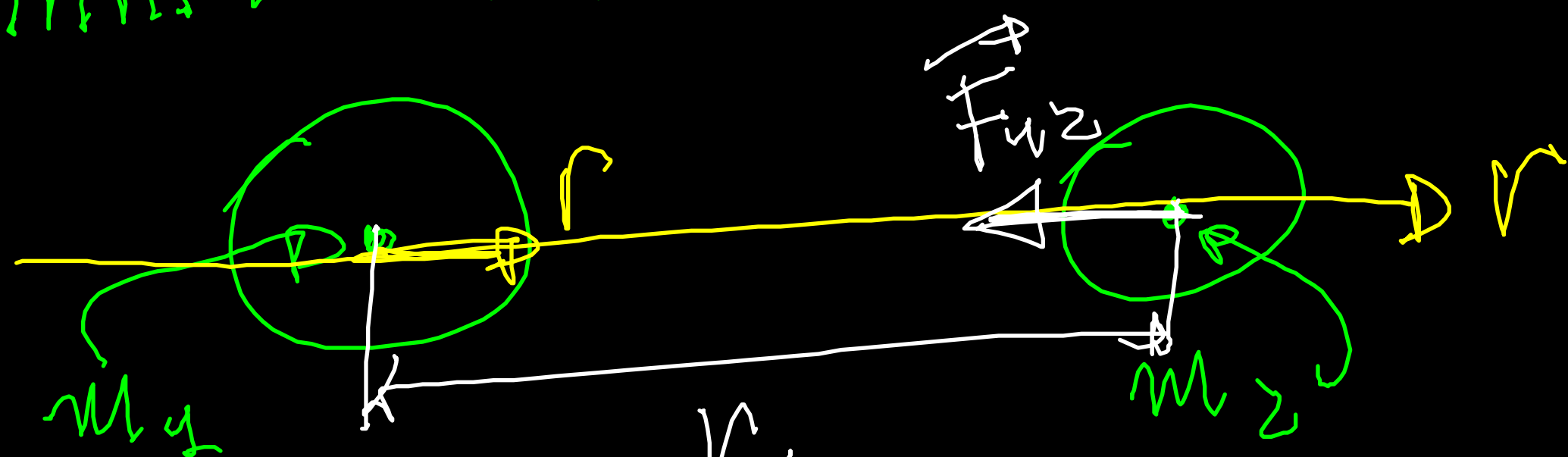
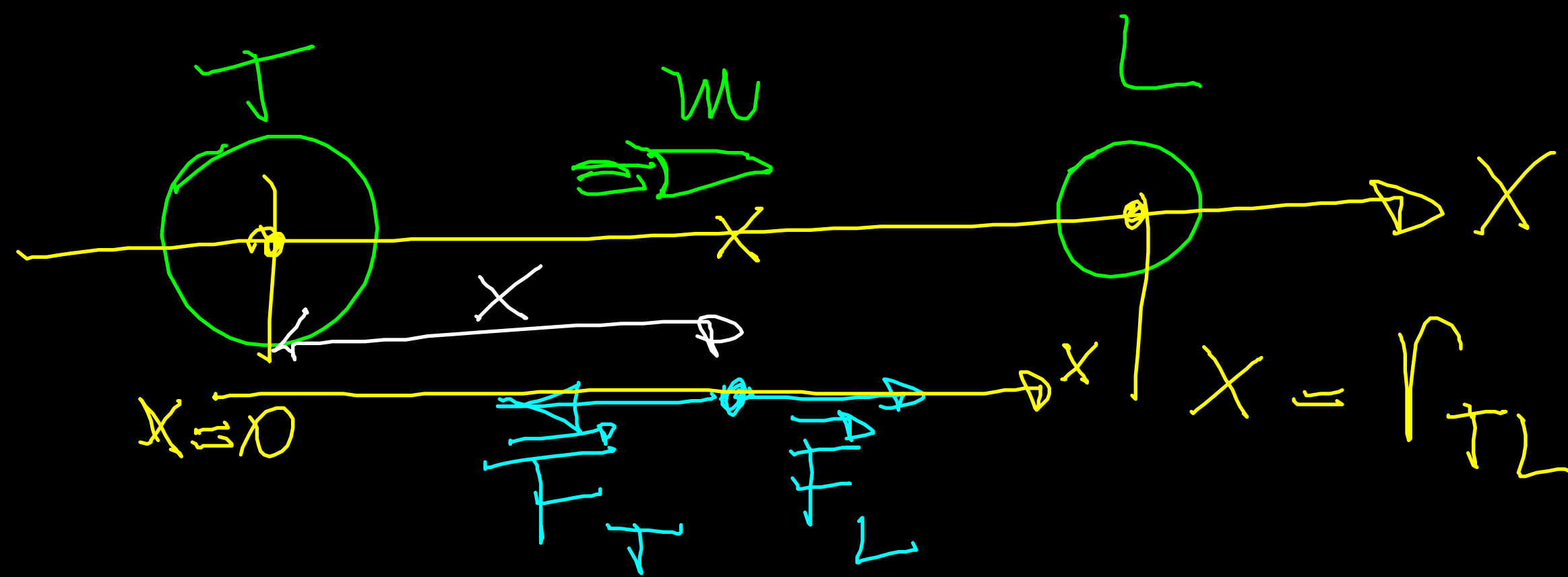


# GRAVITAZIONE UNIVERSALE → ESEMPIO

SI MM. SFERICA



$$\vec{F}_{12} = - \frac{G m_1 m_2}{r_{12}^2} \hat{r}$$



$$-\frac{G M_T m}{x^2} + \frac{G M_L m}{(r_{TL} - x)^2} = 0$$

$$M_T (r_{TL} - x)^2 = M_L x^2$$

$$\left(1 - \frac{M_L}{M_T}\right) x^2 - 2 r_{TL} x + r_{TL}^2 = 0$$

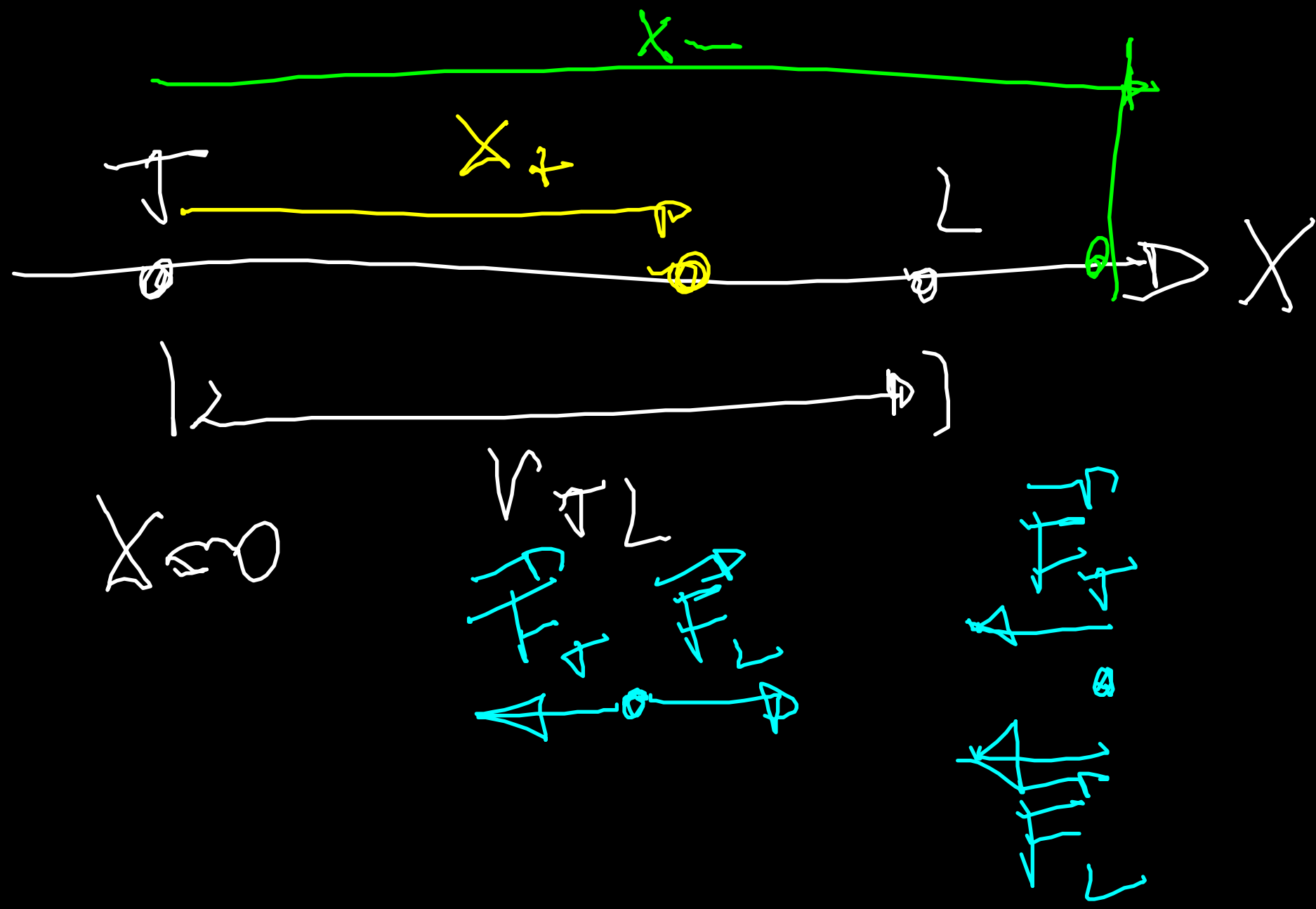
$$X = \frac{v_{T2}}{1 \pm \sqrt{\frac{M_2}{M_T}}}$$

