In case of loss, please return to:

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As a reward: $ 20

Various Topics

1. Thoughts on Hawking's solution to the information prob.
2. de Sitter space in teleparallel gravity
3. Thoughts on the principle of equivalence and the rôle of diffeomorphisms in gravity
4. Coordinate systems in the decay of photons into positron and electron $\mp \gamma \to e^+ + e^-$
5.

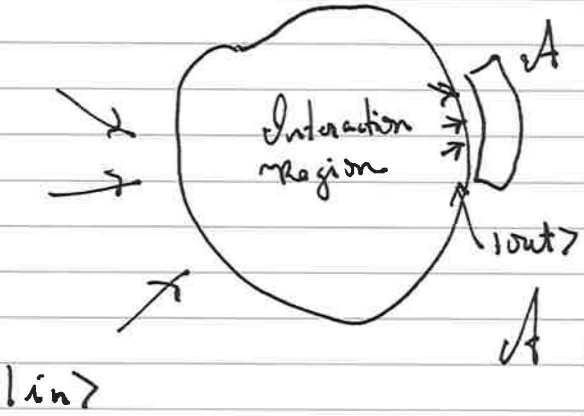
November 12th 2011

This notebook is for the purpose of reevaluating where I stand wrt various ideas. Primarily

The Generalized gauge theory of gravity.

Nov 13th 2011

Removal of measuring apparatus to "∞".



- A must simply record, not interfere with the interaction between |in> & |out> states.

A disturbs spacetime metric $g_{\mu\nu}$

mass of A = m_A.
density of m_A is $\rho_A \sim T^A_{\mu\nu}$

⇒ gravitational field induced by A.

$$G_{\mu\nu} = 8\pi T^A_{\mu\nu}$$

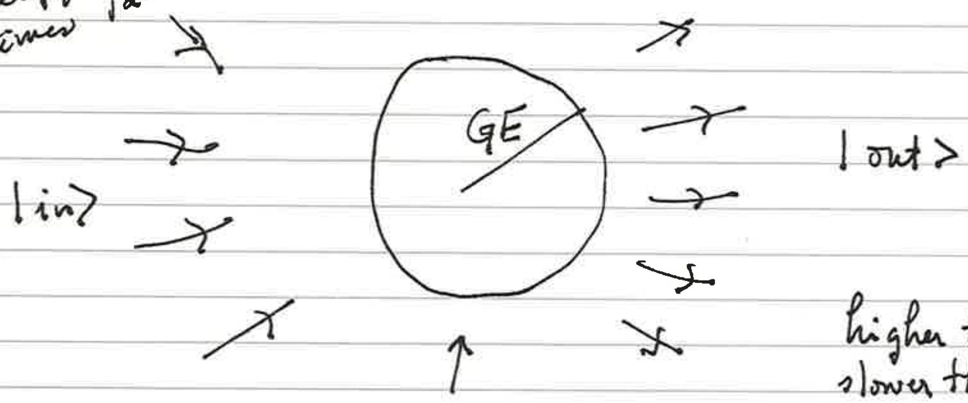
3 grav. fields

i) |in>
ii) |out>
iii) A

In quantum gravity, one must allow for a large interaction region. If the energy of the interaction is E, then the interaction ~~sgi~~ region must be at least of the order

$$r_s = \frac{GM}{c^2} = GE \qquad (1)$$

Energy is many times $\sqrt{\alpha'}$



higher the energy, slower the interaction

here we add up all possible ways the process ~~must~~ must be allowed

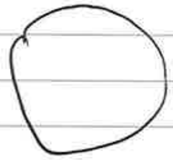
Now, since GE might be absoututely enormous and therefore the measuring apparatus must be pushed off to ∞.

Now, what are the ways one can detect which path has been taken, as with the 2 ~~sl~~ slit experiment. If there is a BH, how can we be sure?

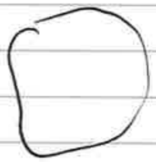
Nov 15th 2011

How can we detect for sure that there *is* a BH?

A:

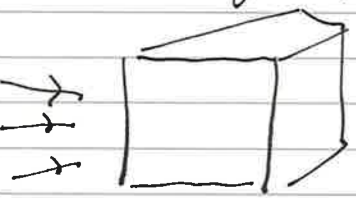


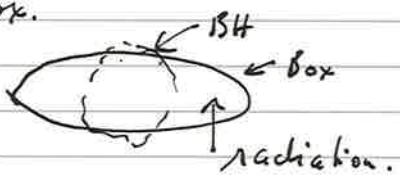
B:



- BH has no hair
- emitts democratically – although we must wait for the whole evaporation to see this.

perhaps we can surround the prospective interaction region with a box full of radiation. If the BH breaks the box a flood of radiation will exit? No. it will become part of the BH. Depends on the ~~spape~~ ~~sp~~ shape of the box.

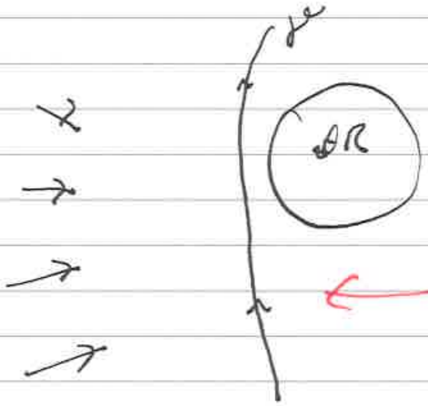




Nongravitational interactions occur on small time scales – gravitational ones on large time scales.

