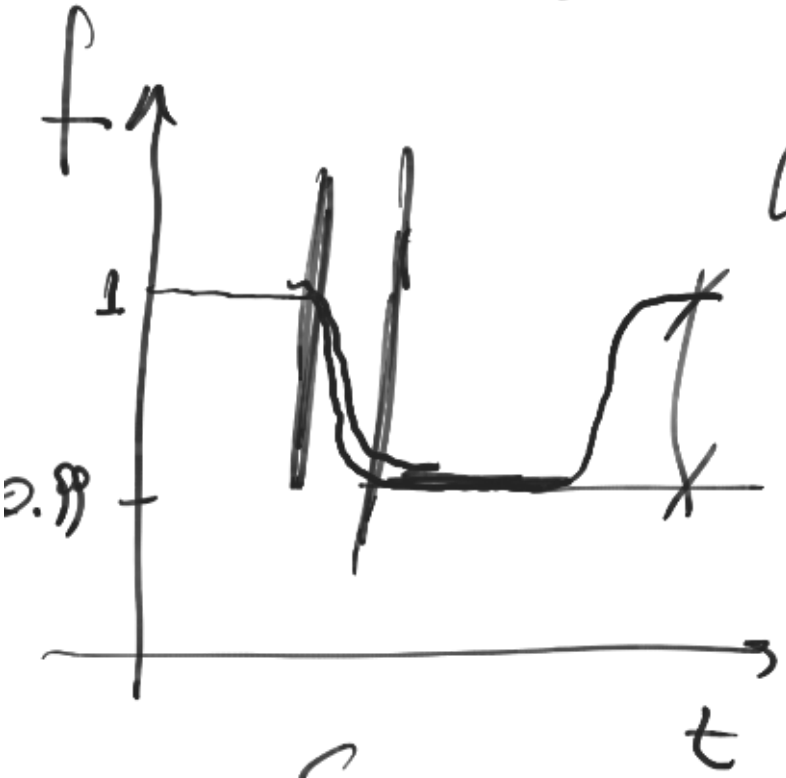
$$\frac{\sigma R^2 T^4 \pi r^2}{d^2} = 4\pi r^2 \sigma T_{\oplus}^4$$

$$T_{\oplus}^4 = \frac{R^2 T^4}{4d^2} \Rightarrow T_{\oplus} = \sqrt[4]{\frac{R^2 T^4}{4d^2}}$$

$$T_{\oplus} = \sqrt{\frac{\frac{RT^2}{2d}}{}} \Rightarrow \boxed{T_{\oplus} = \sqrt{\frac{R}{2d}}\, T}$$

temperatura orbital

$$T_\Theta = \sqrt[4]{\frac{L_\odot}{16\pi\sigma d^2}} = \left(\sqrt[4]{\frac{1}{16\pi\sigma}}\right) \cdot \frac{\sqrt[4]{L_\odot}}{\sqrt{d}}$$