(+)

$$X_+ = \frac{v_{T2}}{1 + \sqrt{\frac{M_2}{M_T}}} < v_{T2}$$

(-)

$$X_- = \frac{v_{T2}}{1 - \sqrt{\frac{M_2}{M_T}}} > v_{T2}$$

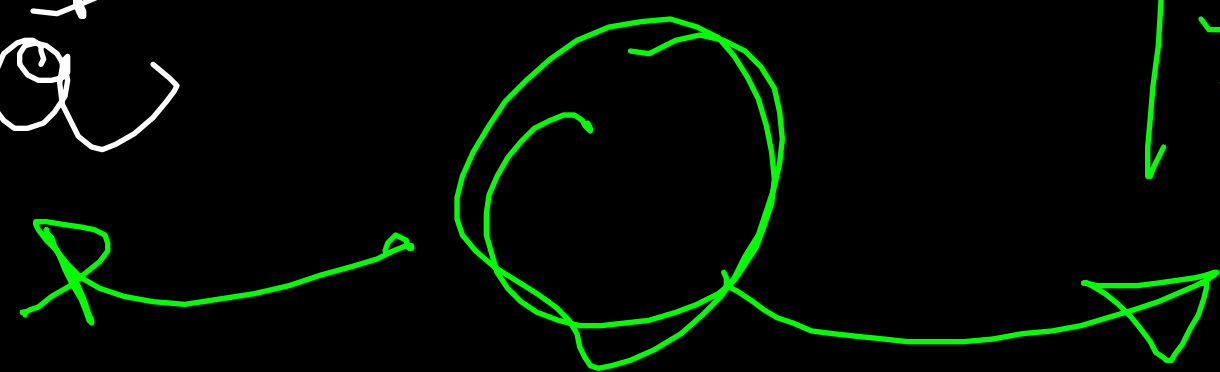


# MASSA INERZIALE E MASSA GRAVITAZIONALE

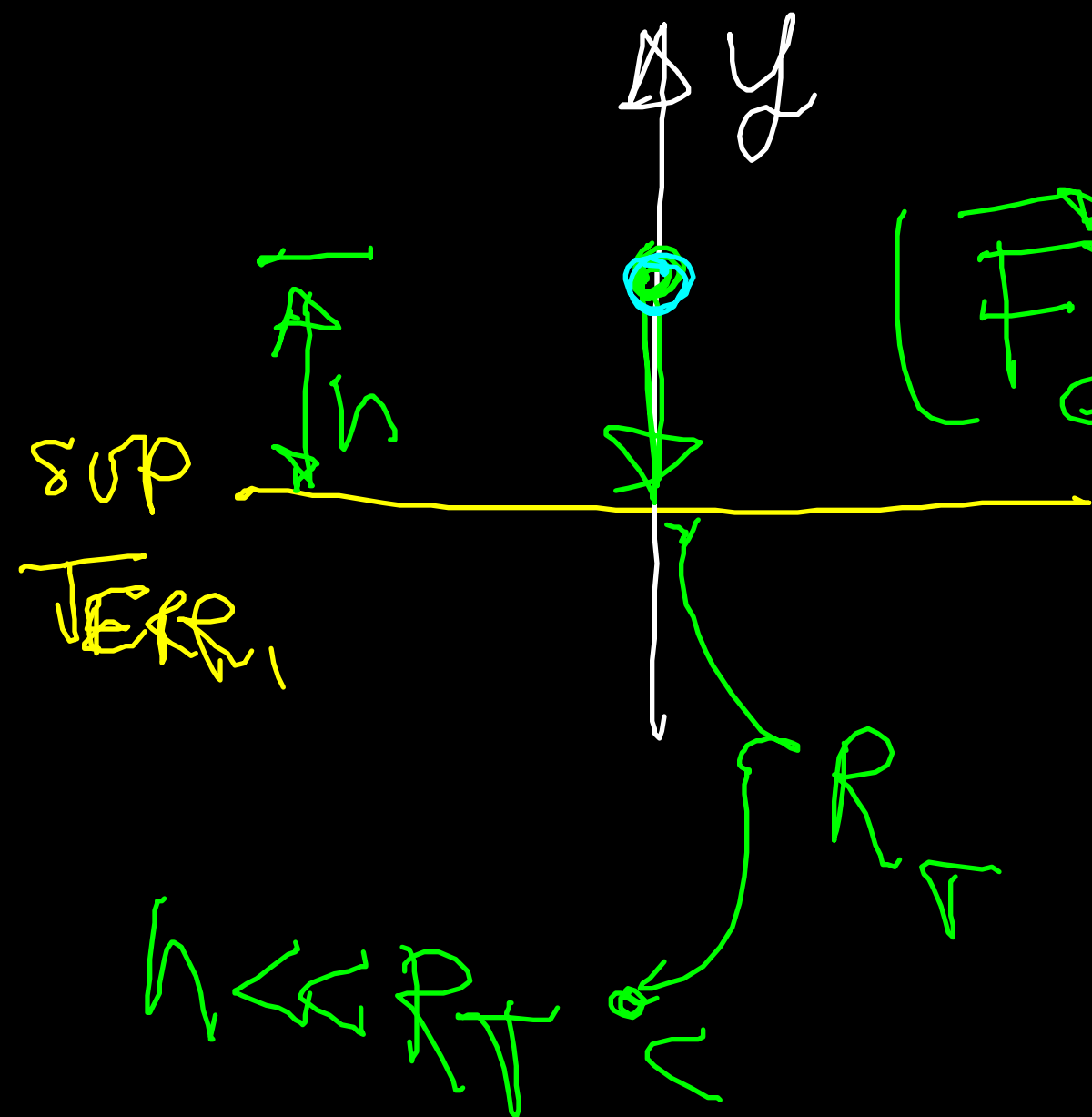
II. PR. DI NEWTON

GRAV. UNIV.

