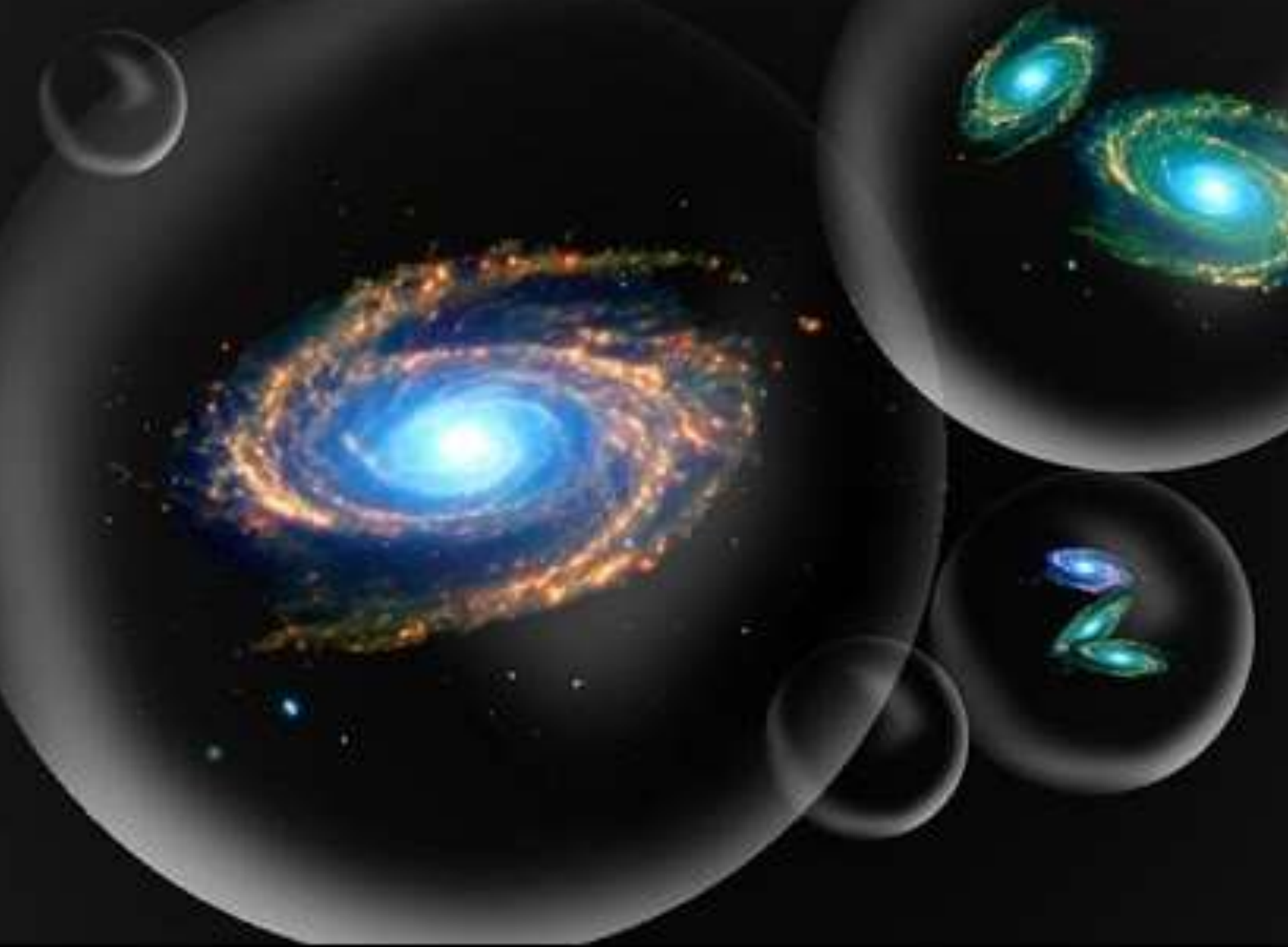


Parallel Universes

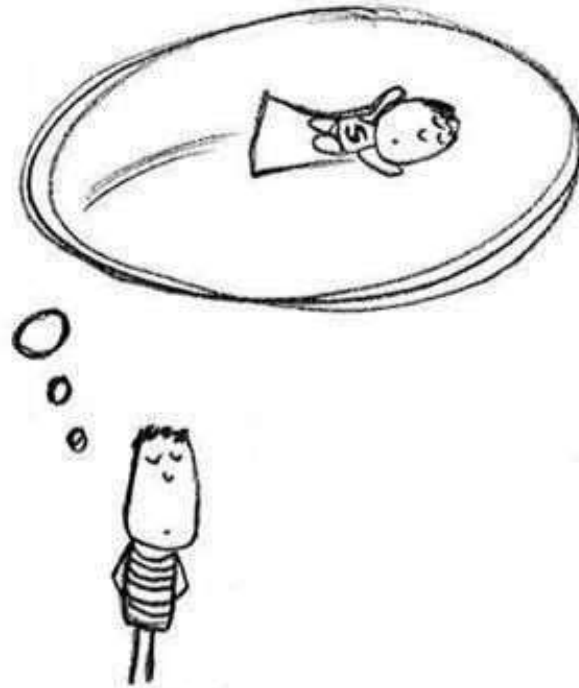
Catalina Curceanu, LNF-INFN

INSPYRE 2017



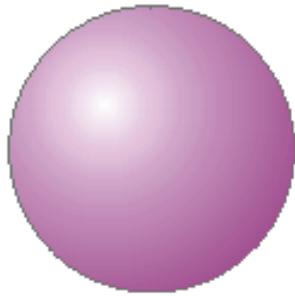


HAPPINESS IS

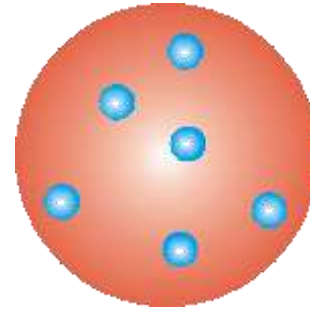


**...knowing that in a
parallel universe, most likely,
you're a superhero.**

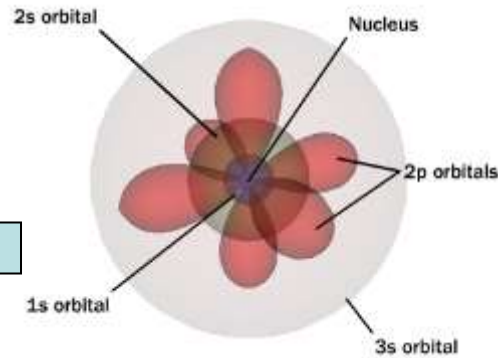
L'atomo all'inizio del '900



