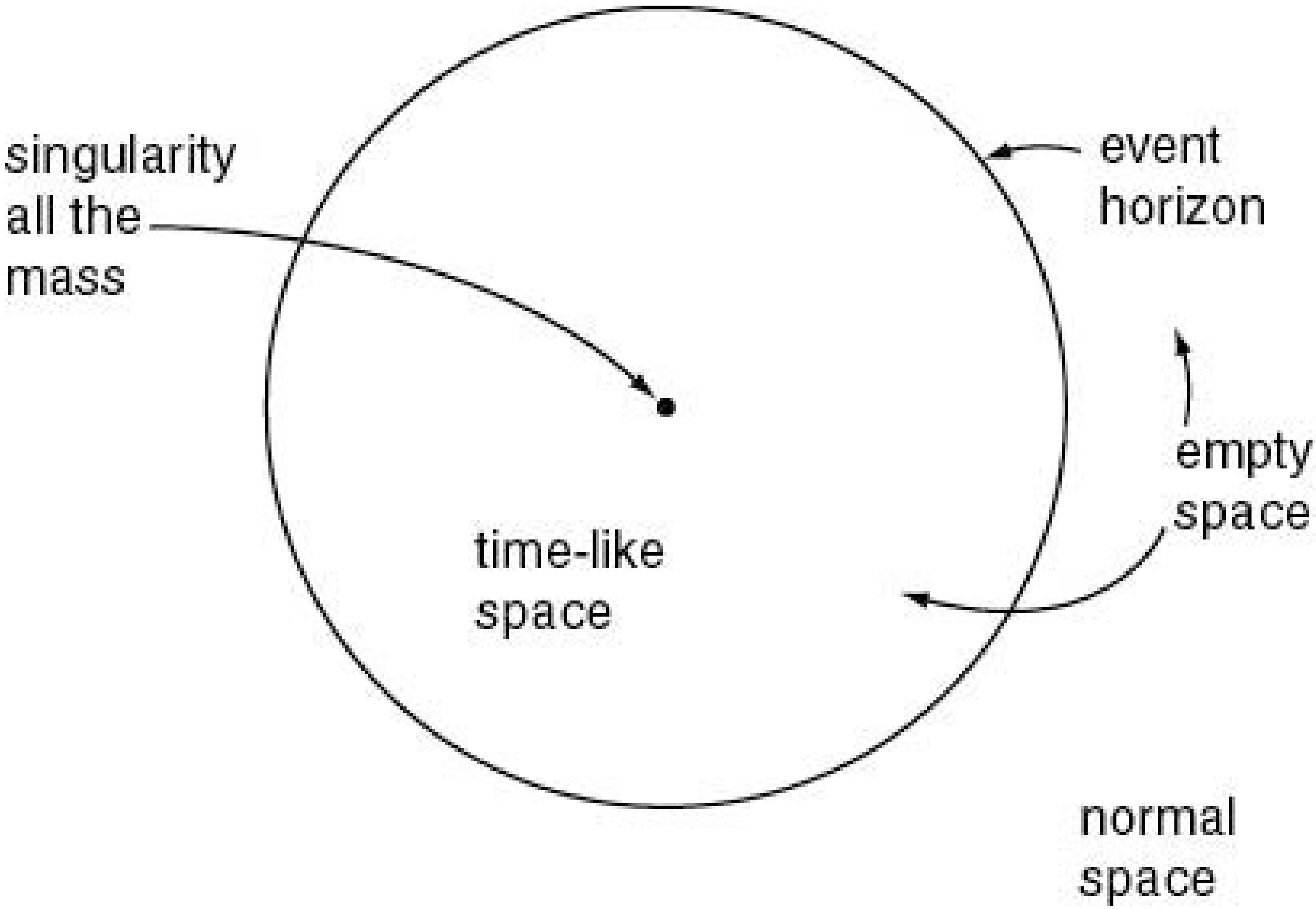
11/3/06

Reading- Chapter 9 sections 1 - 5

News? New PBS Nova Program on Black Holes.