$$\sum_{i=1}^n \vec{F}_i = m_I \vec{a}$$



$$|\vec{F}_{12}| = \frac{G m_1 m_2}{r_{12}^2}$$

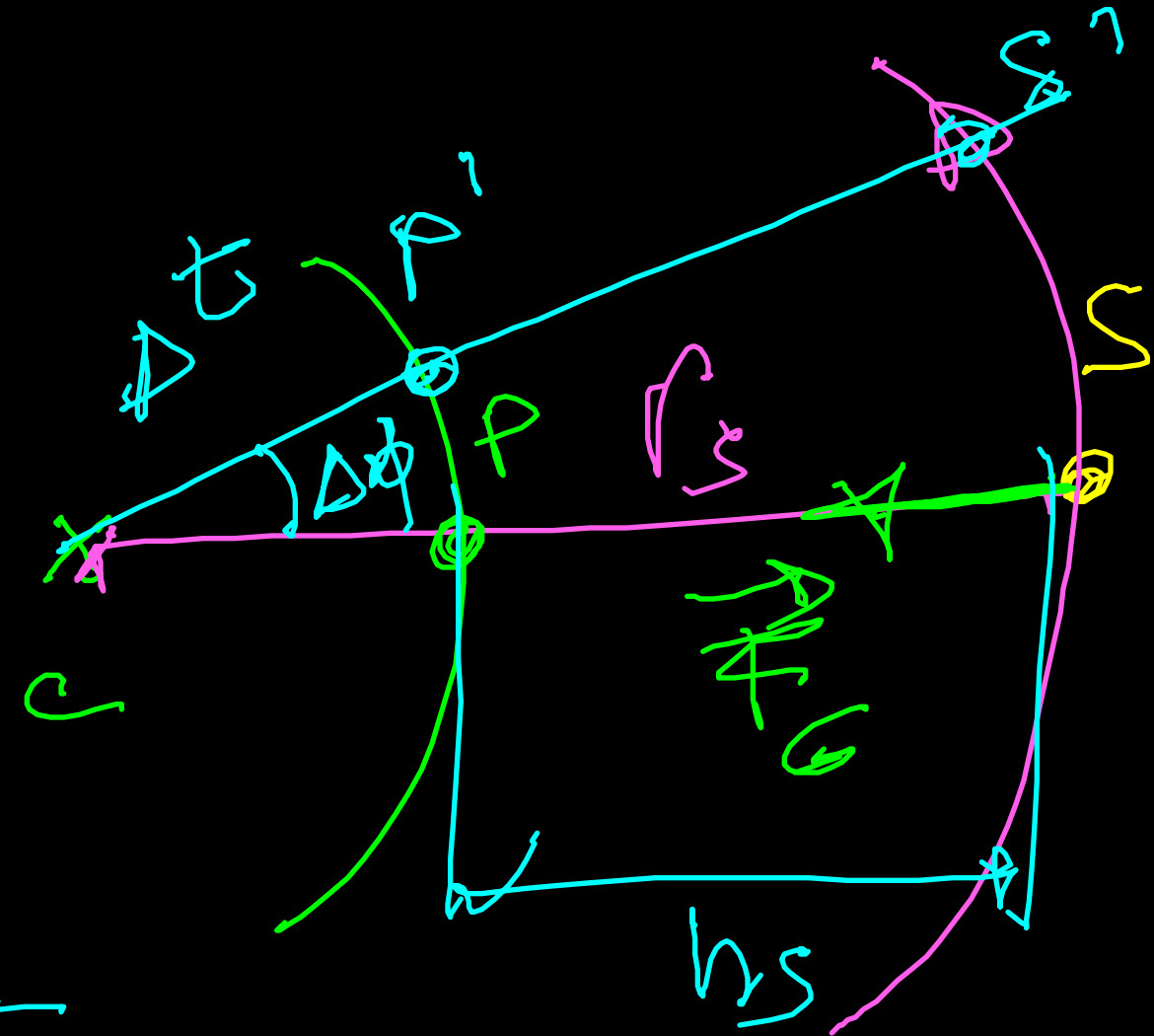


$$(\vec{F}_G)_y = -\frac{G M_T m_G}{(R_T + h)^2} \approx -\frac{G M_T m_G}{R_T^2}$$

MISURO  $a_y \Rightarrow m_I a_y = (\vec{F}_{12})_y = -\frac{G M_T m_G}{R_T^2}$

$$a_y \approx -\left(\frac{m_G}{m_I}\right) \frac{G M_T}{R_T^2} \equiv g \Rightarrow m_I = \left(\frac{G M_T}{R_T^2 g}\right) m_G$$

# SATELLITE GEOSTAZIONE ARXO



MOTO CIRC. UNIFORME  
CON VEL. ANGOLARE  $\omega_S = \frac{2\pi}{T_S}$

$$|\vec{F}_G| = \frac{GM_T m_S}{r_S^2} = a_c = m_S \omega_S^2 r_S$$

$$T_S = 86400 \text{ s}$$

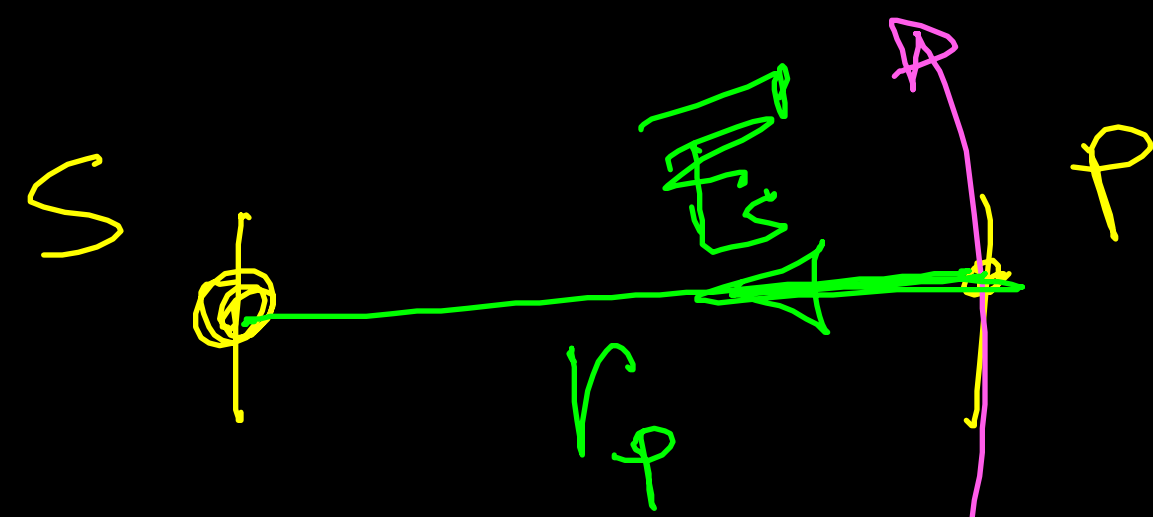
$$G \approx 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2} \quad \frac{GM_T}{r_S^2} = \omega_S^2 r_S \Rightarrow r_S^3 = \frac{GM_T}{\omega_S^2} = \frac{GM_T T^2}{4\pi^2}$$

