

$$\tan\left(\frac{\phi}{2}\right) = \sqrt{\frac{1+e}{1-e}} \tan\left(\frac{u}{2}\right)$$

$$u - e \sin u = \omega t \quad \text{where: } \omega = \sqrt{\frac{\alpha}{ma^3}}$$

$$r = a(1 - e \cos(u))$$

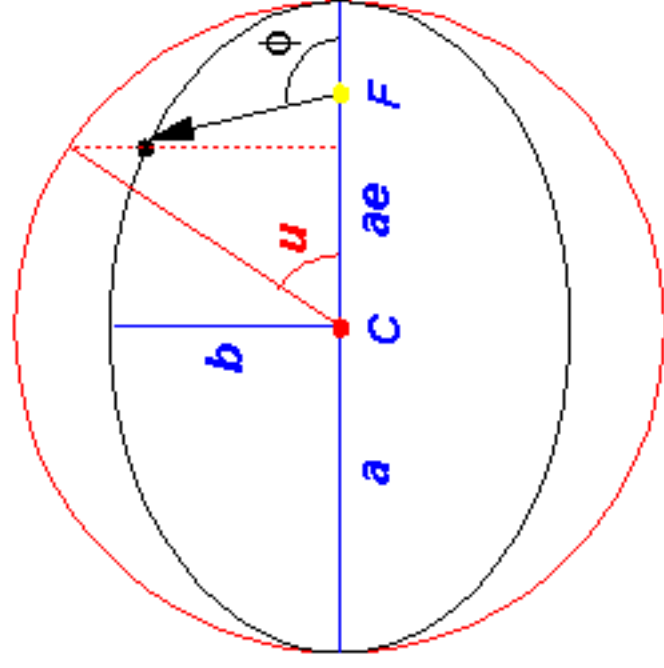
$$v_0 = \sqrt{\frac{\alpha}{ma(1-e^2)}}$$

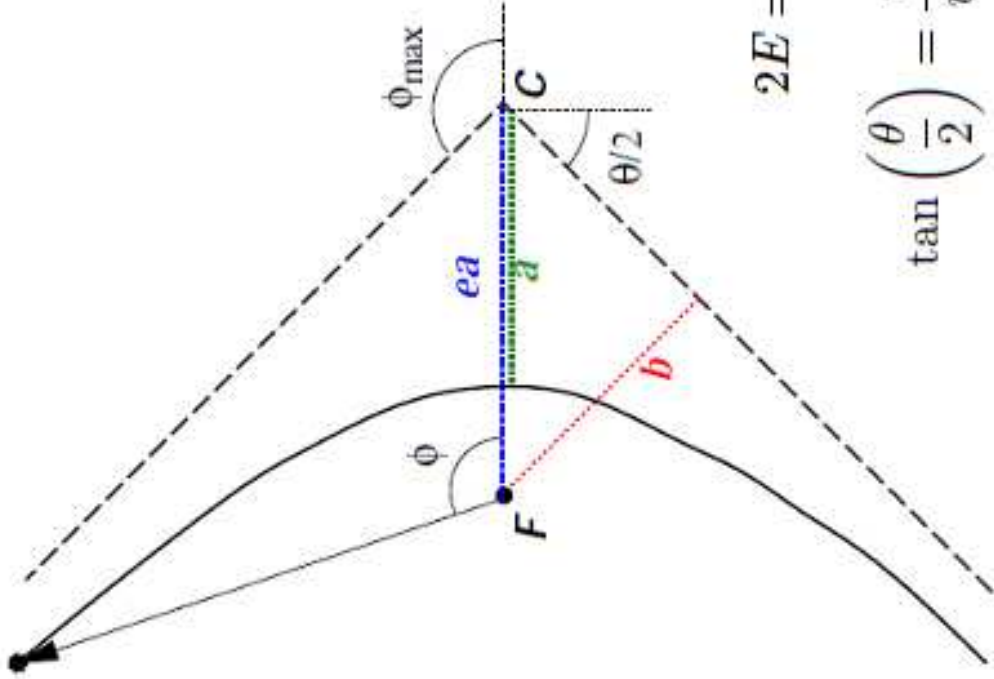
$$r = \frac{a(1-e^2)}{(1+e \cos \phi)}$$

