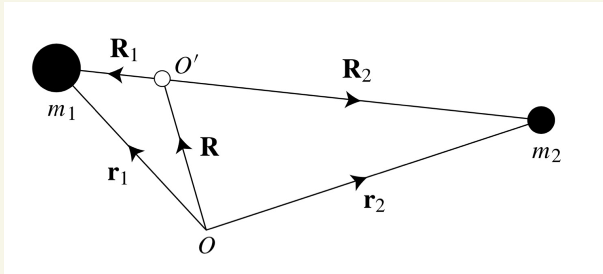
BARYCENTRIC ORBITS

R: POSITION OF CENTER OF MASS O'.



$$R = \frac{m_1 r_1 + m_2 r_2}{(m_1+m_2)}$$

$$R_1 = r_1 - R$$

$$R_2 = r_2 - R$$

$$\cancel{R(m_1+m_2)} = m_1(R_1+\cancel{R}) + m_2(R_2+\cancel{R})$$

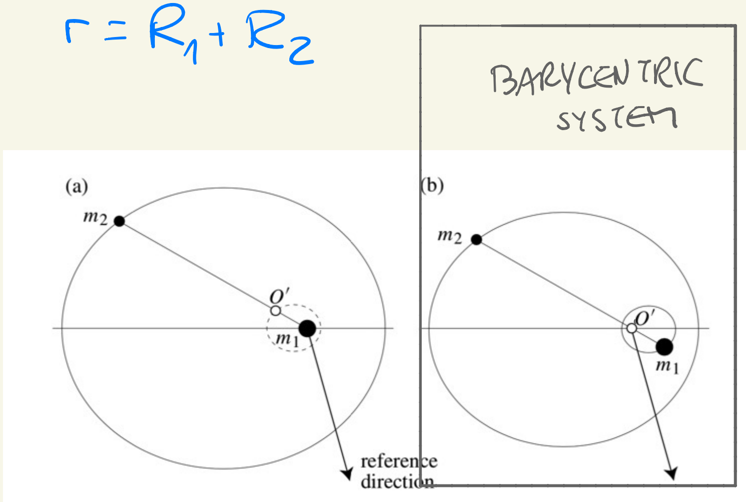
$$m_1 R_1 + m_2 R_2 = 0$$

SEPARATION $\quad r = R_1 + R_2$

$$m_1 R_1 = m_2 R_2$$

$$R_1 = \frac{m_2}{(m_1+m_2)} \cdot r$$

$$R_2 = \frac{m_1}{(m_1+m_2)} \cdot r$$



$$L = r^2 \dot{\theta}$$

$$\boxed{\begin{aligned} R_1 &= \frac{m_2}{(m_1+m_2)} \cdot r \\ R_2 &= \frac{m_1}{(m_1+m_2)} \cdot r \end{aligned}}$$

$$R_1 ; R_2 \propto r$$

$$R_1^2 \dot{\theta} = \text{const} = L_1 = \left(\frac{m_2}{m_1+m_2}\right)^2 \cdot L$$

$$R_2^2 \dot{\theta} = \text{const} = L_2 = \left(\frac{m_1}{m_1+m_2}\right)^2 \cdot L$$

$$L^* = m_1 \cdot L_1 + m_2 \cdot L_2 = \frac{m_1 m_2}{(m_1+m_2)} \cdot L$$

$$\boxed{L = \left(\frac{1}{m_1} + \frac{1}{m_2}\right) L^*}$$

$$n = \frac{2\pi}{T} \Rightarrow n_1 = n_2 = n$$

$$a_1 = \frac{m_2}{(m_1+m_2)} \cdot a \qquad a_2 = \frac{m_1}{(m_1+m_2)} \cdot a$$

$$L = n a^2 \sqrt{1-e^2}$$

$$L = na^2\sqrt{1-e^2}$$

$$a_1 = \frac{m_2}{(m_1+m_2)} \cdot a$$

$$a_2 = \frac{m_1}{(m_1+m_2)} \cdot a$$

$$\therefore L_1 = na_1^2\sqrt{1-e^2}$$

$$L_2 = na_2^2\sqrt{1-e^2}$$

$$E^* = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 - \frac{G m_1 m_2}{r}$$

$$v_1 = \dot{R}_1^2 + (R_1 \dot{\phi}_1)^2$$

$$E^* = \frac{1}{2} m_1 \left[\dot{R}_1^2 + (R_1 \dot{\phi}_1)^2\right] + \frac{1}{2} m_2 \left[\dot{R}_2^2 + (R_2 \dot{\phi}_2)^2\right]$$

$$- \frac{G m_1 m_2}{r}$$

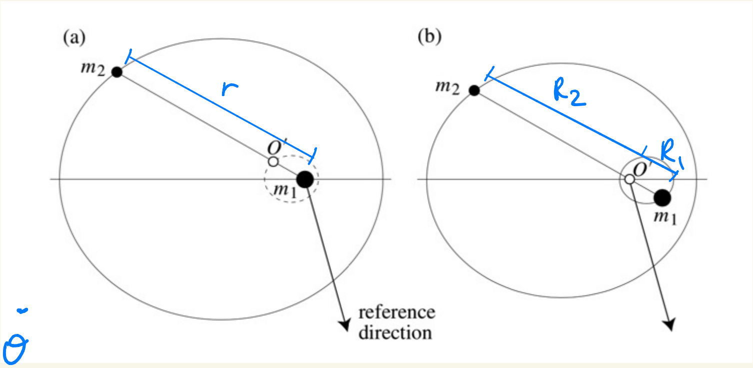
$$E^* = \frac{m_1 m_2}{(m_1 + m_2)} E \qquad = - \frac{G m_1 m_2}{2a}$$