$$M_T \approx 5.97 \times 10^{24} \text{ kg}$$

$$r_S = 42 \times 10^6 \text{ m} = 42000 \text{ km}$$

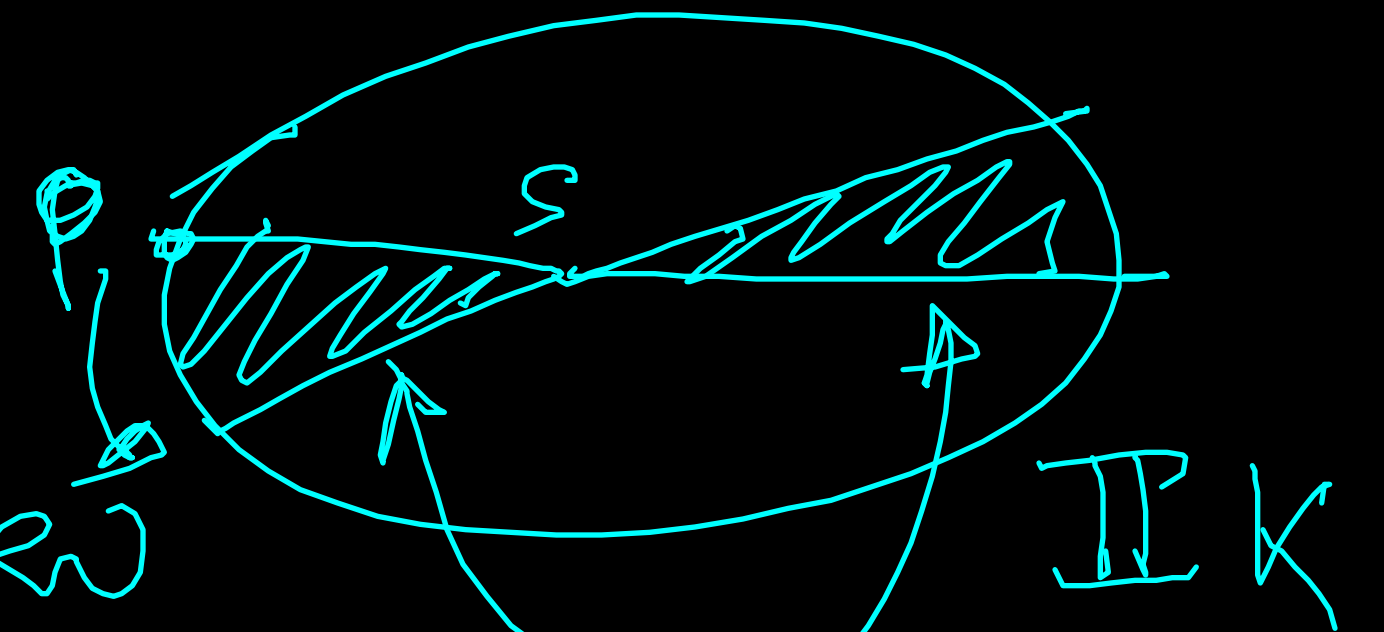
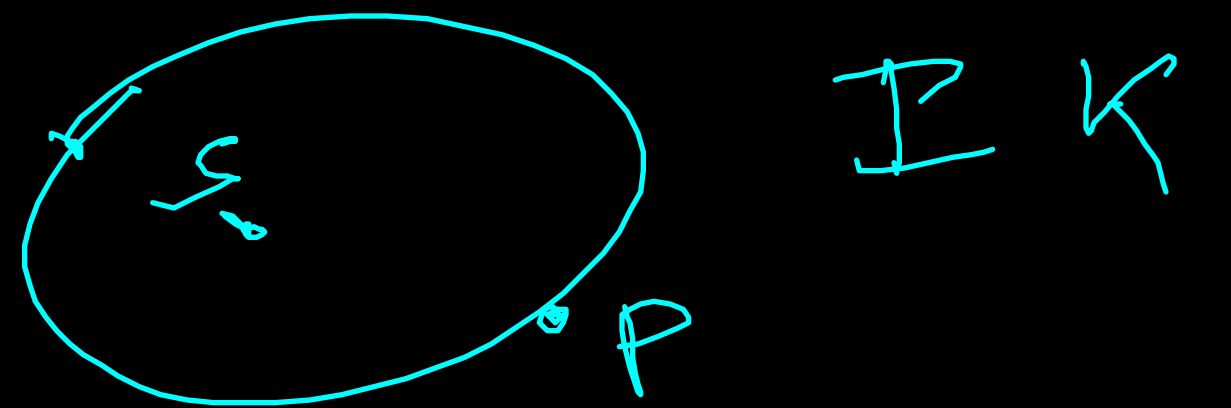
$$h_S = 35600 \text{ km}$$

