PHYS 325: Lecture 24

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Foucault pendulum

We have that

$$ma_{\text{app}} = \sum F_{\text{true}} + F_{\text{fict}} \tag{1}$$

We have that

$$F_{\text{true}} = -\nabla U \tag{2}$$

We have that

$$U = -mgh \iff -mgL\cos\beta \tag{3}$$

For small β, we have that

$$c + \frac{mg}{2L}(x^2 + y^2) \tag{4}$$

Thus

$$F_{\text{net}} = -\nabla U = -\frac{mg}{L}(x\hat{e} + y\hat{n}) \tag{5}$$

Coriolis Force

$$F_{\text{cor}} = -2m\vec{\omega} \times \vec{v}_{\text{app}} \tag{6}$$

$$\ddot{x} = -\frac{g}{L}x + 2\omega\dot{y}\sin\theta \tag{7}$$

$$\ddot{y} = -\frac{g}{L}y - 2\omega\dot{x}\sin\theta \tag{8}$$

$$\ddot{z} = 0 + 2\omega\dot{x}\cos\theta \tag{9}$$

Let $\omega_z = \omega\sin\theta$

$$\ddot{x} = -\frac{g}{L}x + 2\omega_z\dot{y} \tag{10}$$

$$\ddot{y} = -\frac{g}{L}y - 2\omega_z\dot{x} \tag{11}$$

If $\theta = 0$, then this is a simple harmonic oscillator.