Decay time : 1 galactic mass 10^{100} years.

perhaps in order to detect whether or not there is a hole in the interaction region, we may send a light beam by the interaction region and examine its bending



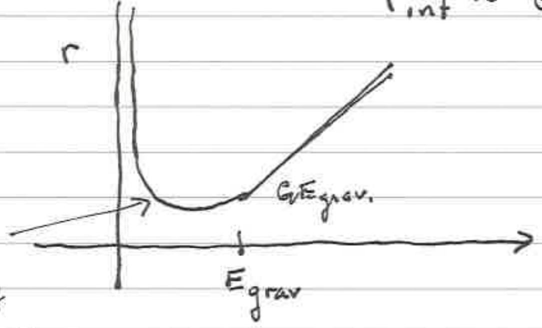
IR ≡ interaction region

But wont the energy, even if there is no BH yeild a Schwarzschild metric and bend the light anyway?

Let the energy of the beam be small so as not to affect the experiment.

Remember that the interaction ~~&~~ region is proportional to the energy of the incoming state

$$r_{int} \sim GE. \qquad (2)$$



this shape is a guess but can be calculated.

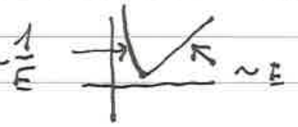
for a scattering experiment for which $E \ll E_{grav}$, we probe smaller and smaller distances as E gets larger

$E = \hbar\nu = \frac{h}{\lambda}$ $\quad\lambda \equiv$ resolution. $= r$ for $E \ll E_{grav}$.

$\lambda = h/E$

$r(E) = h/E \quad \frac{\partial r}{\partial E} = -h/E^2 \Rightarrow$ no critical point?

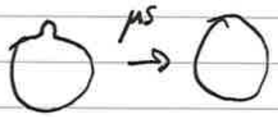
So, perhaps this is more accurate:



Just as in the 2 slit experiment we need to conceive of a thought experiment that can occur in two clearly defined ways, one producing a black hole as an intermediate state and one not. There must also be a way to "look" at the experiment midway and discover if there is or is not a BH present. All in analogy with the 2 slit experiment

Easier said than done!

1) The hair on a black hole dissipates ~~at~~ in a tiny timescale.
$\sim[\mu S] = t_{dissip.}$



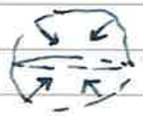
2) The decay time for the hole is much longer then the the decay time for a typical intermediate state without a BH.

January 1st 2012

A new year! And how I look forward to it! 2011 has been uneventful in research, as it has been over-eventful in private life.

"The principle novelty of Hawkings argument is that "the Black Hole" is firmly placed in the interaction region and is therefore not accessible to experiment. Hawking assumes that all that can be measured about the Black Hole is available on the boundary.

Suppose we set a shell of matter infalling and require that the total mass is sufficient to create a Black Hole.



$M > M_s$

If Hawking is correct, the observers at infinity have no measurement paradox. What about the observer in the bulk that can experimentally determine whether or not a black hole has actually formed. Such an observer may then report to the boundary observers.

Say Δ_1 observes, after the time required to allow the infalling matter to form what it may, various debris around the hole to be rotating in such a way as to assure that a black hole has been formed.

$$\partial_\nu \ln \Omega = \partial_\nu \ln \left[\overset{\to 0}{\cancel{\ln}(1)} - \ln\left(1 - \frac{x^2\Lambda}{12}\right) \right]$$

$$= - \partial_\nu \ln\left(1 - \frac{x^2\Lambda}{12}\right)$$

$$= - \frac{1}{1 - \frac{x^2\Lambda}{12}} \cdot \partial_\nu \left(1 - \frac{x^2\Lambda}{12}\right)$$

$$= - \Omega \left(-\frac{\Lambda}{12}\right) \cdot 2 x_\nu$$

I'm making a dumbass mistake

$$\frac{d}{dx} \ln(u) = \frac{du}{dx} \underbrace{\frac{d}{du} \ln(u)}_{\frac{1}{u}} = \frac{1}{u} \frac{du}{dx}$$

let $u \equiv \Omega \to$
$\frac{d}{dx} \equiv \partial_\nu \to$ $\Big\} \to$

$$\partial_\nu \ln \Omega = \frac{1}{\Omega} \partial_\nu \Omega$$

$$= \frac{1}{\Omega} \partial_\nu \left(\frac{1}{1 - \frac{x^2\Lambda}{12}} \right)$$

$$= \frac{1}{\Omega} \cdot - \left[\frac{1}{1 - \frac{x^2\Lambda}{12}} \right]^2 \partial_\nu \left(1 - \frac{x^2\Lambda}{12}\right)$$

$$= \Omega^{-1} \cdot \left(- \Omega^2\right) \left(-\frac{\Lambda}{12}\right) \cdot 2 x_\nu$$

$$= \Omega \cdot \left(\frac{\Lambda}{12}\right) \cdot 2 x_\nu$$

$$= \Omega \left(\frac{\Lambda}{6}\right) x_\nu$$