$$r_s^3 = \frac{GM_s T_s^2}{4\pi^2}$$

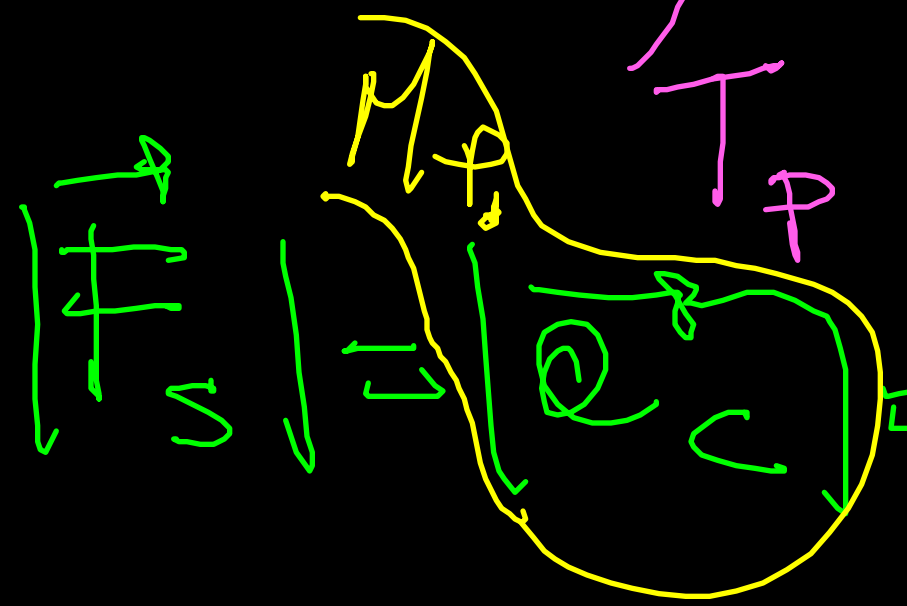


$$r_p^3 = \frac{GM_s T_p^2}{4\pi^2}$$

III LEI KEPLERU

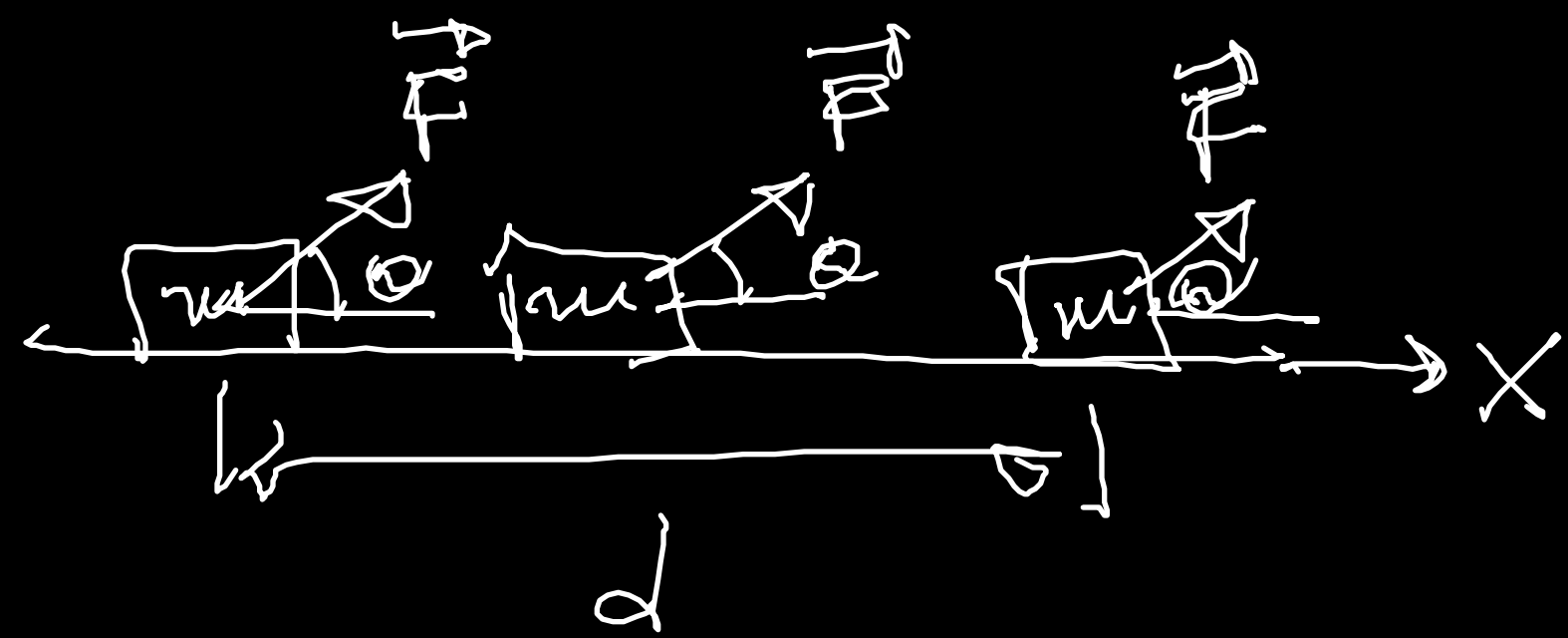
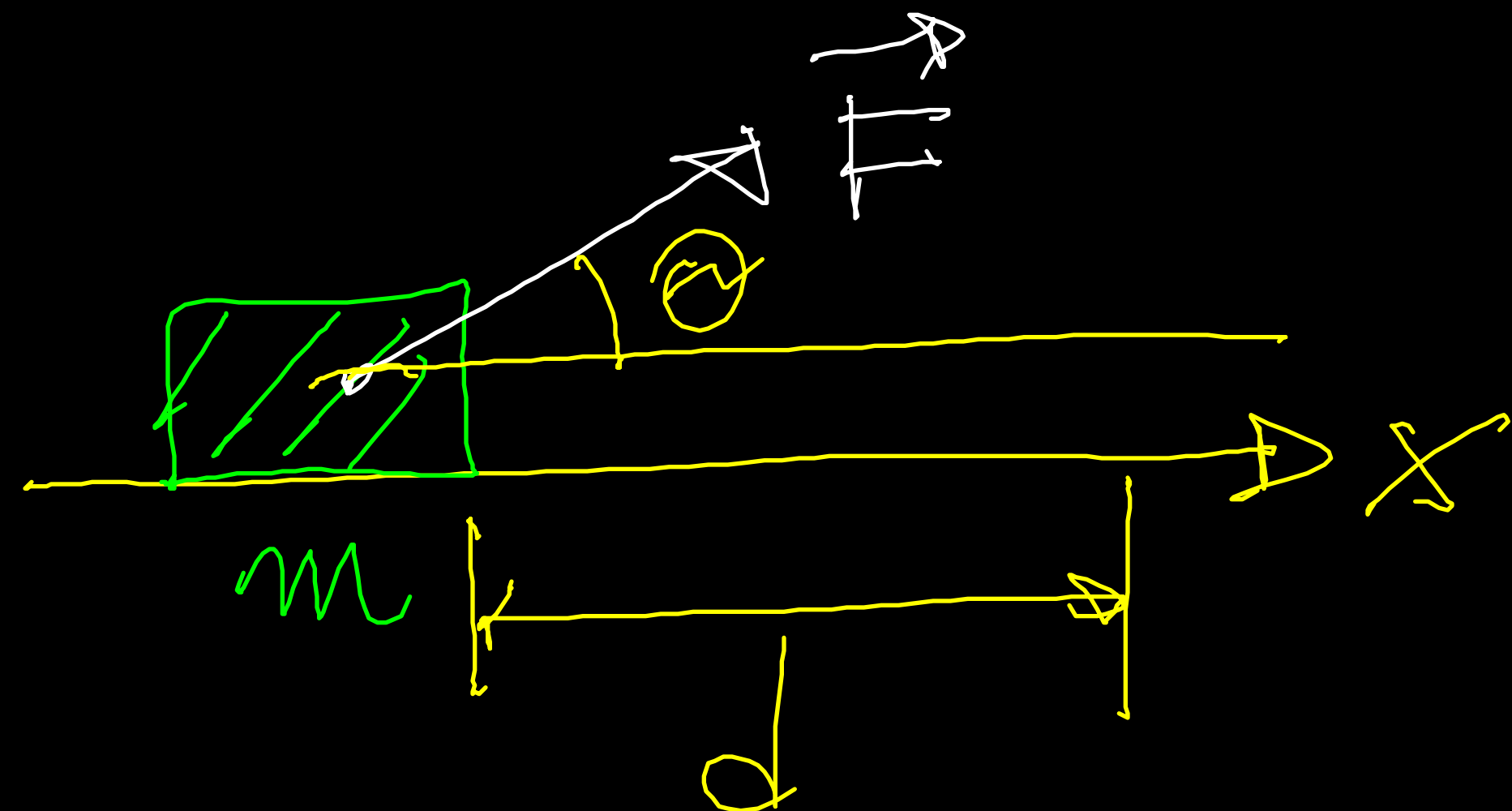


$A_1 = A_2$   
Per  $\Delta t$



$$\frac{M_p 4\pi^2}{T^2} r_p = \frac{GM_s M_p}{r_p^2}$$

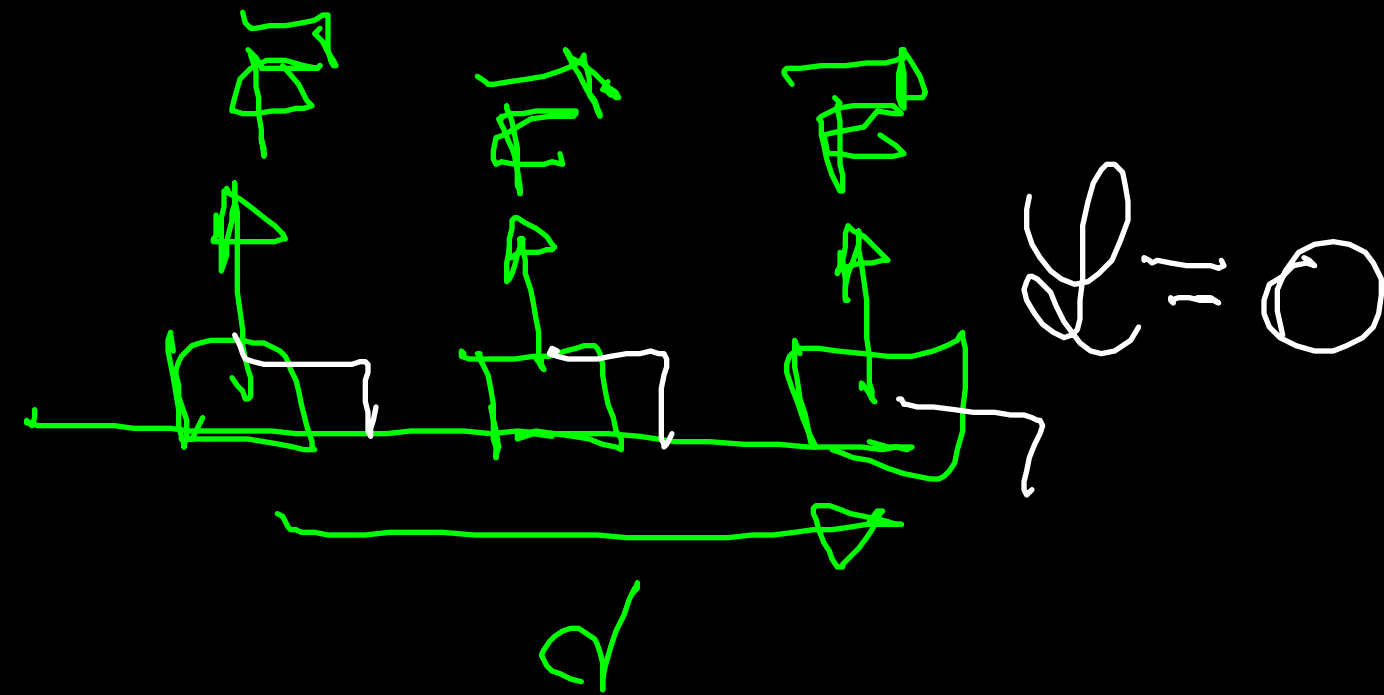
# LAVORO (DI UNA FORZA)