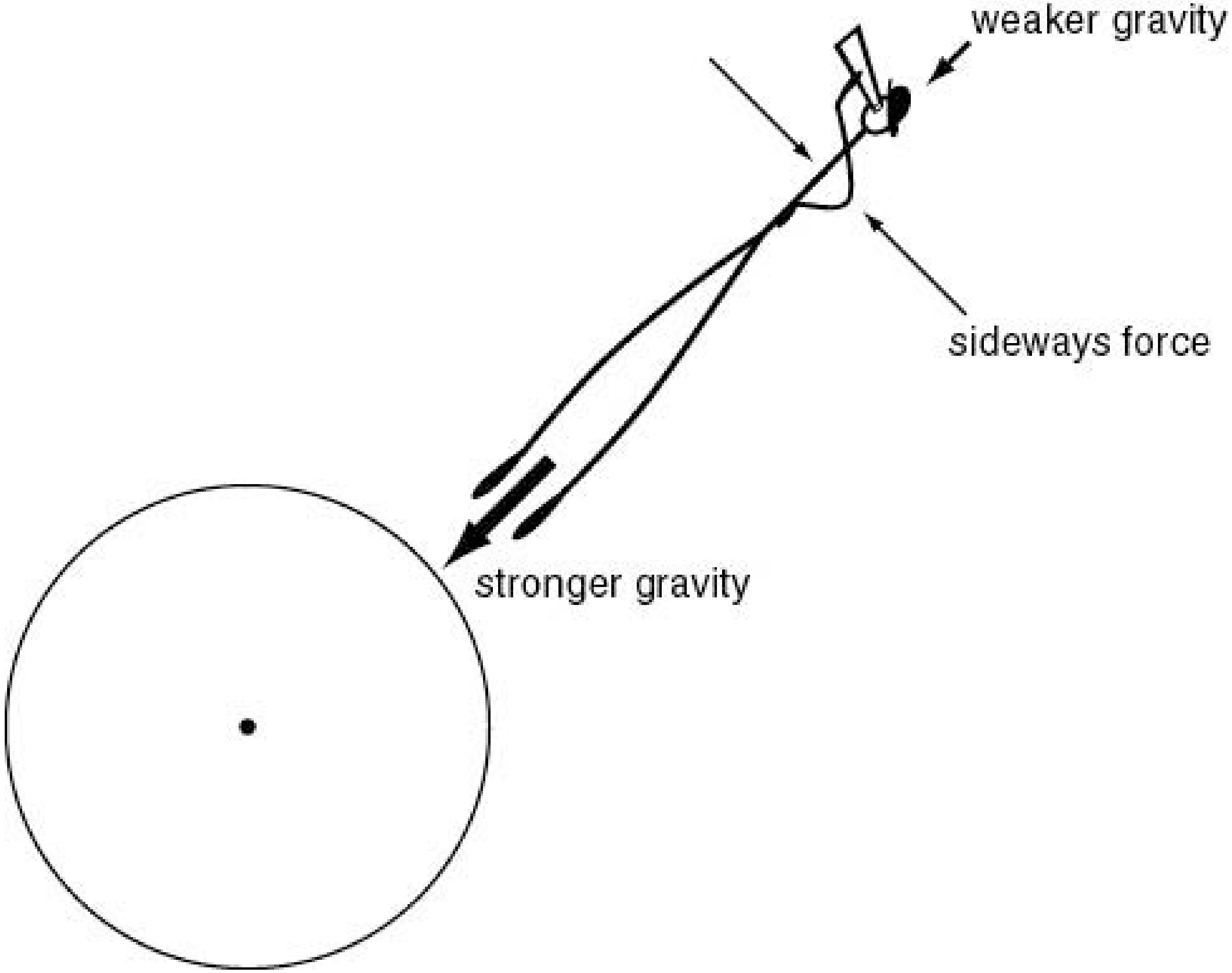
Pic of the day - Hubble photo of V838 Mon, possible young star in binary, mysterious eruption in 2002, light echoes.

