ϖ

ϖ

$\varpi\varpi\varpi$

∞ $\propto$ $\uparrow$ $\Uparrow$ $\downarrow$ $\Downarrow$ $\equiv$

$$\propto \ \uparrow \ \Uparrow \ \downarrow \ \Downarrow$$

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

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

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

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

$$\mathbf{a} = \frac{d}{dt}\,\mathbf{v}(t) = \frac{1}{m}\,\mathbf{F}(\mathbf{r}(t)) = -\,\frac{\alpha\hat{\mathbf{r}}}{mr^2}$$

$$|\mathbf{a}| = v_0\dot{\phi}$$

$$L = mr^2\dot{\phi} = mv_0(1+e)\,a(1-e) = \sqrt{\alpha ma(1-e^2)}$$

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

$$\begin{aligned} |\mathbf{a}| &= v_0\dot{\phi} \\ &= v_0\left(\frac{v_0 a(1-e^2)}{r^2}\right) \\ &= \frac{\alpha}{mr^2} \end{aligned}$$

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

$$V_{\text{eff}}(r) = U(r) + \frac{L^2}{2mr^2}$$

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

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

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

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

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

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

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

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

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

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

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

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