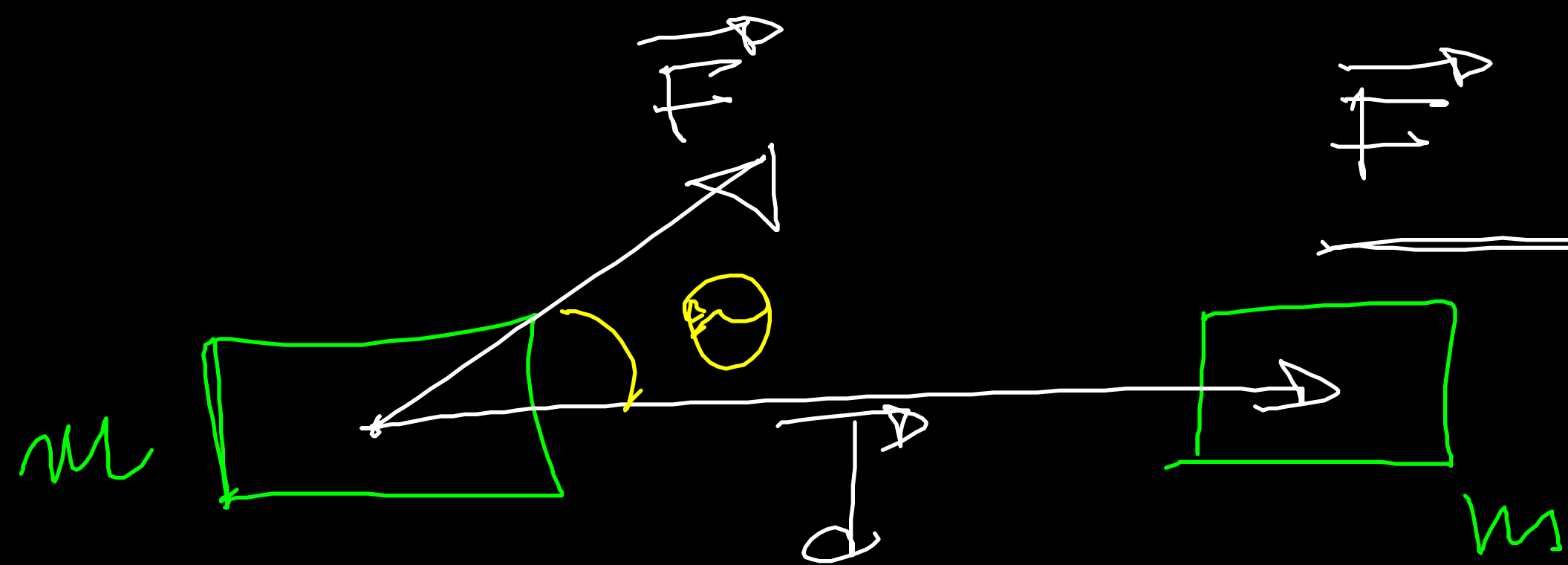


$F$  È COSTANTE

DEF. DI LAVORO

$$L = W = F \cdot d \cos \theta$$



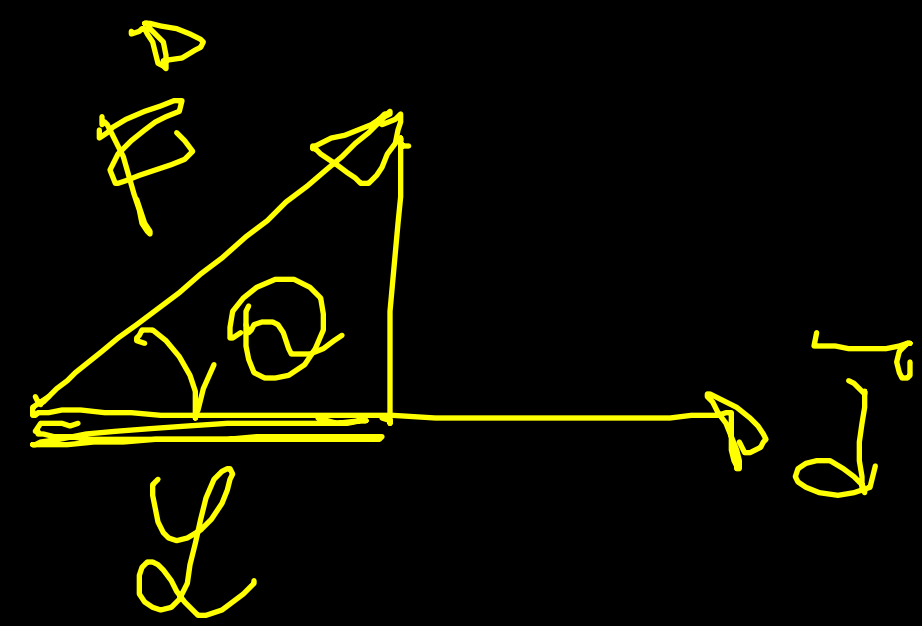


$F'$  COSTANTE

$$W = F \cdot d = F d \cos \theta$$

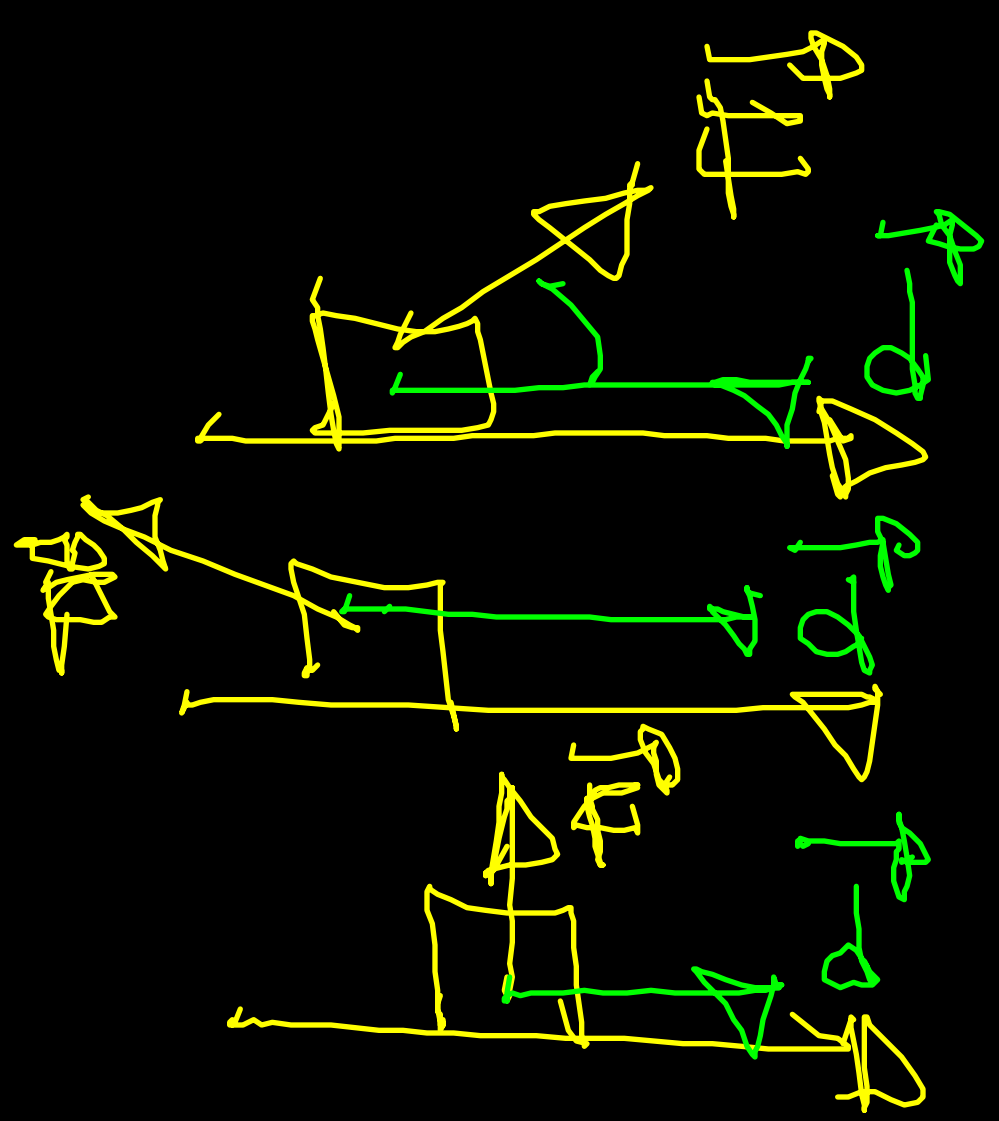
LAVORO

PRODOTTO SCALARE FRA VETTORI