$$E = \left(\frac{1}{m_1} + \frac{1}{m_2}\right) E^*$$

$$E^* = \mu^* \cdot E \qquad \mu^* = \frac{m_1 m_2}{(m_1 + m_2)}$$

$$E = \frac{1}{\mu^*} \cdot E^* \qquad \frac{1}{\mu^*} = \frac{1}{m_1} + \frac{1}{m_2}$$

$$L = r^2 \dot{\theta} = \text{const}$$



$$R_1 = \frac{m_2}{(m_1+m_2)} \cdot r$$

$$R_2 = \frac{m_1}{(m_1+m_2)} \cdot r$$

$$L_1 = R_1^2 \dot{\theta} \quad ; \quad L_2 = R_2^2 \dot{\theta}$$

$$L_1 = \frac{m_2^2}{(m_1+m_2)^2} \cdot r^2 \dot{\theta} = \frac{m_2^2}{(m_1+m_2)^2} \cdot L$$

$$L_2 = \frac{m_1^2}{(m_1+m_2)^2} \cdot r^2 \dot{\theta} = \frac{m_1^2}{(m_1+m_2)^2} \cdot L$$

$$L^* = m_1 L_1 + m_2 L_2 = \frac{m_1 m_2}{(m_1+m_2)} \cdot L$$

$$L = \left(\frac{1}{m_1} + \frac{1}{m_2}\right) L^*$$

Mean Motion

$$n = \frac{2\pi}{T}$$

$$n_1 = n_2 = n$$

$$a_1 = \frac{m_2}{(m_1+m_2)} \cdot a \qquad a_2 = \frac{m_1}{(m_1+m_2)} a$$

$$L^2 = \frac{-\mu^2(1-e^2)}{2E} \quad ; \quad E = -\frac{\mu}{2a}$$

$$L = [\mu a (1-e^2)]^{1/2} \qquad \mu = GM$$

$$n = \frac{2\pi}{T} = \left(\frac{GM}{a^3}\right)^{1/2} = \frac{\mu^{1/2}}{a^{3/2}} \quad \therefore \quad \mu = n^2 a^3$$

$$\boxed{L = na^2\sqrt{1-e^2}}$$

$$\boxed{\begin{aligned} a_1 &= \frac{m_2}{(m_1+m_2)} \cdot a \\ a_2 &= \frac{m_1}{(m_1+m_2)} a \end{aligned}}$$

$$L_1 = \frac{m_2^2}{(m_1+m_2)^2} \cdot L \qquad L_2 = \frac{m_1^2}{(m_1+m_2)^2} \cdot L$$

$$L_1 = \frac{m_2^2}{(m_1+m_2)^2} \cdot na^2\sqrt{1-e^2} \qquad L_2 = \frac{m_1^2}{(m_1+m_2)^2} \cdot na^2\sqrt{1-e^2}$$

$$\boxed{L_1 = na_1^2\sqrt{1-e^2}} \qquad \boxed{L_2 = na_2^2\sqrt{1-e^2}}$$

ENERGIES

$$E^* = \frac{1}{2}m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 - \frac{Gm_1m_2}{r} \qquad v^2 = \dot{R}^2 + (R\dot{\theta})^2$$

$$= -\frac{Gm_1m_2}{2a}$$

$$E^* = \frac{1}{2} m_1 \left[\dot{R}_1^2 + (R_1\dot{\theta}_1)^2\right] + \frac{1}{2} m_2\left[\dot{R}_2^2 + (R_2\dot{\theta}_2)^2\right] - \frac{Gm_1m_2}{r}$$

$$E^* = \frac{1}{2} m_1 \left[\dot{R}_1^2 + (R_1 \dot{\theta}_1)^2\right] + \frac{1}{2} m_2 \left[\dot{R}_2^2 + (R_2 \dot{\theta}_2)^2\right] - \frac{G m_1 m_2}{r}$$

$$R_1 = \frac{m_2}{(m_1+m_2)} \cdot r$$

$$R_2 = \frac{m_1}{(m_1+m_2)} \cdot r$$

$$E^* = \frac{1}{2} \frac{m_1 m_2^2}{(m_1+m_2)^2} \left(\dot{r}^2 + r^2 \dot{\theta}^2\right) + \frac{1}{2} \frac{m_2 m_1^2}{(m_1+m_2)} \left(\dot{r}^2 + r^2 \dot{\theta}^2\right) - \frac{G m_1 m_2}{r}$$

$$\boxed{E^* = \frac{m_1 m_2}{m_1+m_2} \cdot E}$$

$$E = \frac{1}{2}\left(\dot{r}^2 + r^2 \dot{\theta}^2\right) - \frac{G m_1 m_2}{r}$$

$$E = \left(\frac{1}{m_1} + \frac{1}{m_2}\right) E^*$$

$$E = -\frac{G\mu}{2a}$$

$$E^* = -\frac{G m_1 m_2}{2a}$$