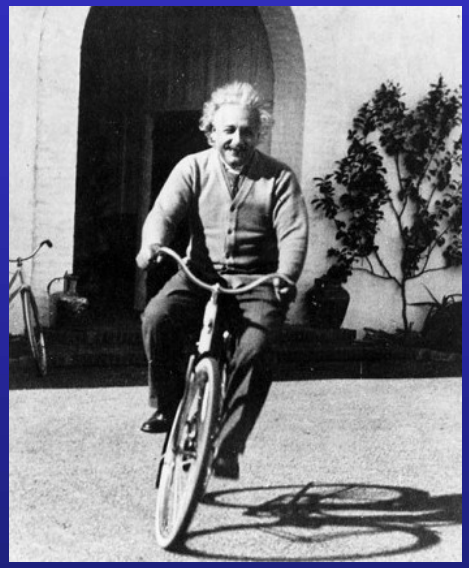
UNIVERSITY OF
Southampton
School of Physics
and Astronomy

Classical Mechanics

PHYS 2006

Tim Freegarde



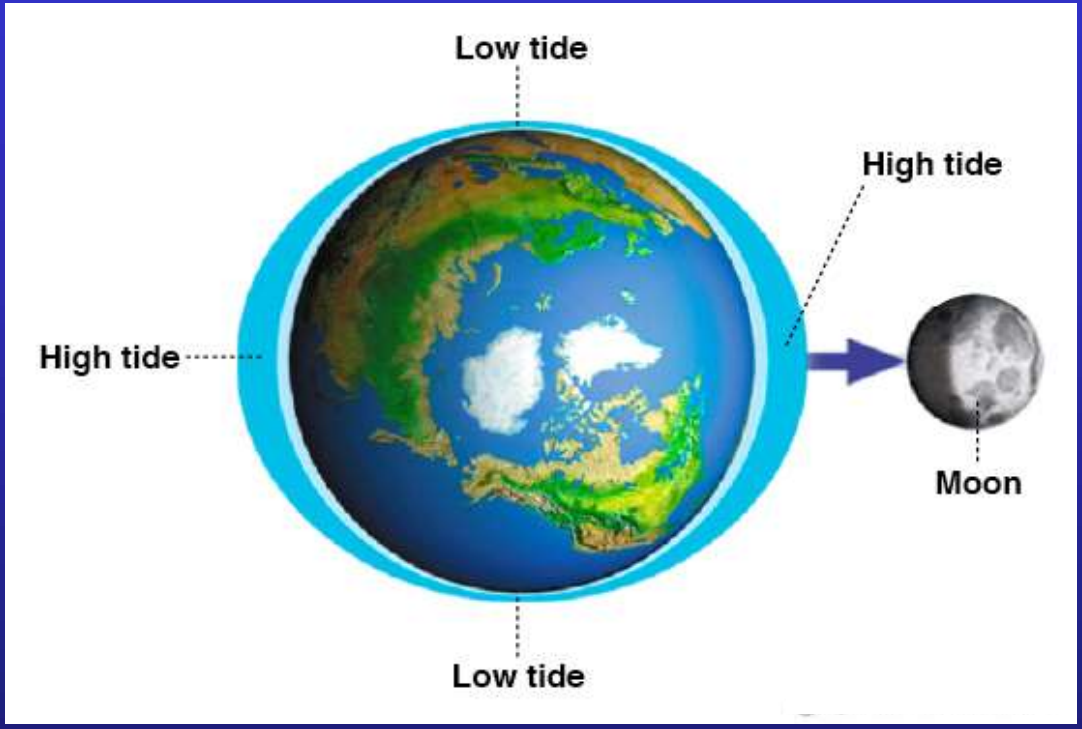
Rotational motion

- body motion not determined solely by centre of mass
- distribution relative to centre of mass also important

http://www.esa.int/spaceinimages/Images/2016/08/Full_Moon

Tides

- body motion not determined solely by centre of mass
- distribution relative to centre of mass also important



