Draft 38 cont.

Look at Ham. eqns of motion for $\dot{\rho} + \dot{p}_\rho$:

1) $$\dot{\rho} = \frac{p_\rho}{(1+4\rho^2/a^2)m}$$

2) $$\dot{p}_\rho = \frac{p_\rho^2}{2m(1+4\rho^2/a^2)^2}\left(\frac{8\rho}{a^2}\right) + \frac{p_\phi^2}{m\rho^3} - 2mg\rho/a.$$

Since motion is assumed to be nearly circular, write $\rho = \rho_0 + \xi$ with $\boxed{\rho_0^2 = ah}$.

Also, since p_ϕ = const, assume

$$p_\phi = \text{circular value} = m\rho^2\dot{\phi}\Big|_{\text{circ}} = m\rho_0^2\omega$$

$$= mah\sqrt{\frac{2g}{a}} = mh\sqrt{2ga}$$

Now work with equations 1) + 2) and expand in powers of $\xi + \dot{\xi}$. Keep only constant terms + terms linear in ξ, $\dot{\xi}$, + $\ddot{\xi}$.