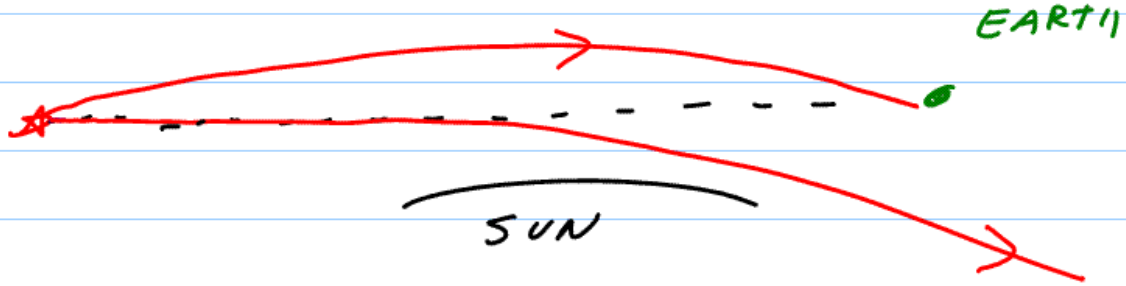
PHY132S Relativity
Class 5 - Monday April 6 2009

"General" Theory: observers in any state of relative motion, including acceleration.

Also a theory of gravity

PIECE 1



Straight line ≡ "GEODESIC"

No gravitational force!

PIECE 2

$\vec{p} = \gamma m \vec{v}$

$$\vec{F}_{\text{on } m} = -G \frac{Mm}{r^2} \hat{r}$$

property of matter

inertial mass M_I

gravitational mass M_G

Is $M_I = M_G$?

Experiments

2 bodies $\frac{M_{I,1}}{M_{I,2}}$ collisions

$\frac{M_{G,1}}{M_{G,2}}$ weighing them

$M_I = M_G$

Why?

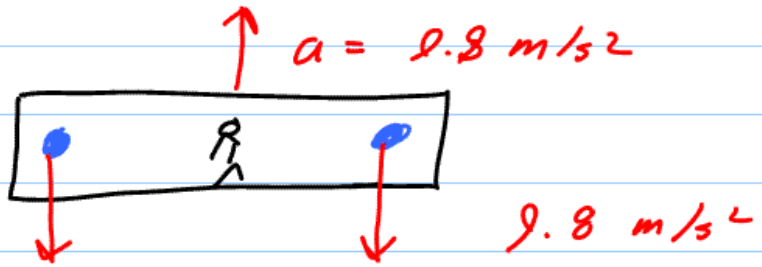
Foucault Pendulum

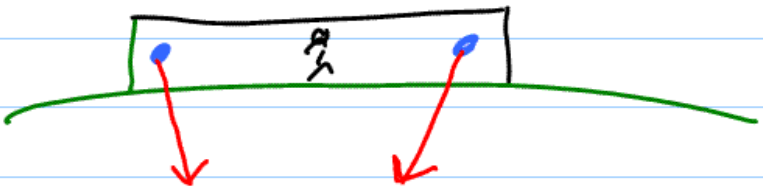
MACH! inertia is due to gravitational interaction with mass of the universe!

M_I due to M_G

PIECE 3

Why is TARDIS small?



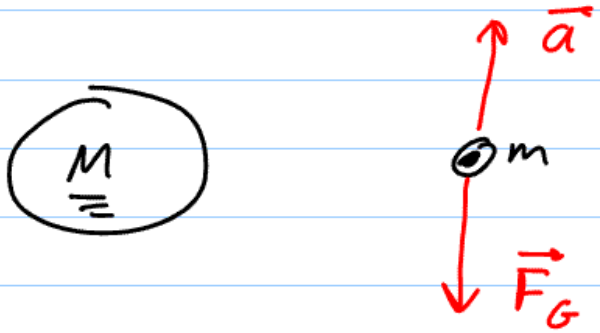


Same "locally"

Einstein (1908):

Acceleration is equivalent to gravitation.

More Mach



$$F_G \sim G \frac{mM}{c^2 r} a$$ NEW "FORCE"

$$F_{G,tot} = \sum_{\substack{all \\ universe}} G \frac{mM}{c^2 r} a$$

$$\simeq G \frac{\rho R^2}{c^2} ma$$

none are well known!

- ρ - density of universe
- R - size of universe

$$\vec{F}_{G,tot} \sim (0.9)\, ma$$

Newton's 2nd Law from Mach's Principle.