5/18/12

What does a corotation ~~resonce~~ resonance look like w/in a disk harboring, say, an $M_\oplus$ satellite?

→ What do the Lindblad resonances look like in that setup?

$$\Omega_g = \Omega_p \pm \frac{\Omega_g}{2}$$

$$\frac{3}{2}\Omega_g = \Omega_p \qquad\qquad \frac{1}{2}\Omega_g = \Omega_p$$

$$P^2 \propto r^3 \longrightarrow P \sim r^{3/2}$$

$$\Omega = \frac{2\pi r}{P} = \frac{2\pi r^1}{r^{3/2}} = \frac{2\pi}{r^{1/2}}$$

$$\frac{3}{2}\Omega_g = \Omega_p$$

$$\frac{3}{2} r_g^{-1/2} = r_p^{-1/2}$$

$$\frac{9}{4}\frac{1}{r_g} = \frac{1}{r_p}$$

$$\frac{4}{9} r_g = r_p$$

$$\boxed{r_g = \frac{9}{4} r_p}$$

← radial location of outer Lindblad resonance

$$\frac{1}{2}\Omega_g = \Omega_p$$

$$\frac{1}{2} r_g^{-1/2} = r_p^{-1/2}$$

$$\frac{1}{4}\frac{1}{r_g} = \frac{1}{r_p}$$

$$\boxed{r_g = \frac{1}{4} r_p}$$

← radial location of inner Lindblad resonance

This analysis does <u>not</u> account for the gas' subkeplerian rotational velocity.

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What if you take into account the gas' sub-keplerian motion?

Then, $P^2 \neq a^3$. Instead, the gas speed increases more slowly w/ radius, due to ~~the~~ ~~rate~~ its internal pressure support.

So, let's say $P^2 \sim a^2$

~~Then~~

Then, $P \sim a$

$\Omega_g = \frac{2\pi r}{r} = \text{const} \ldots ?$

$\frac{3}{2}\Omega_g = \Omega_p$

$\Omega_g = \frac{2}{3}\Omega_p$

~~This moves the~~

$2\pi = \frac{2}{3}\Omega_p$

$2\pi = \frac{2}{3}\left(\frac{2\pi}{\sqrt{r^3}}\right)$

$r = \frac{4}{9}$

$\frac{1}{2}\Omega_g = \Omega_p$

$\Omega_g = 2\Omega_p$

$2\pi = 2 \cdot \frac{2\pi}{\sqrt{r}}$

$r = 4$

Grr, not really useful...