$$[W] = \left[ \frac{\text{kg} \cdot \text{m}^2}{\text{s}^2} \right] = [\text{Joule}] = [J]$$

~~Nm~~



$\theta < 90^\circ \Rightarrow W > 0$   
 $\theta = 90^\circ \Rightarrow W = 0$   
 $\theta > 90^\circ \Rightarrow W < 0$

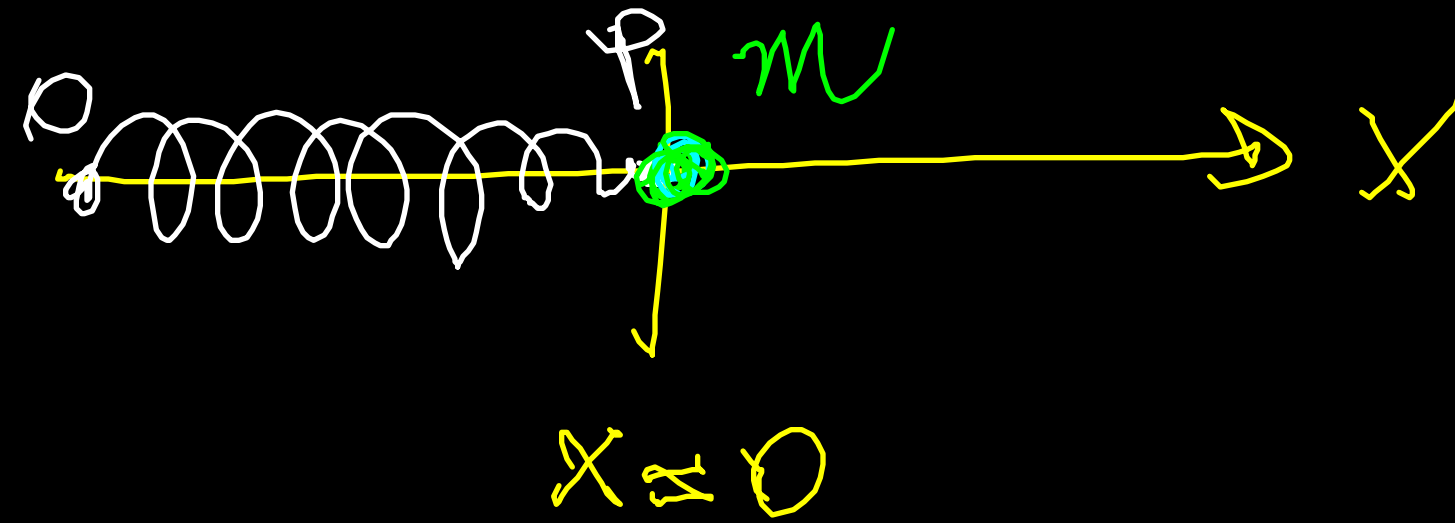
# FORZA NON COSTANTE

ES. MOLLA

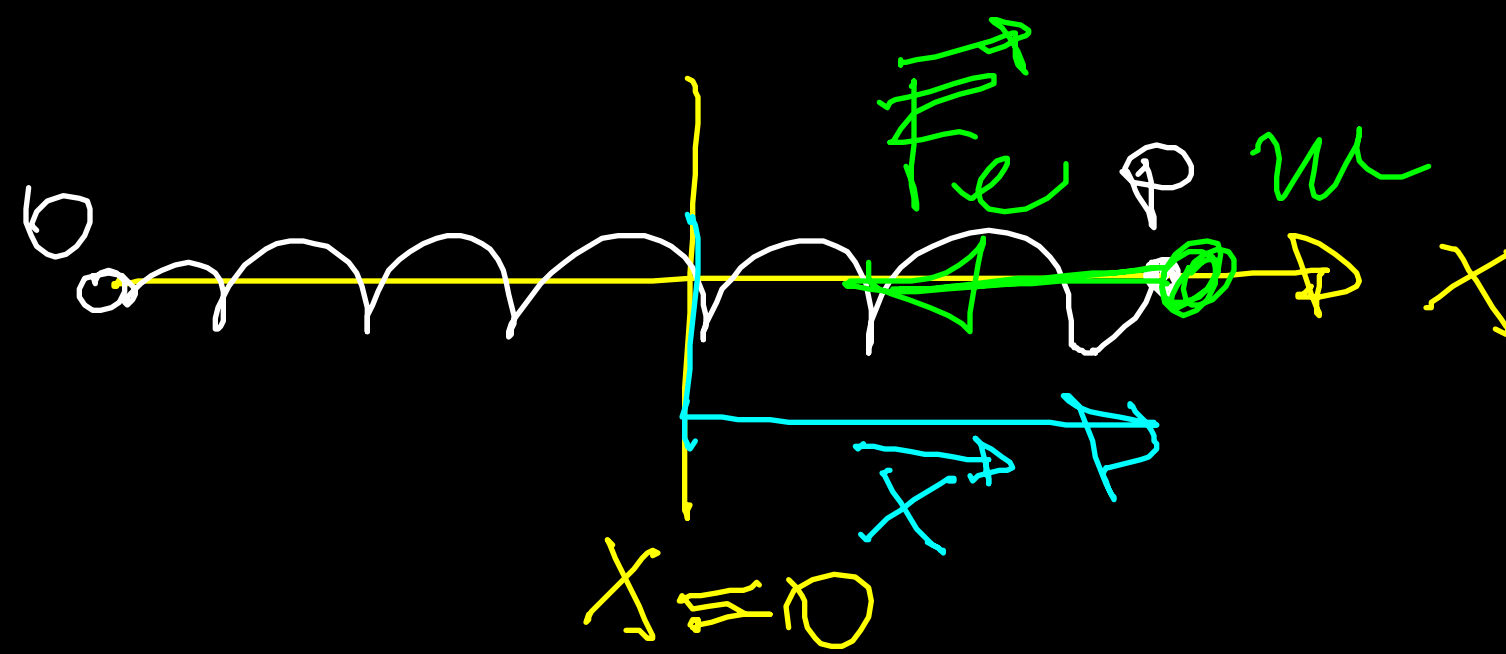
$$\vec{F}_{el} = -k \vec{x}$$

FORZA EL.

