

When $\vec{\Omega}$ is absent pendulum oscillates along \vec{v} & stays approximately in the yellow shaded plane.

assume:

- Long string length l
- Small angle oscillation

\vec{g} driven oscillation along \hat{x}

$$\vec{a} = a_r \hat{r} + a_\theta \hat{\theta} \left\{ \begin{array}{l} a_r = \ddot{r} - \dot{\theta}^2 r \\ a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta} \end{array} \right\} \text{ these are } (r, \theta) \text{ in the tangent pln.}$$

$\vec{v}_{pln} = \dot{\vec{r}}$

$$\begin{aligned} \text{Coriolis force} &= -2m(\vec{\Omega} \times \vec{v}_{pln}) \\ &= -2m(\underbrace{\vec{\Omega}_\perp}_{\substack{\uparrow \Omega \sin \lambda \\ \text{normal to tangent pln}}} + \underbrace{\vec{\Omega}_\parallel}_{\substack{\uparrow \Omega \cos \lambda \\ \text{|| to pln.}}}) \times \vec{v}_{pln} \end{aligned}$$

Note $\vec{\Omega} \times \vec{v}_{pln}$ does not lie on the pln.

But, $\vec{\Omega}_\perp \times \vec{v}_{pln}$ lies on the pln & is \perp to \vec{v} , i.e., along $\hat{\theta}$
 $\vec{\Omega}_\parallel \times \vec{v}_{pln}$ lies \perp to the pln & will compete with \vec{g}

$$\Omega = \frac{2\pi}{24 \text{ hr}} \simeq 7 \times 10^{-5} \text{ s}^{-1} \text{ very small!}$$

$$\text{Only force in the pln is along } \hat{\theta} = -2m\Omega \sin \lambda \dot{\theta}$$

$$\ddot{a}_\theta = \cancel{r\ddot{\theta}} + 2\dot{r}\dot{\theta}$$

$$-2\Omega \sin\lambda \dot{r} \simeq 2\dot{r}\dot{\theta}$$

$$\boxed{-\Omega \sin\lambda \simeq \dot{\theta}} \Rightarrow \text{A new } \omega_c \text{ along } \hat{\theta}$$

$$a_r = \ddot{r} - \dot{\theta}^2 r$$

$$-T \sin\lambda = \ddot{r}, \quad T \cos\lambda = mg$$



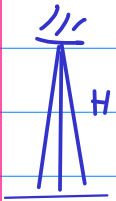
$$T_F = \frac{2\pi}{\omega_c} = \frac{2\pi}{\Omega \sin\lambda}$$

$$\boxed{T_F = \frac{24 \text{ hr}}{\sin\lambda}} \quad T_F \rightarrow \infty \text{ at equator } (\lambda=0)$$

$$\lambda = 45^\circ \quad T_F \simeq 1.5 \text{ days}$$

very slow!!

Make the string very long
so that during oscillation
it ~ stays in the same plane



$$T_0 = 2\pi \sqrt{\frac{H}{g}} \ll T_F$$

simple period
typically few sec.

Can make H large to increase T_0

} Will take many cycles of T_0 oscillations
to see one T_F cycle.