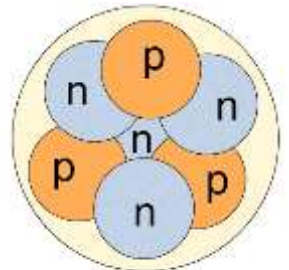
L'atomo di Thompson



L'atomo quantistico

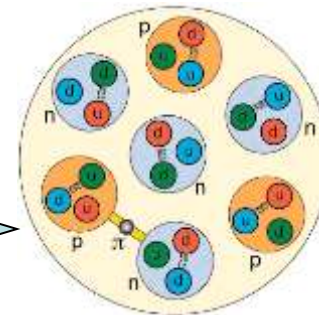


L'atomo di Rutherford e Bohr



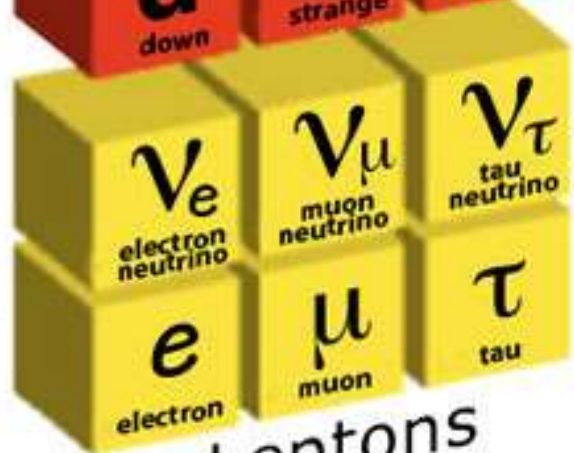
1.6 fm
4.8 fm

La struttura del nucleo



Il nucleo oggi

Quarks

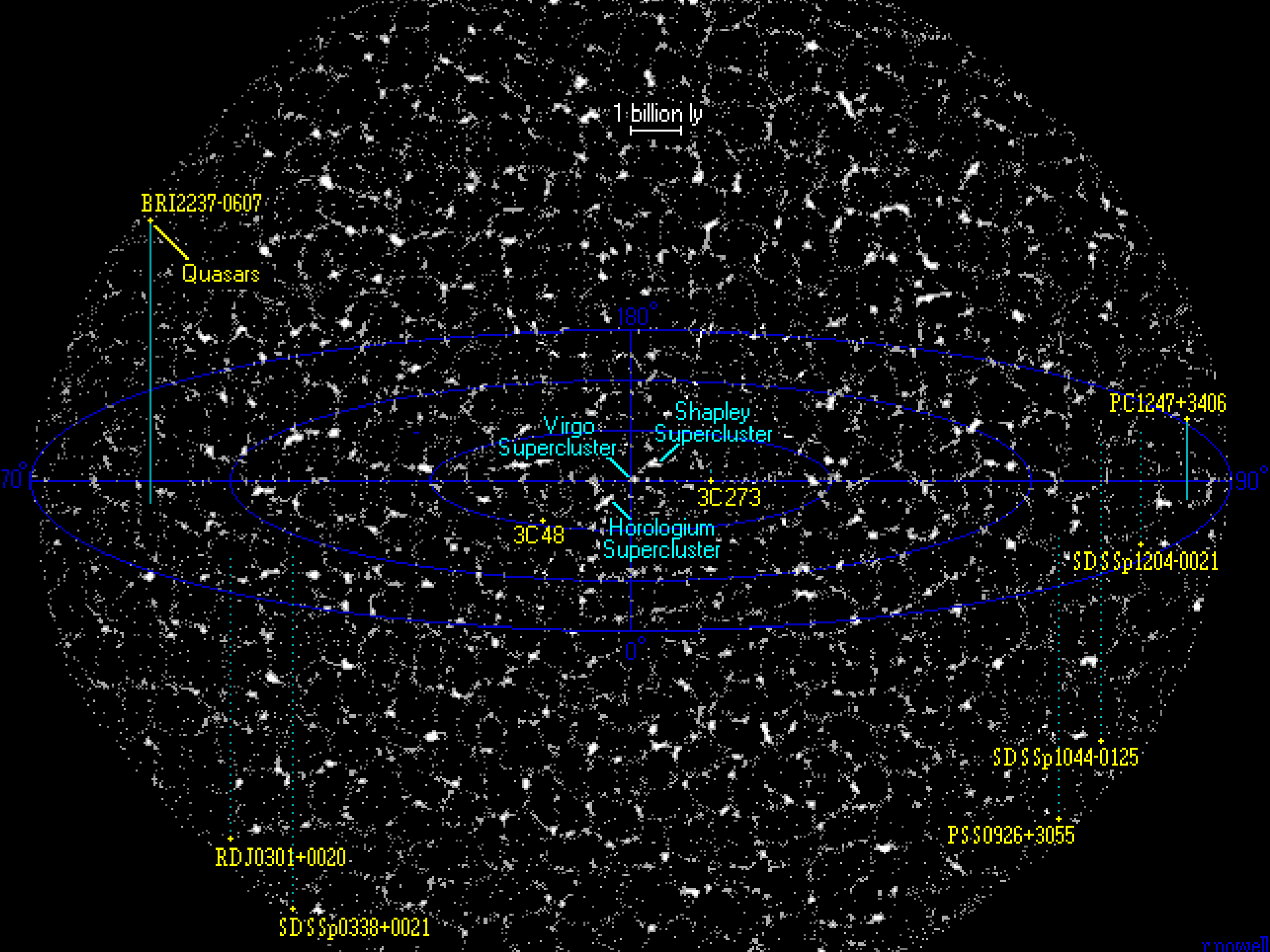


Leptons

Antiquarks



Antileptons



1 billion ly

BRI2237-0607

