

Title: Cohort Project Presentation 7

Speakers:

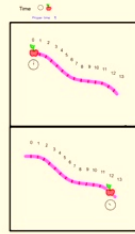
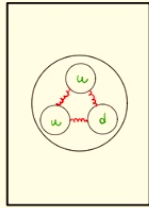
Collection: PSI 15th Anniversary Reunion

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# PHYSICS WITH(OUT) WORDS

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**CONFINEMENT**  
 Protons and neutrons are NOT fundamental particles for example, they have quarks inside of them. At low energy, we see a quark alone, at low energy they are confined. However, at very high energies all quarks exist freely without interacting.

**AdS/CFT duality**  
 A quantum theory with gravity in d+1 dimensions is equivalent to a quantum theory without gravity (in d dimensions) (living on the boundary).  
 Holographic correspondence.

$$1+1+1+\dots = -\frac{1}{2}$$

$$1+2+3+\dots = -\frac{1}{12}$$

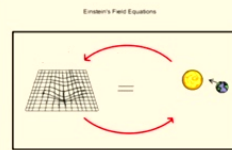
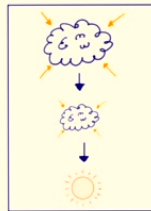
$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$$

The time measured by an external observer seeing the apples fall on Earth is a coordinate. We represent the coordinate time by the letter "t". Coordinate time measured by an observer is not the same as the apple's proper time.  
 - Cynthia Arias, Physicist

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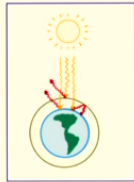
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**Jeans Mass**  
 It is the critical mass that a gas cloud needs to collapse and form stars. It depends on the temperature of the gas and describes the point where the pressure of the cloud cannot resist the gravity of the gas, leading to a collapse.  
 - Javier Hernandez Morales, Astronomer

**Greenhouse effect**  
 Most of the sunlight reaching earth is absorbed on the surface and immediately re-emitted as infrared light. However, not all of this radiation escapes because part of it is absorbed again by gases present in the atmosphere and reflected back at earth. This process regulates the temperature of the planet, maintaining of a greenhouse.  
 - Michael Müller, Physicist

**Planetary Transit**  
 It occurs when a planet passes in front of its star, and it eclipses the light coming from it. Astronomers use telescopes to observe stars and detect periodic dimmings in the brightness, revealing the possible presence of a planet orbiting the star.  
 - Cynthia Arias, Physicist

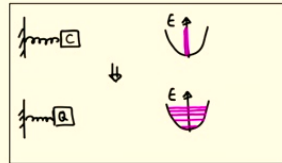


**ZETA FUNCTION REGULARIZATION**  
 Sometimes get by to do a calculation and the answer is infinity. But if you go further and get the limit, this may be a finite answer. This is called regularization. The idea involves use used by Riemann in 1859. It's not the same as the usual regularization.  
 - John Wheeler

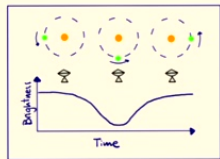
An observer who is accelerating in the vacuum, at temperature zero, will perceive a thermal bath at higher temperature. This phenomenon is called the Unruh effect.

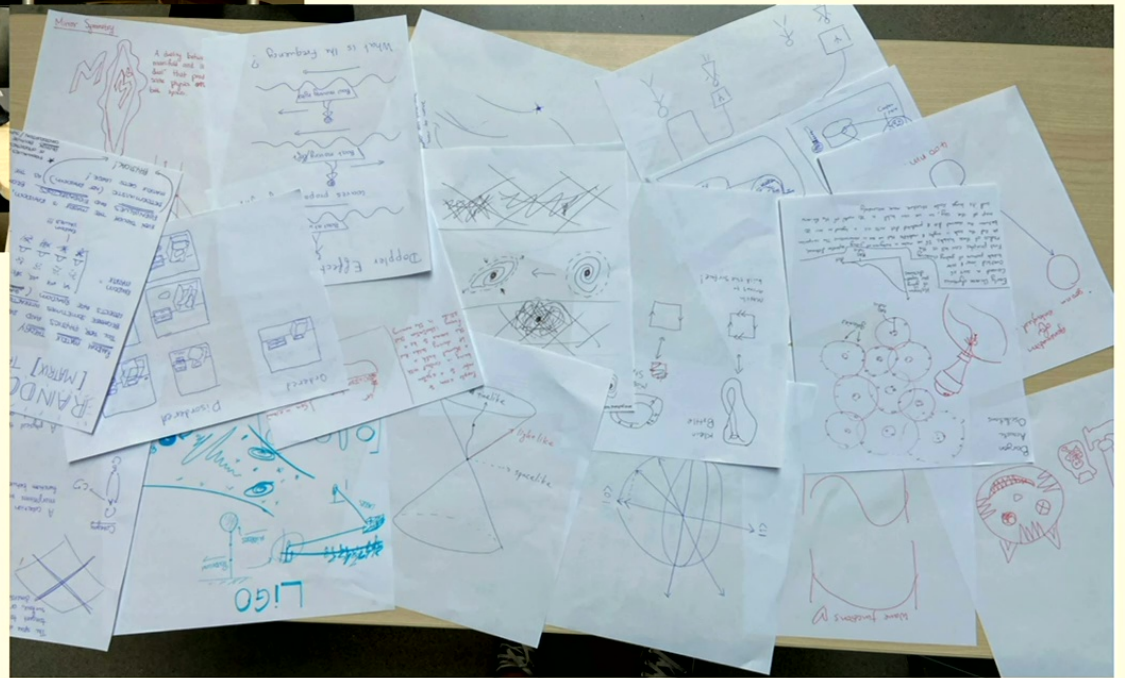
$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = \frac{8\pi G}{c^4}T_{\mu\nu}$$

Spacetime tells matter how to move and matter tells spacetime how to curve.  
 - John Wheeler



A quantum harmonic oscillator is similar to a classical one. However, in the classical case the energy can be increased by a tiny amount as you wish. In the quantum case, this increase is has to be a specific amount.





**THANK YOU**