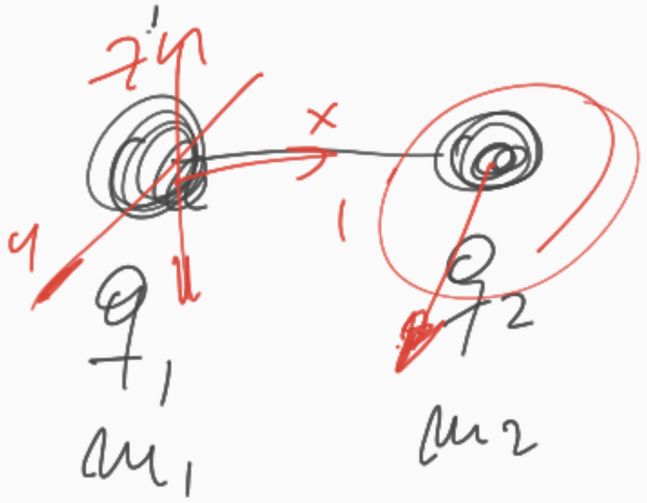
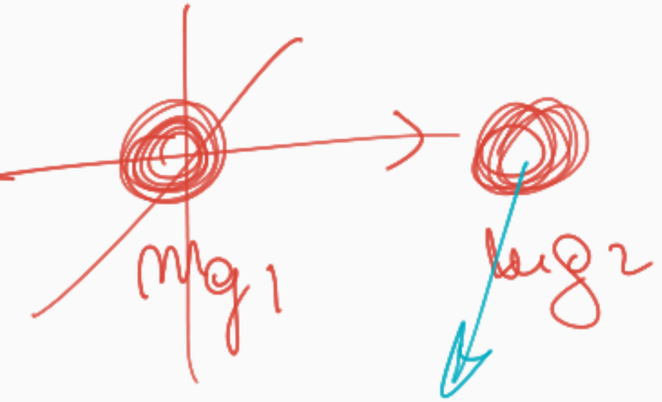
- **Unidad** 03–Astrofísica: escalas
- **Clase** U03C03 - 13/16
- **Fecha** 28 Oct 2020
- **Cont** Objetos Compactos
- **Cátedra** Asorey
- **Web** https://gitlab.com/asoreyh/unrn-ipac/

RIO NEGRO

Notas de clase





$$F_e = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} \Rightarrow \vec{F}_e = \frac{q_1}{4\pi\varepsilon_0}\cdot\frac{q_2}{|r^2|}\hat{r}$$

$$F_e = \frac{q_1}{4\pi\varepsilon_0}\cdot\frac{q_2}{r^2}\hat{r} = m_2\frac{d^2r}{dt^2}$$

$$F_G = G m_{g1}\cdot\frac{m_{g2}}{|r^2|^2}\hat{r} = m_2\frac{d^2r}{dt^2}$$

$$g = \frac{G M_\oplus}{R_\oplus^2} \simeq 9{,}8\ m^2/s$$

$$\frac{1}{2} m v^2 = \frac{3}{2} k T \Rightarrow v = \sqrt{\frac{3kT}{m}}$$

$$p = mv \Rightarrow (\phi)\ p = m\sqrt{\frac{3kT}{m}} \Rightarrow p = \sqrt{3kTm}$$

$$\lambda = \frac{h}{p} \Rightarrow (\chi)\ \frac{h}{\sqrt{3kTm}}$$

$$\Delta x \sim |r_1 - r_2|$$

$$\lambda_e = \frac{h}{\sqrt{3kTm_e}} \sim \Delta x$$

n_e = densidad del número de electrones.

→ Nº electrones / volumen

$\Rightarrow V = \Delta x^3$ N_e electrones

$$n_e = \frac{N_e}{\Delta x^3} \Rightarrow \Delta x^3 = \frac{N_e}{n_e} \Rightarrow$$

$$\Delta x = \sqrt[3]{N_e / n_e} \sim \boxed{\Delta x \sim \sqrt[3]{1/n_e}}$$

$$\Delta x \sim \lambda_e$$

$$\sqrt[3]{\frac{1}{n_e}} \lesssim \frac{h}{\sqrt{KT\, m_e}}$$

$$p = \left(\frac{1}{2} m_e v_e^2\right) \cdot n_e = \frac{n_e}{2} \cdot m_e \left(\frac{p_e}{m_e}\right)^2 = \frac{n_e p^2}{2 m_e}$$

$$\Delta x \, \Delta p \simeq \hbar \Rightarrow n_e^{-1/3} \cdot \Delta p \simeq \hbar \Rightarrow \Delta p \simeq \hbar n_e^{1/3}$$

$$p = \frac{n_e}{2m_e} \hbar^2 (n_e^{2/3}) \Rightarrow \boxed{P_e = \frac{\hbar^2}{2m_e} \cdot n_e^{5/3}}$$

$$\rho = n_e \cdot m_e \simeq \mu_p \cdot \Rightarrow \rho = n_e \cdot m_p$$

$$\Rightarrow n_e = \rho / \mu_p$$

$$P = \frac{\hbar^2}{2m_e} \cdot \frac{\rho^{5/3}}{\mu_p^{5/3}} \Rightarrow \boxed{P = \left(\frac{\hbar^2}{2m_e \mu_p^{5/3}} \right) \rho^{5/3}}$$

K

Reacción de fusión

$$E_{cin} = (\gamma - 1) m c^2$$

$$E^2 = p^2 c^2 + m_0^2 c^4$$

$$E^2 \simeq p^2 c^2 \Rightarrow E \simeq p \cdot c \qquad \gamma >> 1$$

$$P = n_e \, p_e c$$

$$\Delta x \Delta p \simeq \hbar \Rightarrow p \simeq \hbar / \Delta x \simeq \hbar \, n_e^{1/3}$$

$$P = n_e \cdot c \cdot \hbar \, n_e^{1/3} \Rightarrow P = \hbar c \, n_e^{4/3} \Rightarrow \rho = n_e \cdot \mu_p \Rightarrow n_e = \frac{\rho}{\mu_p}$$

$$P = \frac{\hbar c}{m_p^{4/3}} \rho^{4/3} \quad K_R \quad \Rightarrow \boxed{P = K_R \cdot \rho^{4/3}}$$

$$\frac{1}{2} m v^2 = \frac{G M m}{R} \Rightarrow v^2 = \frac{2GM}{R} \Rightarrow v_e = \sqrt{\frac{2GM}{R}}$$

$$R_{SCH} = \frac{2G}{c^2} M \Rightarrow \frac{R_{SCH}}{M} = \frac{2G}{c^2} \Rightarrow \frac{M}{R_{SCH}} = \frac{c^2}{2G}$$