Figure 9.1



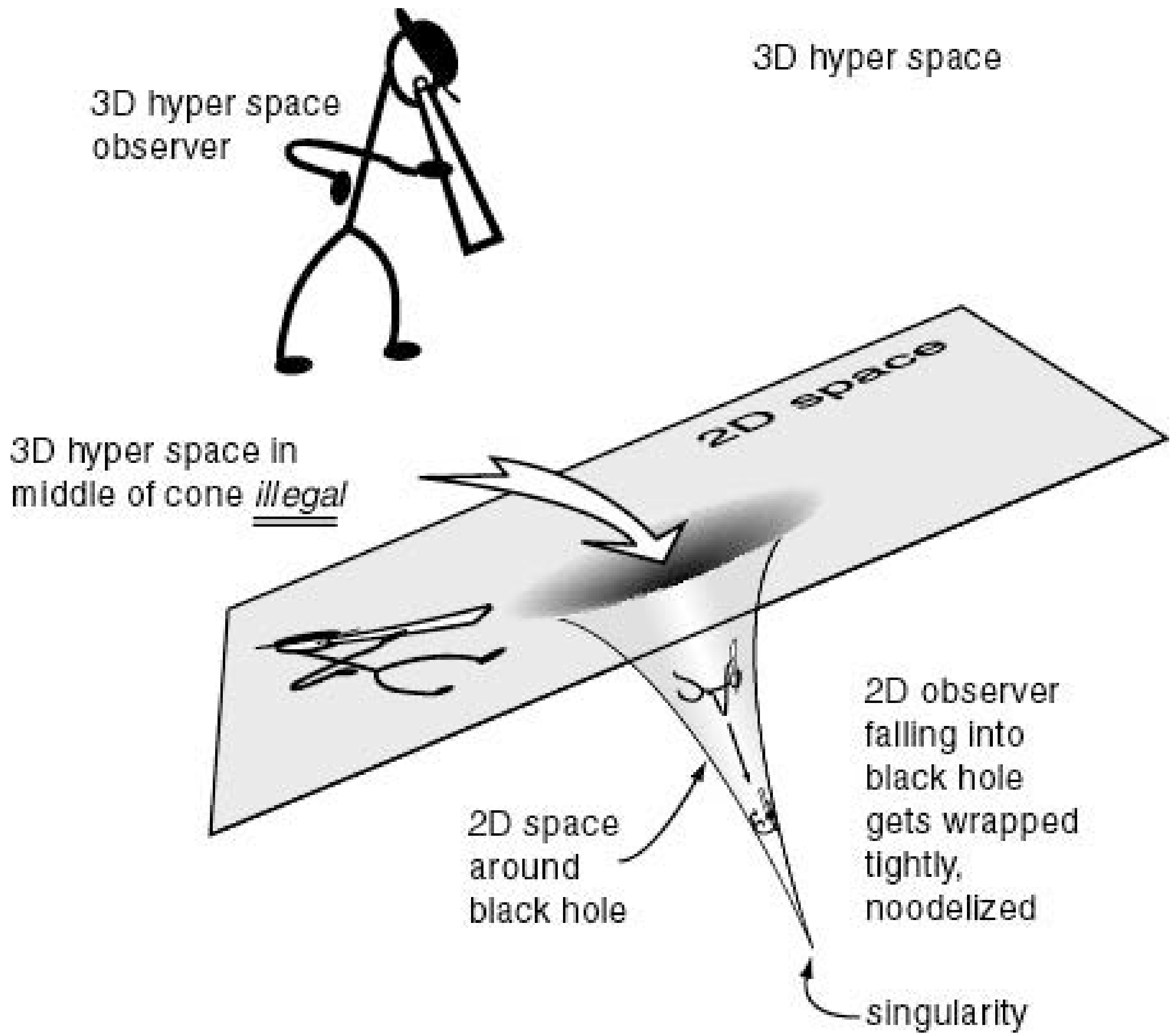
Basic properties of a (non-rotating) black hole

Figure 9.2



Tidal Forces

Figure 9.3



2D embedding diagram of 3D curved space around a black hole

Black holes and Time (Section 5.2)

If a clock moves away from an observer it ticks more slowly.

