Physics I

2017-09-07

Agenda – – SPS.

– dimensional argument.

– scaling argument.

– order-of-magnitude estimate.

http://cosmo.nyu.edu/hogg/physics1/

SPS

1st meeting September 7th

726 Broadway

Thurs 7pm Rm: 1067

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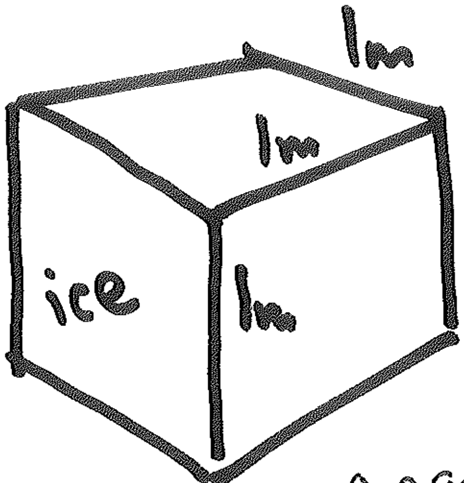
SPS Lounge 1014 → all are welcome!

last class: $t =$ ☺ $\sqrt{\frac{h}{g}}$ ← dimensional analysis.

- larger h → larger t!
- large g → smaller t
- $t \sim \sqrt{h}$ (scaling)
- mass doesn't enter. ← symmetry.

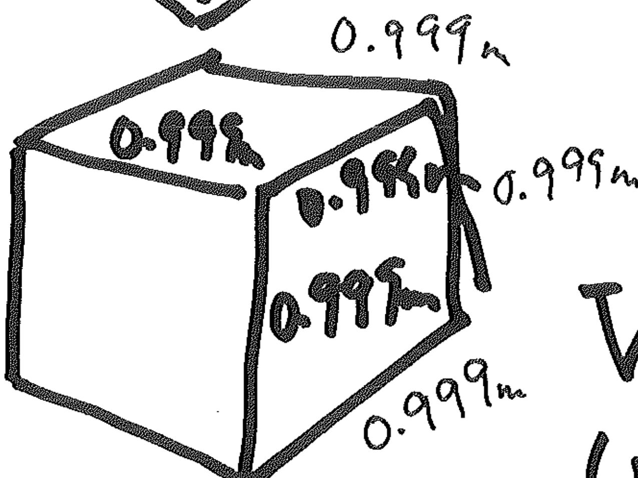
principle underlying General Relativity.

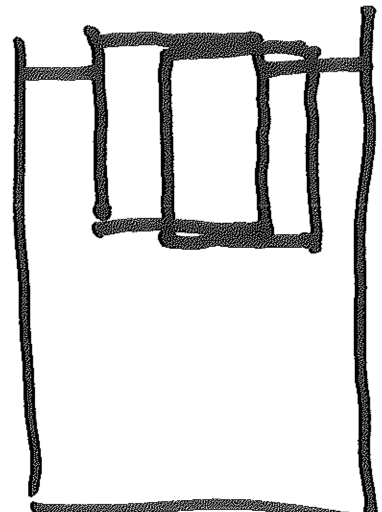
"equivalence principle"



$V = 1\,m^3$

$(M \approx 1000\,kg)$





$V \sim 0.997\ m^3$

$(1-\epsilon)^3 = 1 - 3\epsilon + 3\epsilon^2 - \epsilon^3$

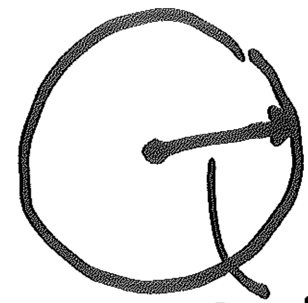
$1 - 0.001 - 0.000999 - 0.000998$

$1 - 0.003 + 0.000003 - 0.0000011001$

Siri: 0.9970002999

Mass of the Earth ?

~sphere $V = \frac{4\pi}{3} R^3$



$R \sim 7000$ km.

$$V = \frac{4\pi}{3} \times 7^3 \times 10^{18}\ m^3$$

$$= \cancel{\frac{4\pi}{3}} \times 3.5 \times 10^{20}\ m^3$$

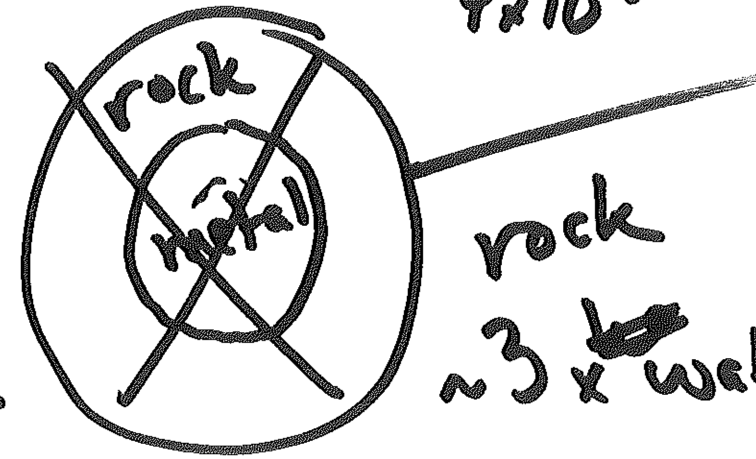
$$= 1.5 \times 10^{21}\ m^3$$

$R \sim 7 \times 10^6$ m

$R^3 = (7 \times 10^6)^3\ m^3$

$7^3 \times 10^{18}$

$$\rho = 3 \times 10^3\ \frac{kg}{m^3}$$



rock ~3 x ~~kg~~ water.

$$M_{Earth} = 4.5 \times 10^{24}\ kg.$$

$$(6 \times 10^{24}\ kg)$$

density of air @ STP ~ 1 kg m^{-3}

density of water ~ 1000 $\frac{kg}{m^3}$

all condensed matter

is at 1–20 × water.

~ 20

Pauli exclusion

density of osmium ~ 22500 kg m^{-3}

QM!