QA International

Rotational motion

Veritasium https://www.youtube.com/watch?v=GeyDf4ooPdo

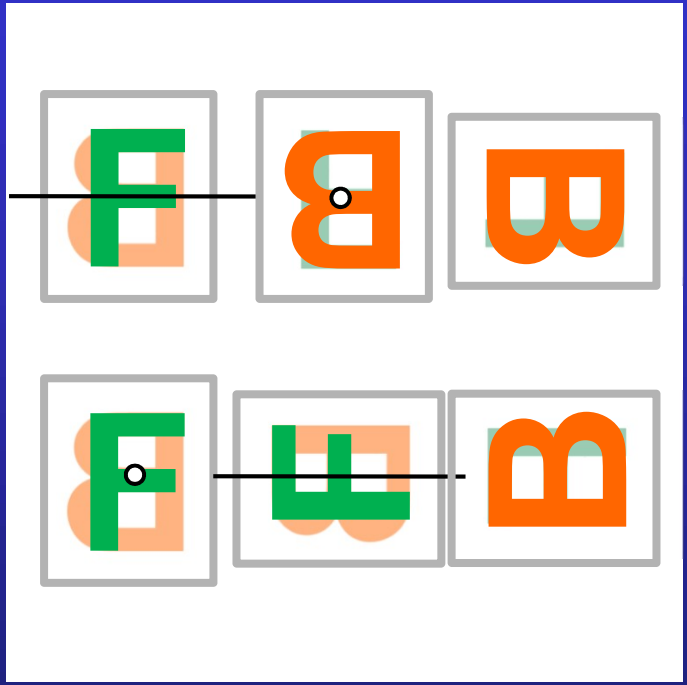
Rotations

- rotations through finite angles do not commute

$$180_x 90_z \neq 90_z 180_x$$

- infinitessimal rotations do commute

$$\mathrm{d}\phi_x \mathrm{d}\phi_z = \mathrm{d}\phi_z \mathrm{d}\phi_x$$



Rotations

- rotations through finite angles do not commute

$$180_x 90_z \neq 90_z 180_x$$

- infinitessimal rotations do commute

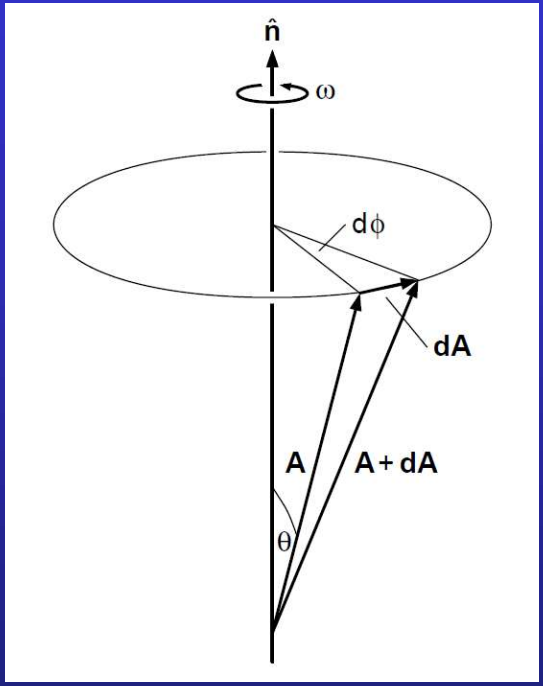
$$\mathrm{d}\phi_x \mathrm{d}\phi_z = \mathrm{d}\phi_z \mathrm{d}\phi_x$$

- infinitessimal rotations can be represented as vectors

$$\mathrm{d}\phi_n \equiv \mathrm{d}\phi\,\hat{\mathbf{n}} = \frac{\mathrm{d}\phi}{\mathrm{d}t}\,\mathrm{d}t\,\hat{\mathbf{n}} \equiv \omega\,\mathrm{d}t\,\hat{\mathbf{n}} = \boldsymbol{\omega}_n\,\mathrm{d}t$$

- angular velocity vectors can hence be added

$$\boldsymbol{\omega}_{total} = \boldsymbol{\omega}_1 + \boldsymbol{\omega}_2 + \ldots$$



Rotational motion

Veritasium https://www.youtube.com/watch?v=tLMpdBjA2SU