If a clock is deep in a gravity well it ticks more slowly according to an observer at large distance where gravity is absent.

Get both effects if you drop a "clock" into a black hole and watch it fall in from a safe distance where gravity is weak (flat 3D space).

What does it mean to fall? Rather deep and strange phenomenon!

Drop things, fall at same rate…

Falling to Einstein

According to Einstein - curved space around gravitating objects “flows” inward - ***inward escalator.***

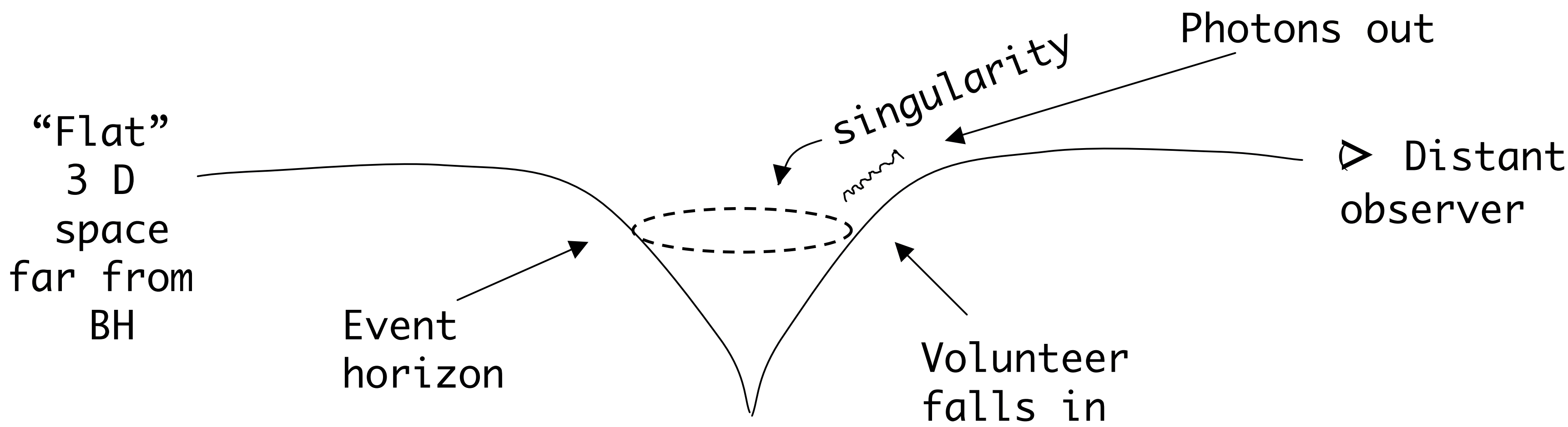
If object floats with ***no force*** in space (free fall), it will move toward the center of gravitation

$\Rightarrow$ falling - all objects respond to same curvature, have the same acceleration

Like water down a drain - sit still in water, but go down the drain.

Must exert force to resist, to avoid free fall, to avoid the flow of space inward toward the center of the gravitating object.

Specifically for Black Holes



Volunteer finds herself rapidly falling through event horizon, noodleized, dies

Distant observer sees Doppler and gravitational redshifts

Received photons get longer, longer wavelength

Time between photons gets longer and longer

Infinite time for last photon emitted just as volunteer reaches the event horizon

⇒***Distant observer never sees volunteer cross the horizon***

⇒***Photons get undetectable, very long wavelength, most of the time is between photons - absolutely black*** **- why black holes are black.**