$$E = -\frac{\alpha}{2a}$$

$$L = \sqrt{\alpha ma(1-e^2)}$$

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





$$2E = \frac{\alpha}{a} = mv_{\infty}^2$$

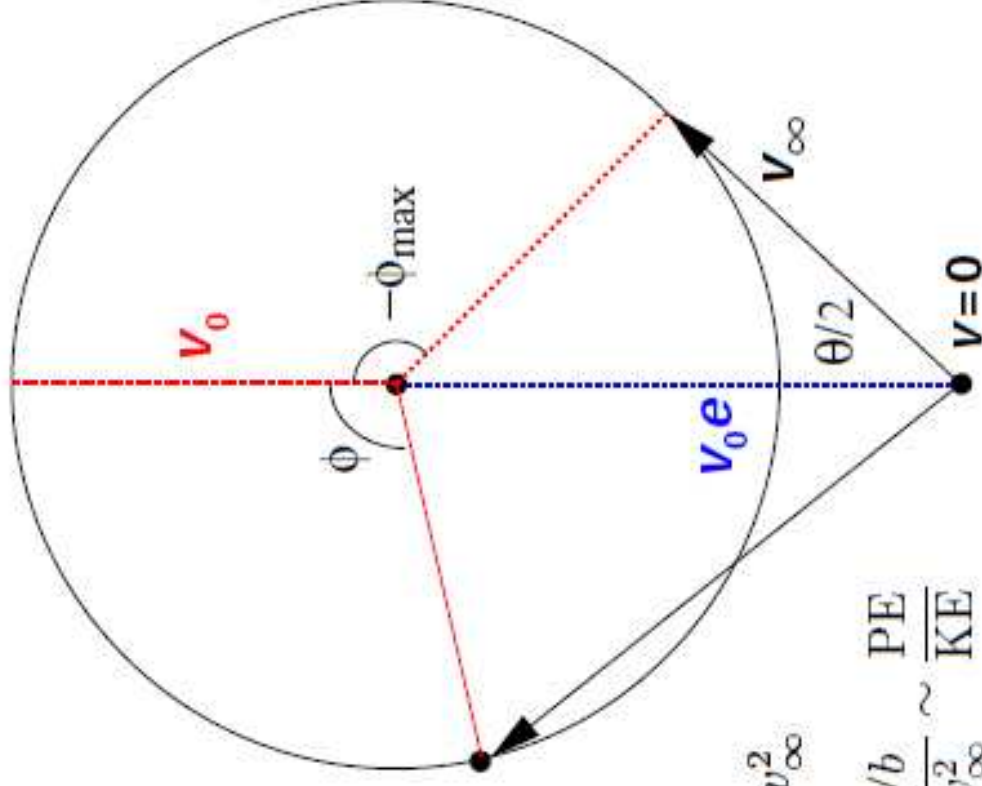
$$\tan\left(\frac{\theta}{2}\right) = \frac{v_0}{v_{\infty}} = \frac{\alpha/b}{mv_{\infty}^2} \sim \frac{\text{PE}}{\text{KE}}$$

impact parameter:  $b = a\sqrt{e^2 - 1}$

$$r = \frac{a(e^2 - 1)}{1 + e \cos \phi}$$

$$L = mr^2 \dot{\phi} = mv_{\infty} b = \sqrt{\alpha m a (e^2 - 1)}$$

$$\cos(\phi_{\max}) = -\frac{1}{e} = -\sin(\theta/2) \quad \phi_{\max} = \theta/2 + \pi/2$$



$$\tan\left(\frac{\phi}{2}\right) = \sqrt{\frac{e+1}{e-1}} \tanh\left(\frac{u}{2}\right)$$

$$e \sinh u - u = \omega t \quad \text{where: } \omega = \sqrt{\frac{\alpha}{ma^3}}$$

$$v_0 = \sqrt{\frac{\alpha}{ma(e^2 - 1)}} = \frac{v_{\infty}}{\sqrt{e^2 - 1}}$$

$$r = a(e \cosh(u) - 1)$$