



IAA Crazy Lunch Talk

Thinking beyond current knowledge

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Methodology in Science

-Today: Theoretical physicist's world(s), dual reality of General relativity and Quantum Theory

Wonko the Sane's house-what is crazy and what normal?

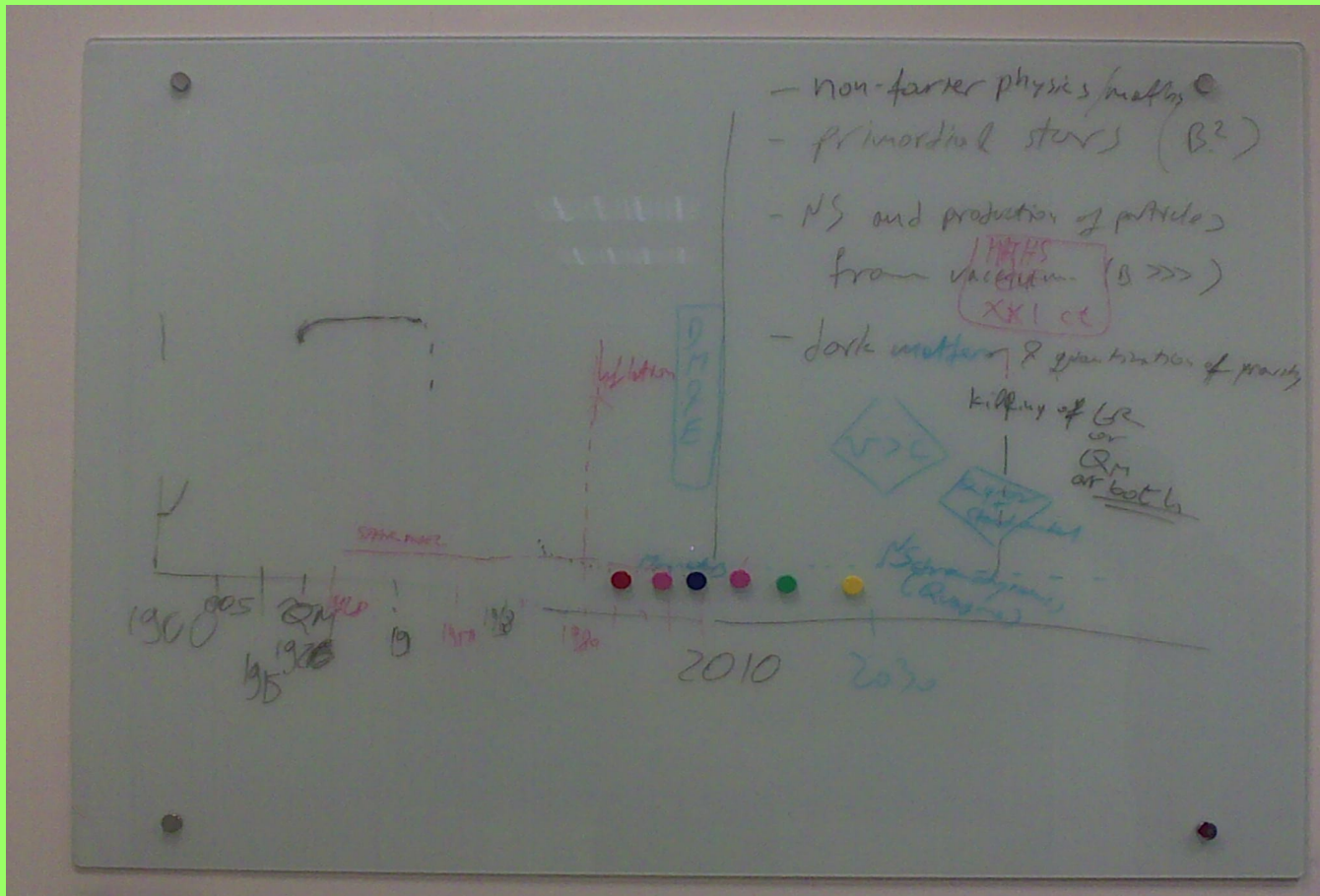
What is true?