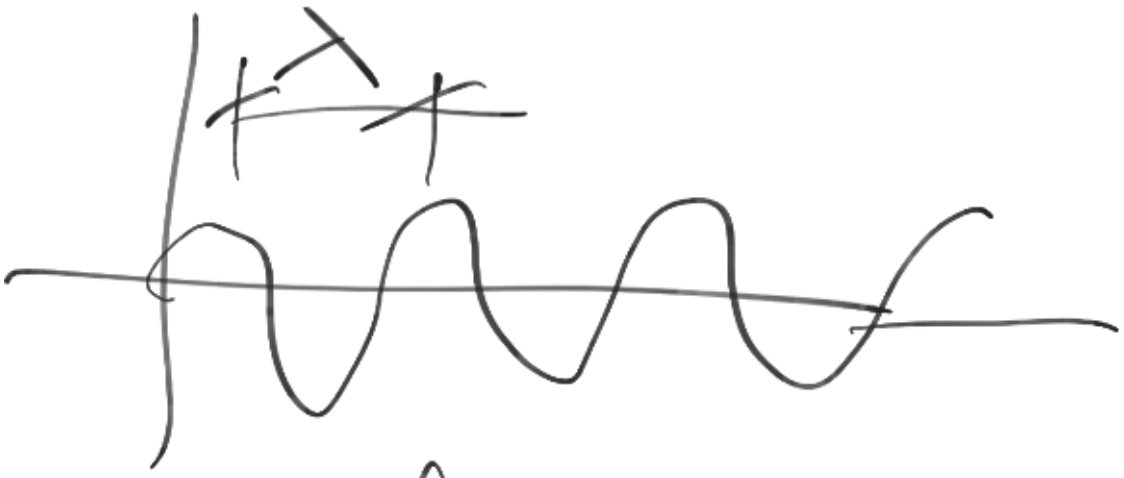



metodo de eclipse

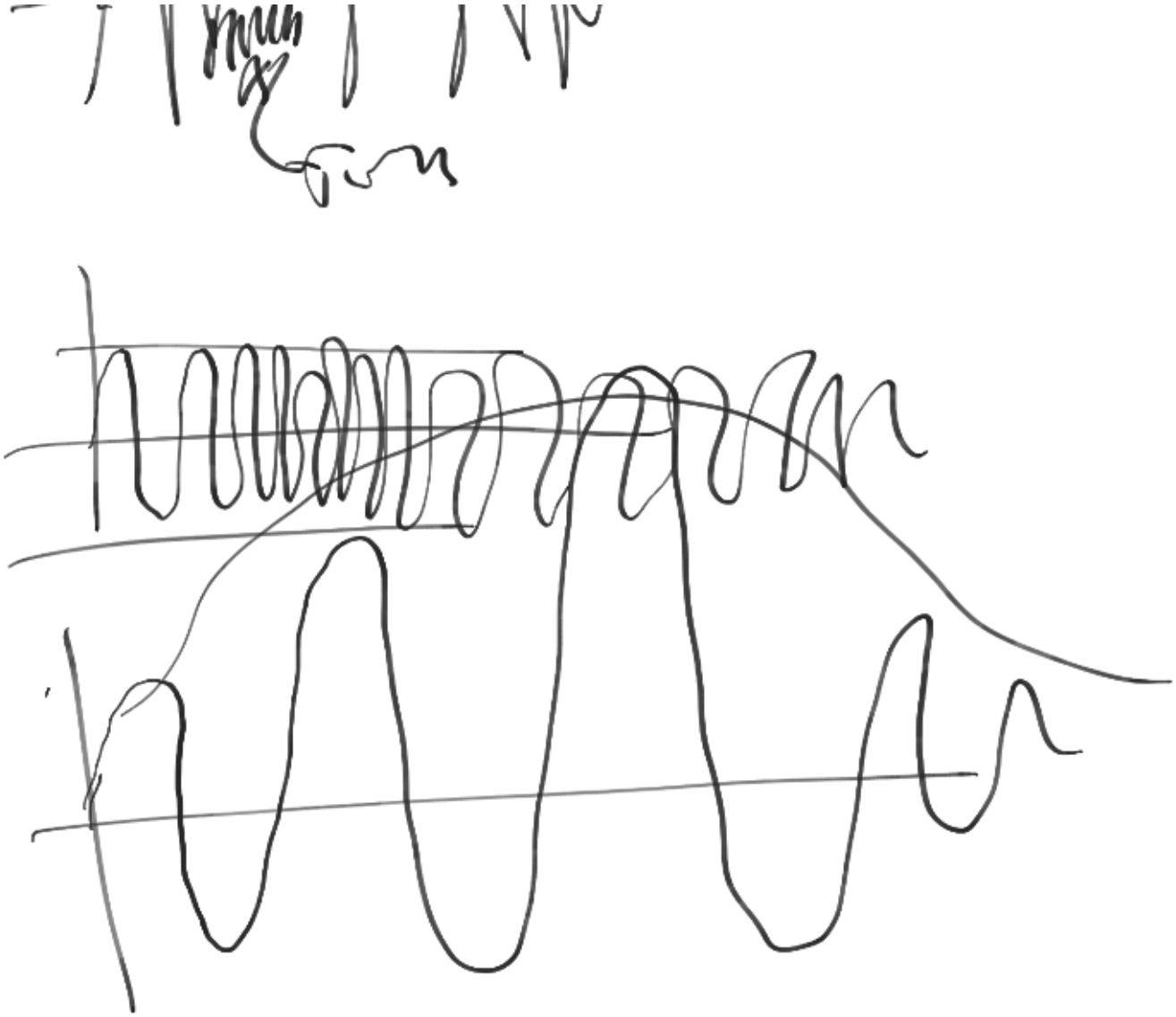
$$\lambda_{max} = \frac{\Sigma}{T} = \frac{3\,mm\,K}{300\,K}$$

$\lambda_{max} = 0{,}03\,m = 3\,\mu m = 3000\,nm.$

infrarroja




f



J