Quasars

180°

Virgo
Supercluster

Shapley
Supercluster

PC1247+3406

70°

90°

3C273

3C48

Horologium
Supercluster

SDSSp1204-0021

0°

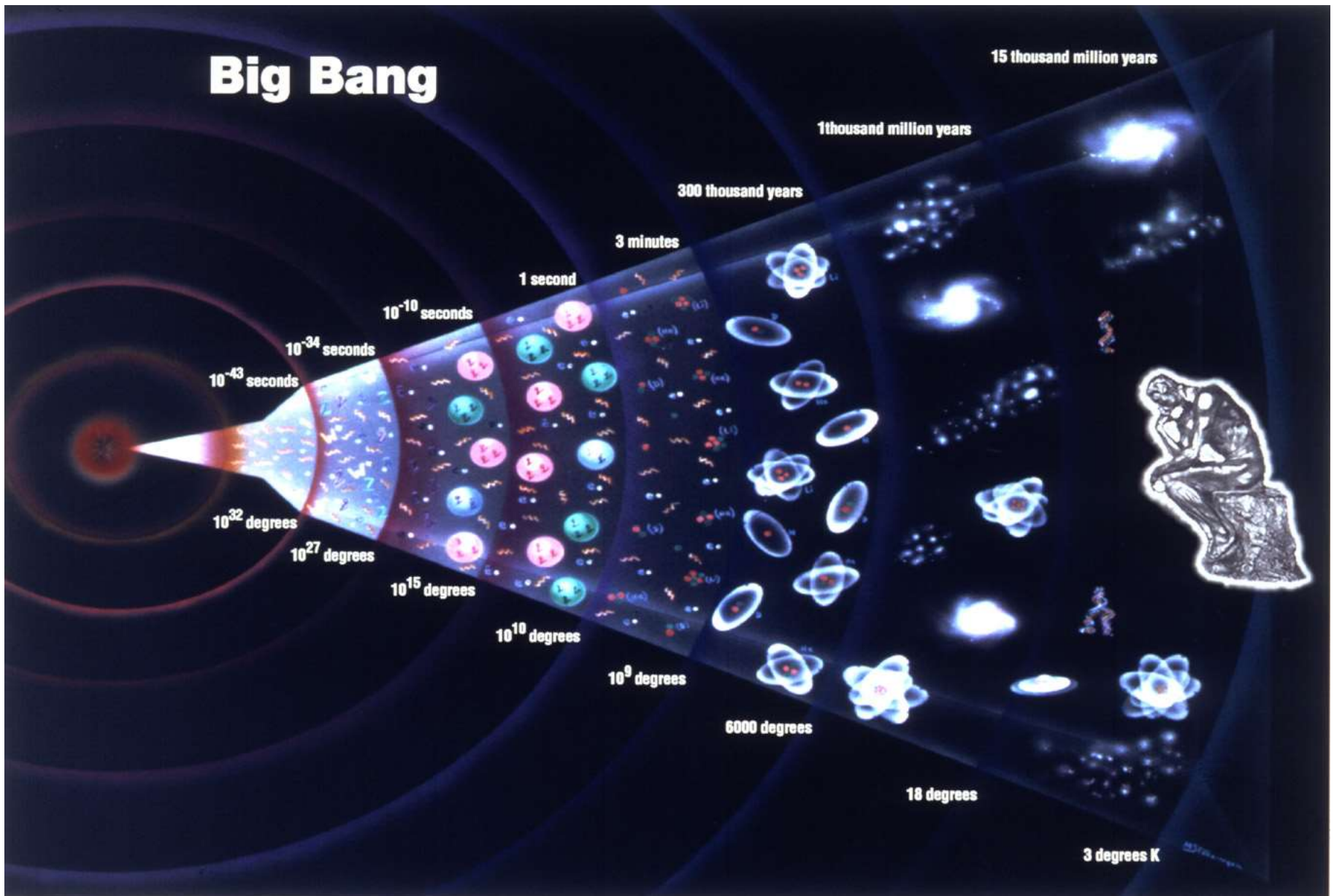
SDSSp1044-0125

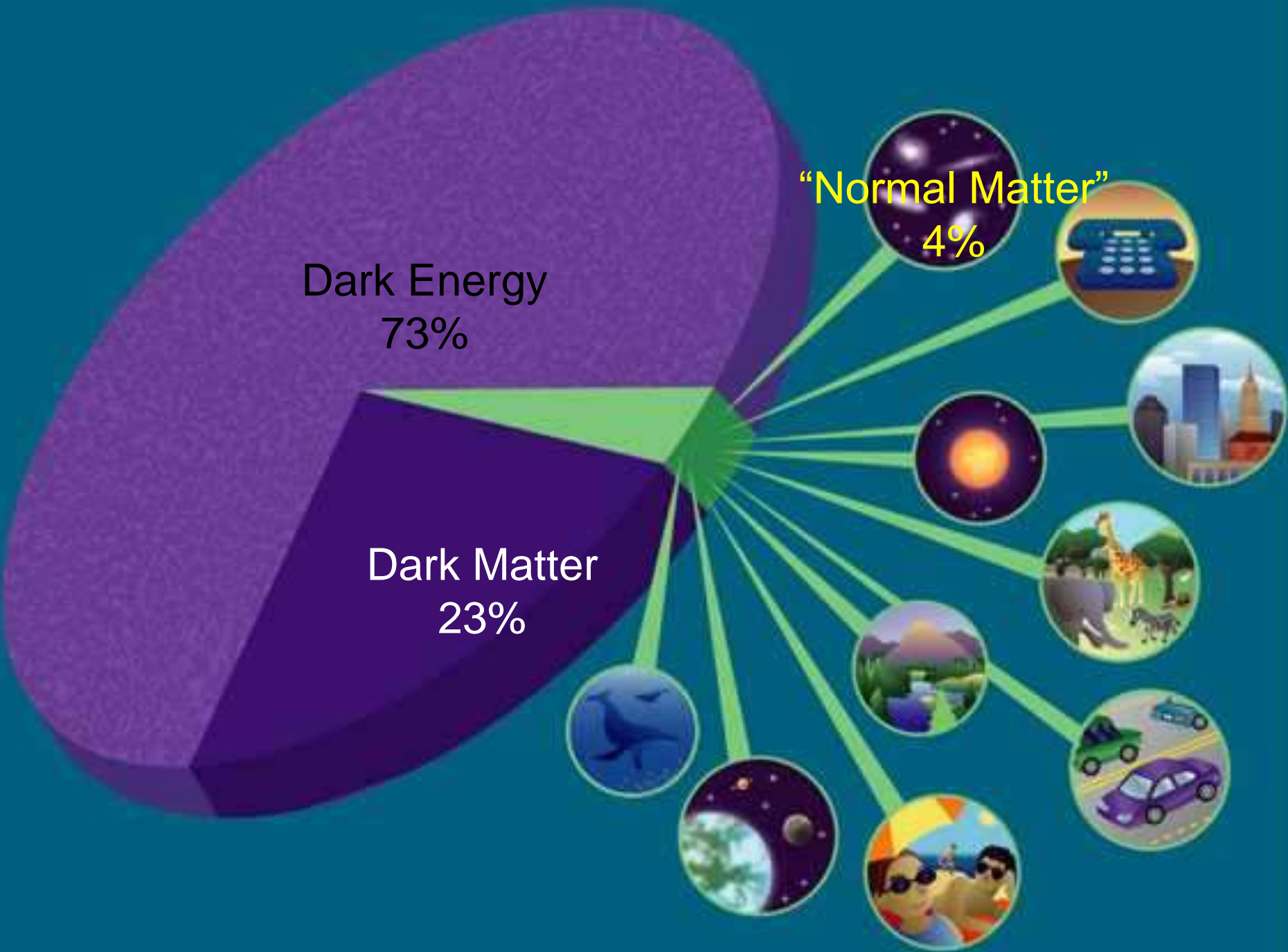
RDJ0301+0020

PS0926+3055

SDSSp0338+0021

La storia dell'Universo





Dark Energy
73%

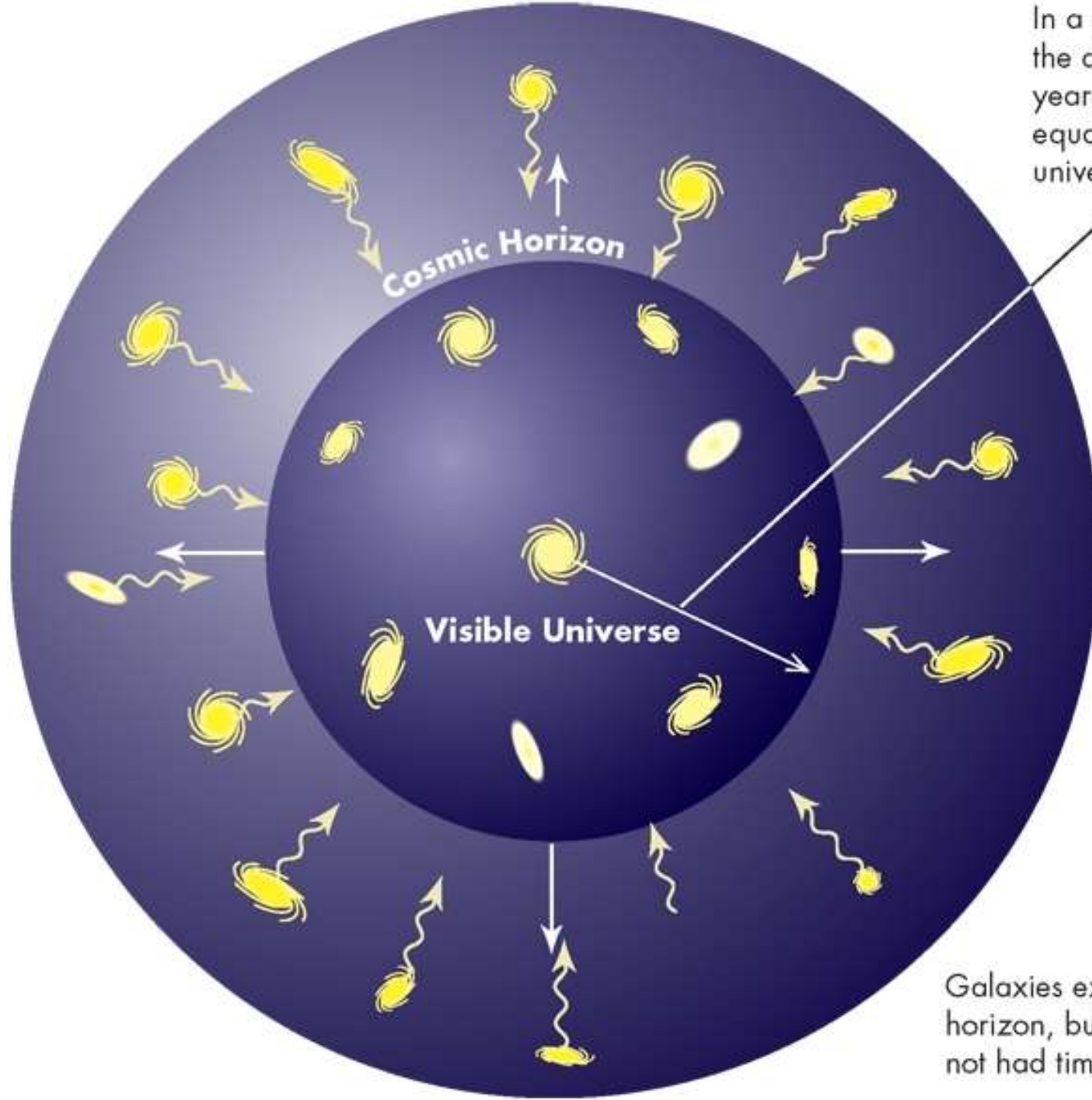
Dark Matter
23%

“Normal Matter”
4%

First type of parallel Universes

The Universe is INFINITE

Our own Universe might be repeated...



In a static universe, the distance in light-years to the horizon equals age of universe in years.

Galaxies exist beyond the horizon, but their light has not had time to reach us.

THE SIMPLEST TYPE of parallel universe is simply a region of space that is too far away for us to have seen yet. The farthest that we can observe is currently about 4×10^{26} meters, or 42 billion light-years—the distance that light has been able to travel since the big

bang began. (The distance is greater than that because cosmic expansion has lengthened it.) The distance to the nearest Level I parallel universes is basically the same as the distance to the farthest we can see. Differences stem from variations in the initial conditions.



How Far Away Is a Duplicate?

EXAMPLE UNIVERSE

Imagine a two-dimensional universe with four particles. Such a universe has 2^4 , or 16, possible arrangements. If more than 16 of these universes exist, they must repeat. In this example, the distance to the nearest duplicate is roughly four times the diameter of each universe.