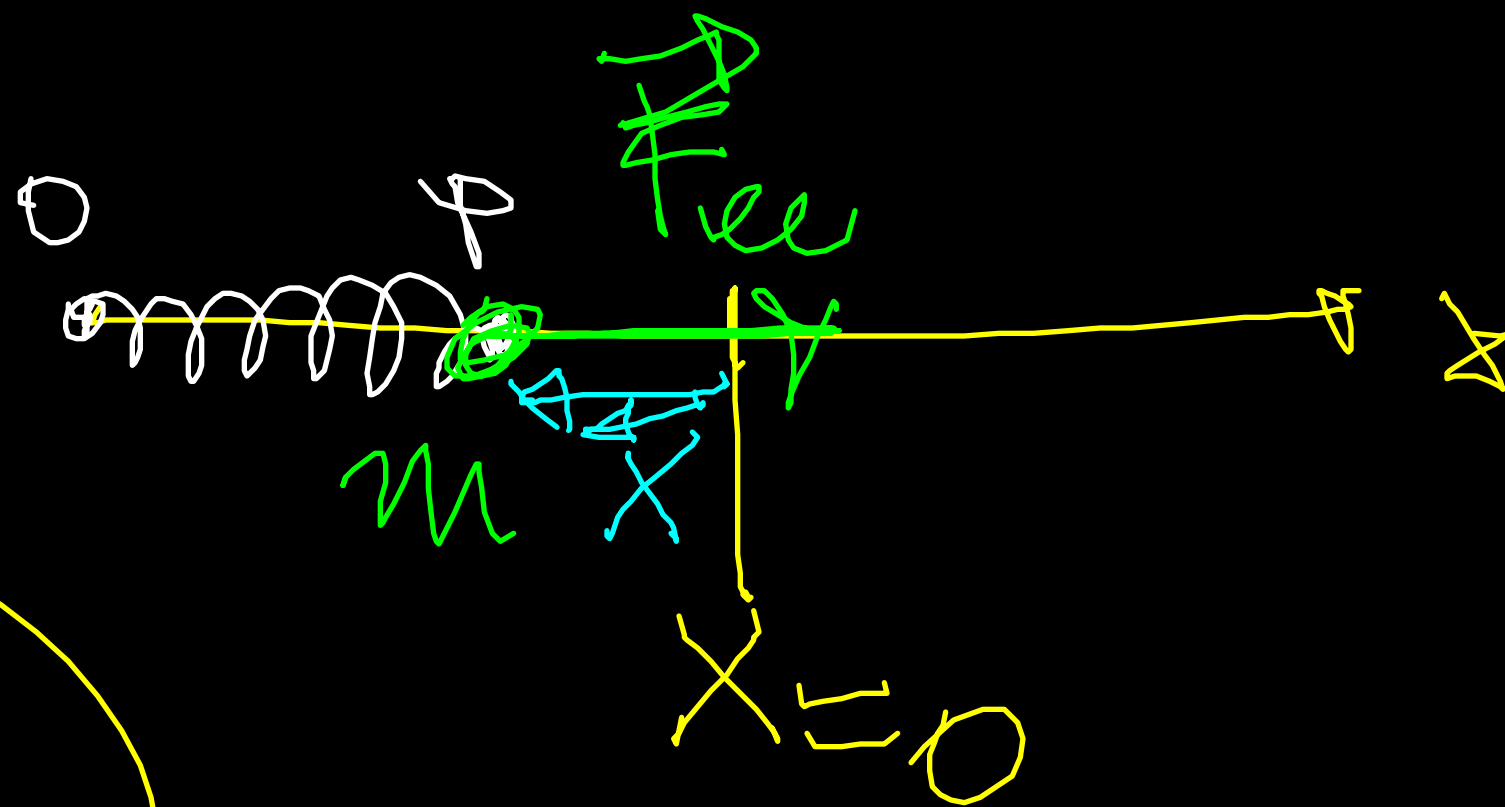
ALTRO ES.  
↳ GRAVITAZ



RIPOSO  
 $\vec{F}_{el} = 0$



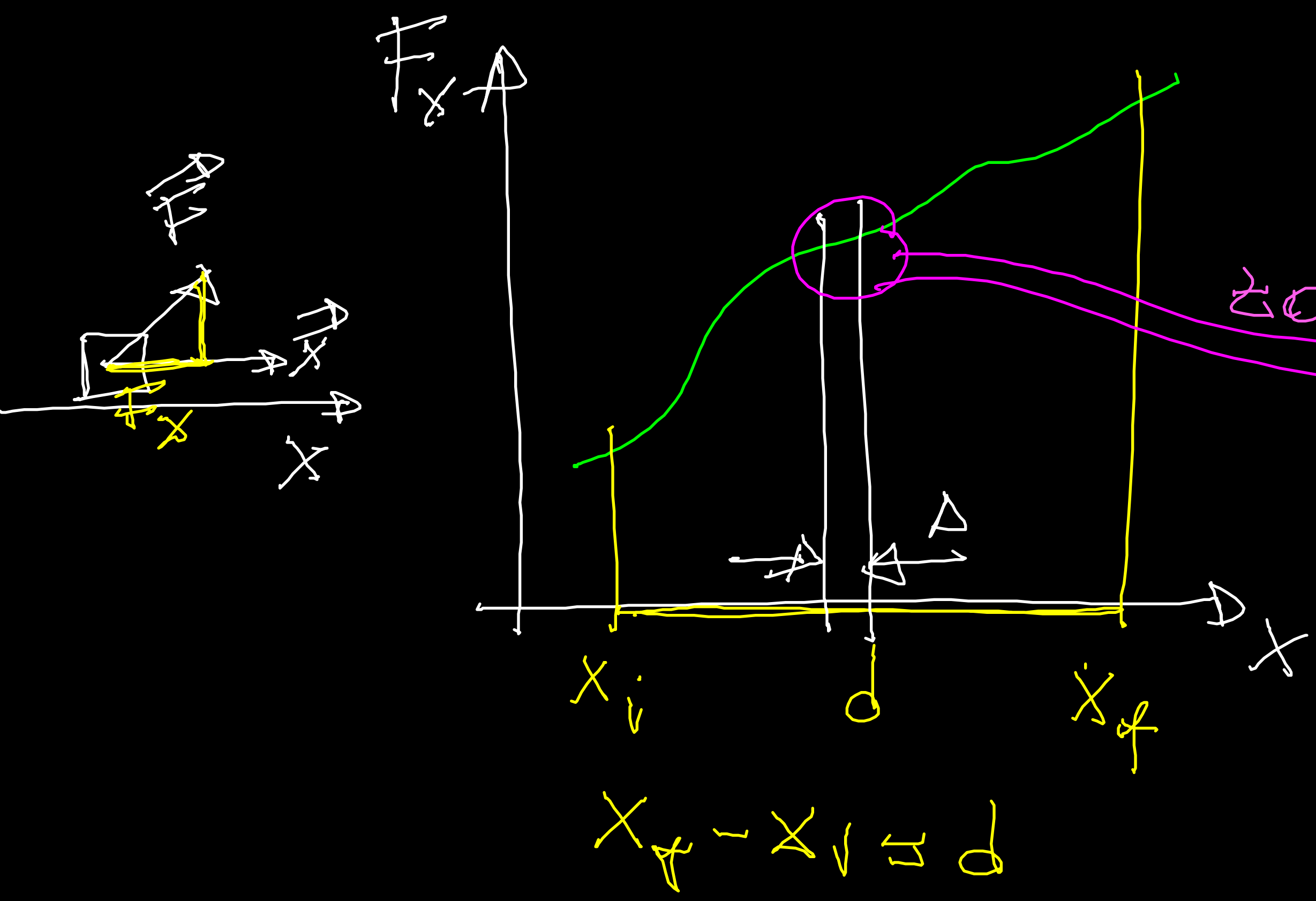
ALLUNG.



COMPRESS.



FORZA  
NON  
COSTANTE



ZOOM

$\sum \Delta = d$   
 $\Delta \ll d$

$F_x \approx$  costante lungo  $\Delta$

