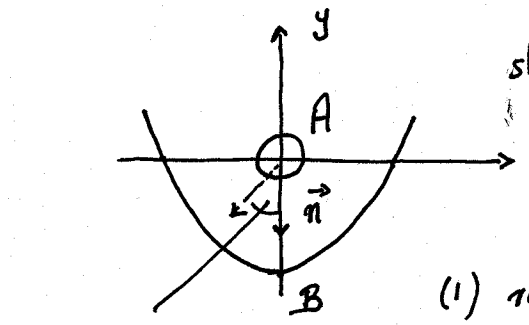
Galaxy A at pericenter:

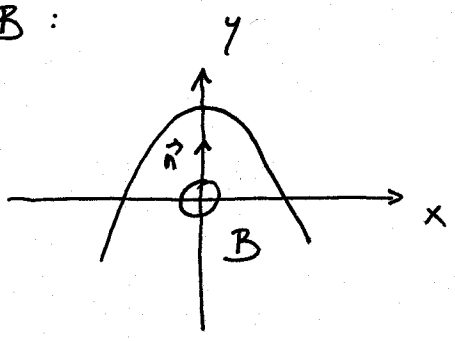


shifted coordinate system

(1) rotate $\vec{n}$ around Z axis by ω_A including sign

(2) rotate galaxy around new $\vec{n}$ by $-i_A$

Galaxy B:



(1) rotate $\vec{n}$ by ω_B

(2) rotate around new $\vec{n}$ by $-i_B$

A rotation is defined by rotation axis $\vec{n} = n_1\vec{e}_1 + n_2\vec{e}_2 + n_3\vec{e}_3$

$|\vec{n}| = 1$, angle of rotation δ

$$R(\vec{n}, \delta) = \begin{bmatrix} a n_1^2 + c & a n_1 n_2 - s n_3 & a n_1 n_3 + s n_2 \\ a n_1 n_2 + s n_3 & a n_2^2 + c & a n_2 n_3 - s n_1 \\ a n_1 n_3 - s n_2 & a n_2 n_3 + s n_1 & a n_3^2 + c \end{bmatrix}$$

$c = \cos\delta$, $s = \sin\delta$, $a = 1 - \cos\delta$

$\delta = -i$ in our case