- Polish logician Alfred Tarski showed in 1930-ties that the concept of "truth" for the sentences of a given language is not correct, as "truth" cannot consistently be defined within that language. Mathematics included. Remember the paradox of Zeno with Achilles & turtle. Your way of thinking can doom reality of your "logical" conclusion.
- Task of a theoretical physicist is to prove his (current) theory is false as fast as possible. (Feynman)
- This is extreme Popperian view: good theory is one which offers ways for showing it is wrong. "Anything goes" of Paul Feyerabend in "Against Method" leads rather to New Age than Science. But... maybe Science IS New Age? For most of the history Science was=magic.
- Imre Lakatos argued that it is not single theory which needs to fail (to be replaced) but rather more general concept of "research programme".

Crazy or normal?

The fastest way to learn more about the Universe is to capture some Alien and squeeze him for informations. But when we are waiting for the poor guy to come, we are on our own. In 1980-ies gamma and X-ray astronomy were described as “new astronomy” in books. What book we can write for kids and call it “new astronomy”?



Example: Dark matter and tunnelling of Gravity

-Tunnelling of gravity through the topological boundary as explanation of Dark Matter

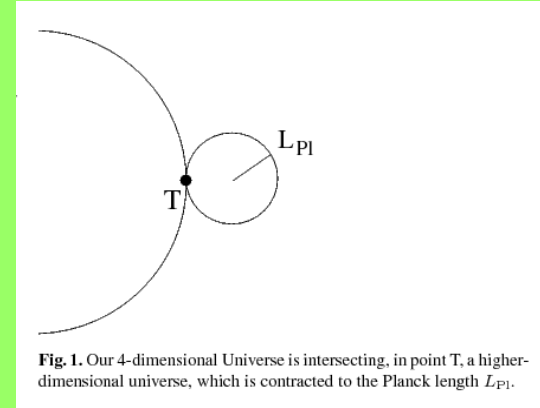


Fig. 1. Our 4-dimensional Universe is intersecting, in point T, a higher-dimensional universe, which is contracted to the Planck length L_{Pl} .

In some of such theories, our Universe is then only one non-curved 4-dimensional sphere, immersed in the foam of bubbles, of which each is an universe on its own.

If we imagine point T in our Universe in which it intersects with one such small universe, we can calculate effects of gravity in such point. If in the point T there is located mass m , Newtonian gravity force between T and surrounding masses M_i is

$$F_g = \sum_i \frac{GmM_i}{r_i^2}. \quad (1)$$

We can describe this with single point interaction with point mass M'_i at the distance r'_i , $F_g = GmM'_i/r_i'^2$.

However, observations show that actual force is of the order of ten larger, i.e. $F'_g = 10F_g = 10GmM'_i/r_i'^2$.

is tunnelling of gravitation from the small universe into our Universe, through the topological boundary at the point T, we can write:

$$F'_g = \kappa \frac{GmM''}{L_{Pl}^2}, \quad (2)$$

where κ is the efficiency of tunneling, and M'' is the mass of the small universe.

Then it follows

$$\begin{aligned} 10 \frac{GmM'_i}{r_i'^2} &= \frac{GmM'_i}{r_i'^2} + \kappa \frac{GmM''}{L_{Pl}^2} \\ 10 \frac{M'_i}{r_i'^2} &= \frac{M'_i}{r_i'^2} + \kappa \frac{M''}{L_{Pl}^2} \\ \kappa &= 9 \frac{M'_i}{M''} \frac{L_{Pl}^2}{r_i'^2} \end{aligned}$$

$$\kappa \approx \frac{10L_{Pl}^2}{M''}. \quad (3)$$

If we suppose that the small universe is of the mass of our Universe, $M'' = M_U \sim 10^{55} kg$, and with $L_{Pl} = \sqrt{\hbar g / (2\pi c^3)} \sim 10^{-35} m$, we have

$$\kappa \approx \frac{10^{-69}}{M_U} \approx 10^{-124}. \quad (4)$$

The tiny coefficient κ could be the reason that we do not observe effects of such tunneling locally, but only in cosmic scales.