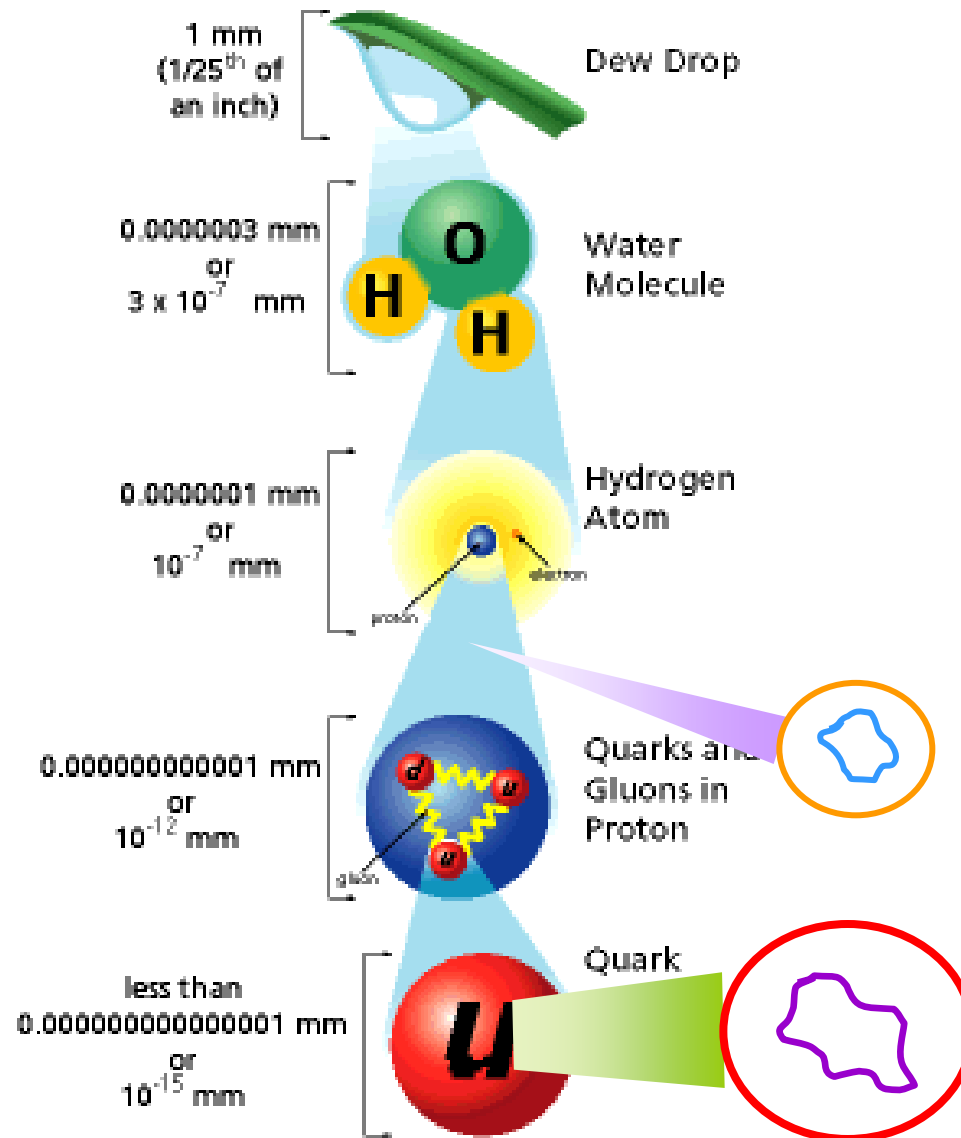
4 particles

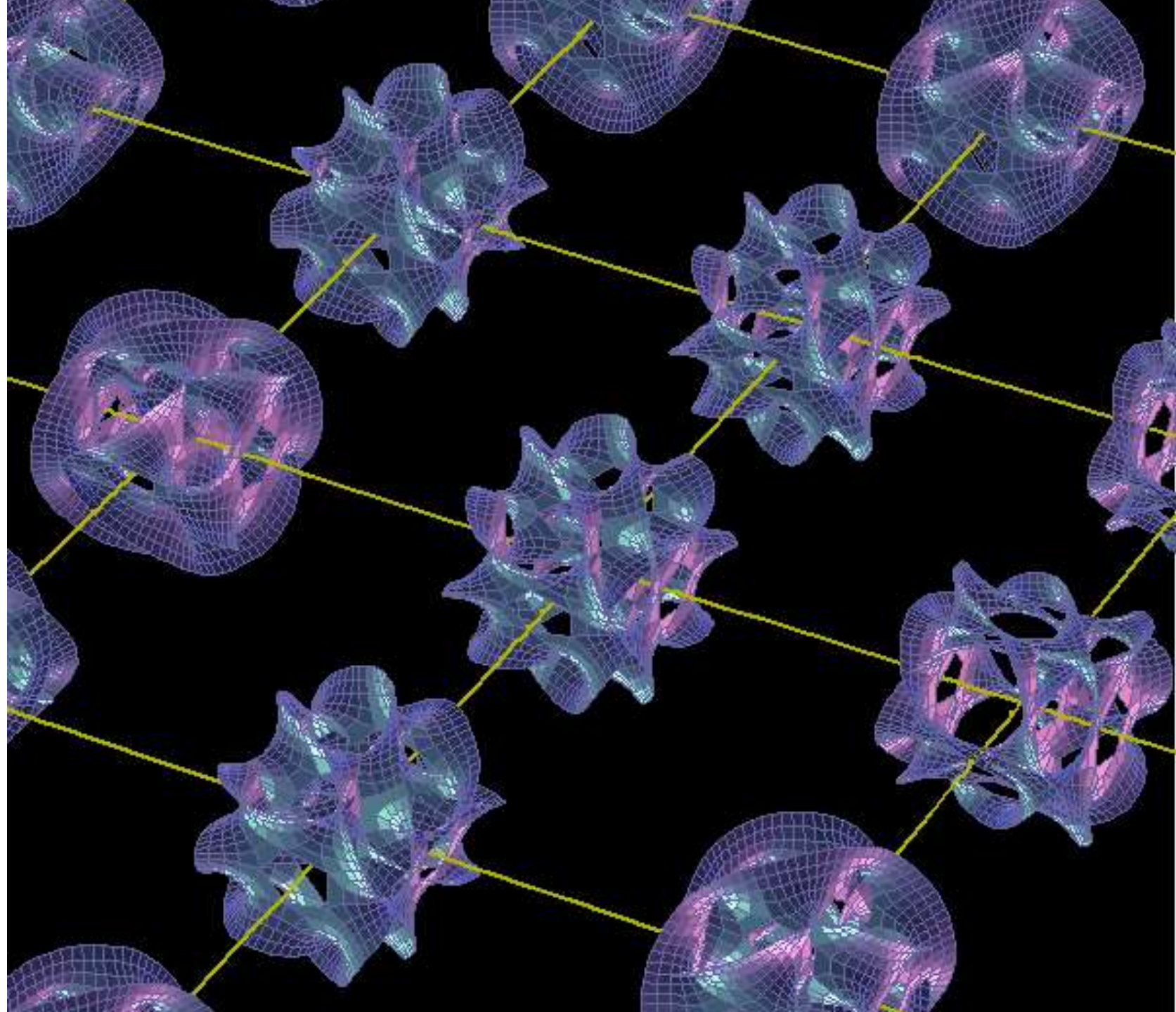


