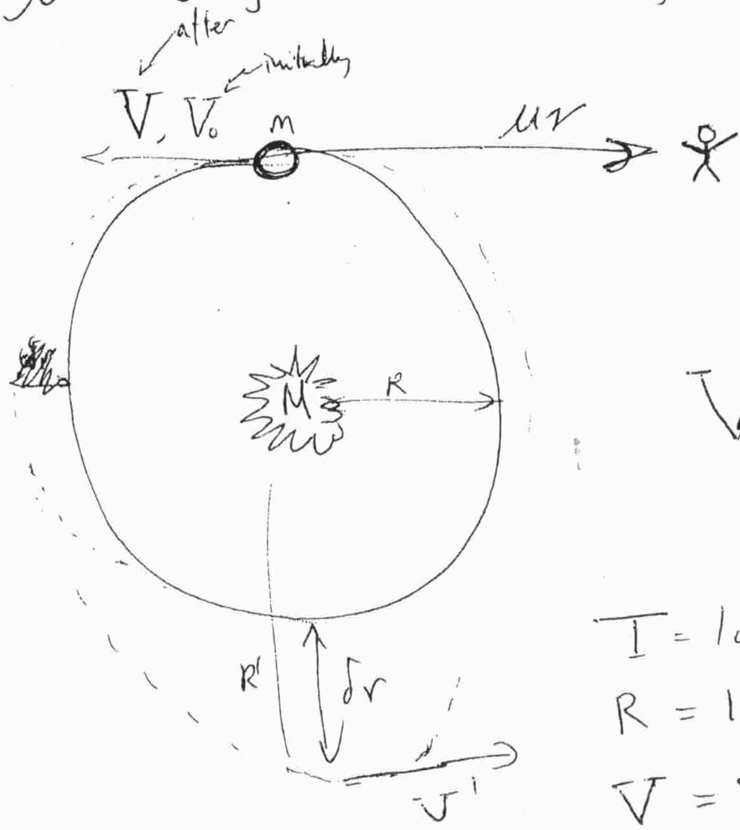
"EQUASION TO CALCULATE WHAT EFFECT THE REMOVAL OF MY Tobias MASS WOULD HAVE ON THE ORBIT OF PLANET EARTH"

$\mu = 78$ kg. $\quad v$ = velocity at which projected.

δr = change in orbital radius.

(makes orbit ellipsoidal).



$$V = \frac{2\pi R}{T}$$

$T = 1\,yr = 3.156 \times 10^7$ secs

$R = 1\,AU = 1.495 \times 10^8$ km $= 1.495 \times 10^{11}$ m

$V = 2.976 \times 10^4$ m/s

$m = 5.98 \times 10^{24}$ kg

conservation of momentum $\quad mV^* = mV_0 + \mu v$

$$V^* - V_0 = \frac{\mu v}{m}$$ Change in earth's velocity.

= for 1m/s change in speed need $v = 7.6 \times 10^{22}$ m/s !

If $v = 0.1c = 3 \times 10^7$ m/s

(conservation of angular momentum) $\quad mVR = mV'(R+\delta r) = mV'R'$

$$\Rightarrow \frac{V}{V'} = \frac{R'}{R} \quad (1)$$

conservation of energy $\quad \frac{1}{2}mV^2 - \frac{GMm}{R} = \frac{1}{2}mV'^2 - \frac{GMm}{R'}$

$$\Rightarrow V^2 - \frac{2GM}{R} = V'^2 - \frac{2GM}{R'} \quad (2)$$

eliminate $\frac{1}{R'}$ and re-arrange:

$$V'^2 - \underbrace{\frac{2GM}{RV}}_{\beta} V' - \underbrace{\left(V^2 - \frac{2GM}{R}\right)}_{\alpha} = 0$$

$$V' = \frac{+\beta \pm \sqrt{\beta^2 + 4\alpha}}{2}$$

$$\delta R = R\left(\frac{V}{V'} - 1\right) \simeq 0$$

m