PS #4 p/s hand in ON CHAIRS

$$(d\tau)^2 = \frac{(dr)^2}{(1 - R_s/r)} + r^2(d\Omega)^2 - c^2\left(1 - R_s/r\right)(dt)^2$$

r is a coordinate

$R_s = 2GM/c^2$

↳ θ, ϕ, Ω, t

object of M, R_o ↳ radius of object

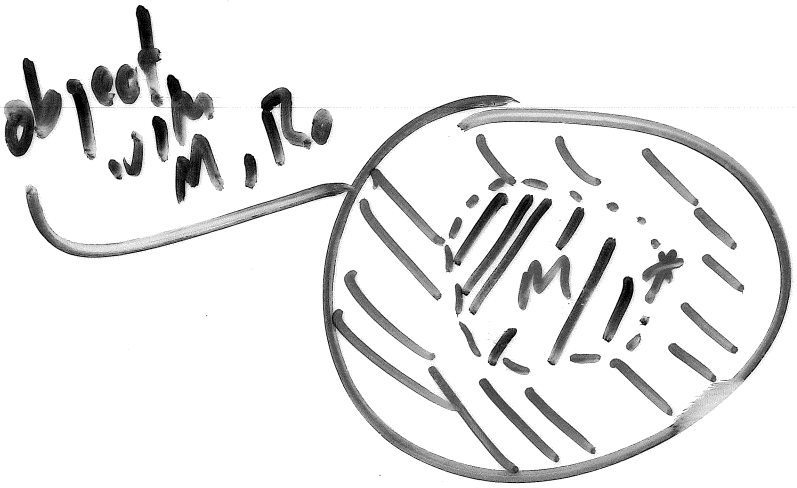
black hole: $R_o < R_s$

↳ some r where $r = R_s$

if $R_o > R_s$

Then no $r = R_s$

The relevant mass is mass INSIDE r

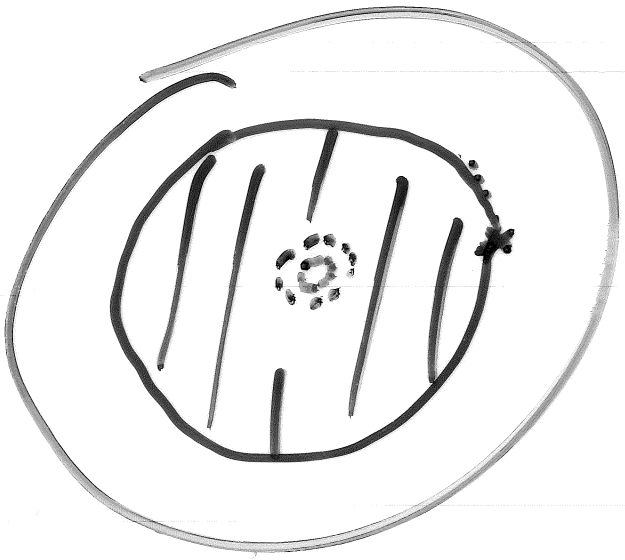


So for $r < R_0$ → radius of object

then relevant $M < M_0$ → total mass of object

if $R_0 > R_S$

then there is no $r < R_S$



$R_0 > R_S$

M

What is R_S that goes into the metric for person x

$R_0 < R_S$

$r > R_S$

$r = R_S$ ARGH!

POST-NEWTONIAN GRAVITATION EFFECTS

P-N effect #1:
precession of perihelion
(e.g. Mercury)

PN effect #2:
deflection of light

multiple images

distant galaxy, quasar

look at star behind sun
appears to be in a
different position than
when observed at night.

DO THIS BY OBSERVING
DURING ECLIPSE

1917 Einstein publishes G.R.

1919 eclipse in Brazil

Eddington mounts
expedition to Brazil
WORKS

FABLE: 1919 eclipse expedition

MORAL: science is international universal quest

: science works as advertized

maybe ?

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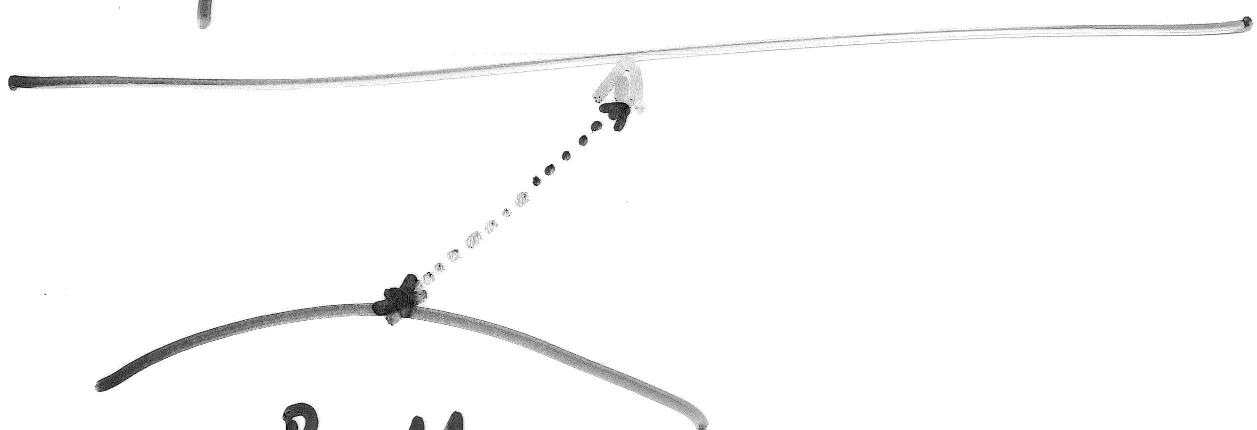
post-N effect #3

gravitational redshift



R, M

$$\frac{\Delta\lambda}{\lambda_0} = \frac{1}{\sqrt{1 - R_s/R}} - 1$$

↑ distance to mass

E of photon

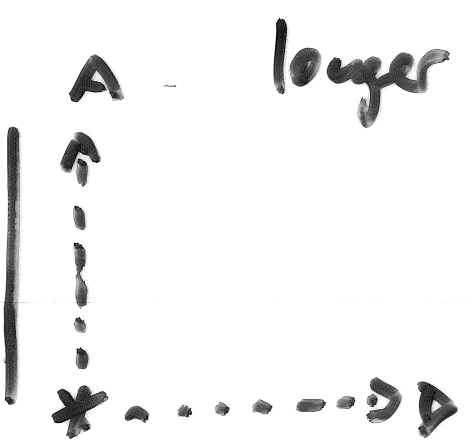
↑ gets less

$= \frac{hc}{\lambda}$ ← speed of light

→ longer

→ Planck's constant

TESTED IN LAB



$\frac{\Delta\lambda}{\lambda_0} = \frac{\Delta\lambda_{R_1} - \Delta\lambda_R}{\lambda_0}$

P-N effect #4:

gravitational waves

as mars moves back & forth (in orbit)

→ ripples in space-time propagate outwards at c

The energy in "gravitational waves"

comes from orbit

orbits gets gradually smaller

objects spiral in

can see this in binary with short orbit

"BINARY PULSAR"