ANOTHER YOU IN ANOTHER UNIVERSE



Open issues in Modern Physics & String Theory

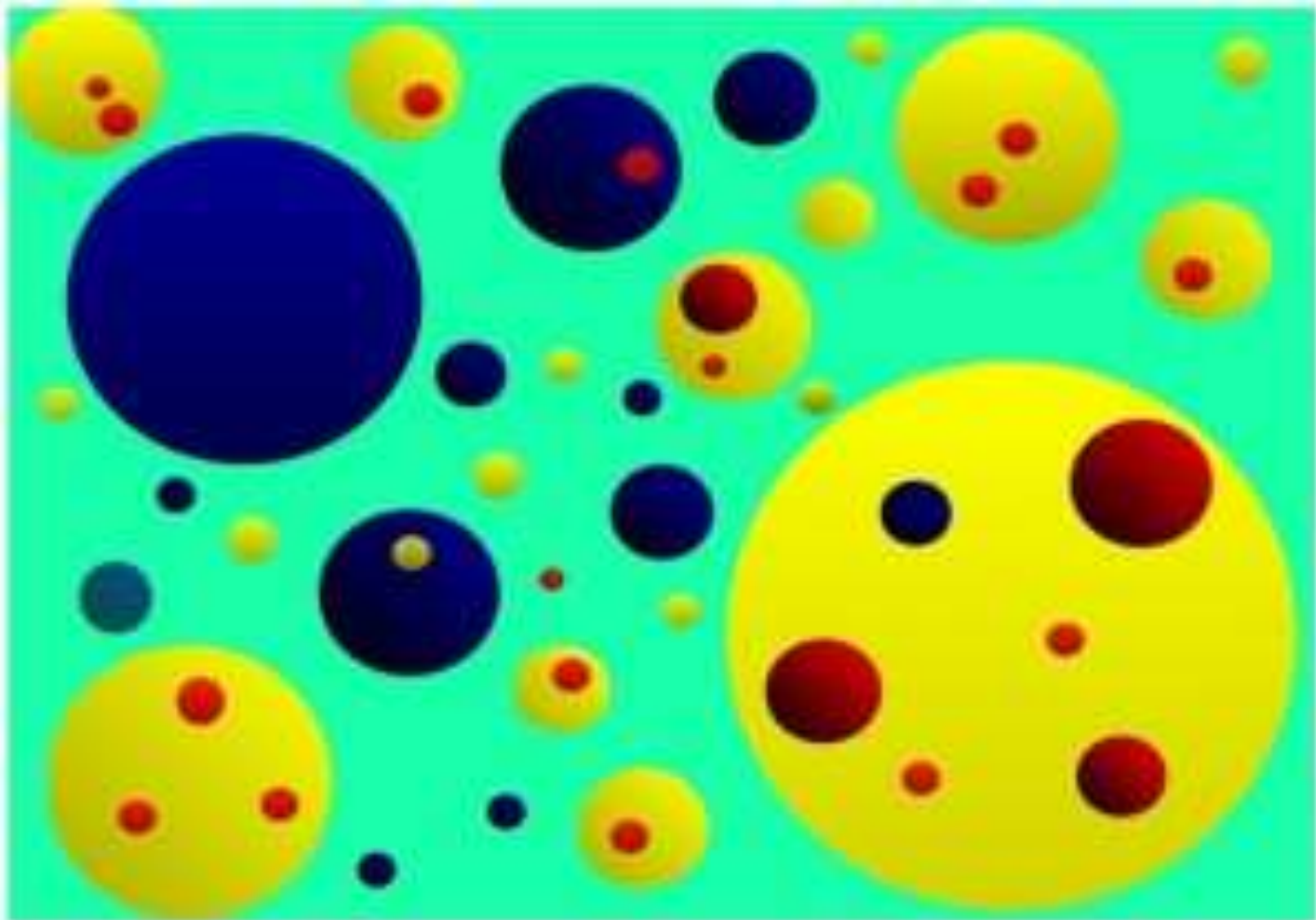




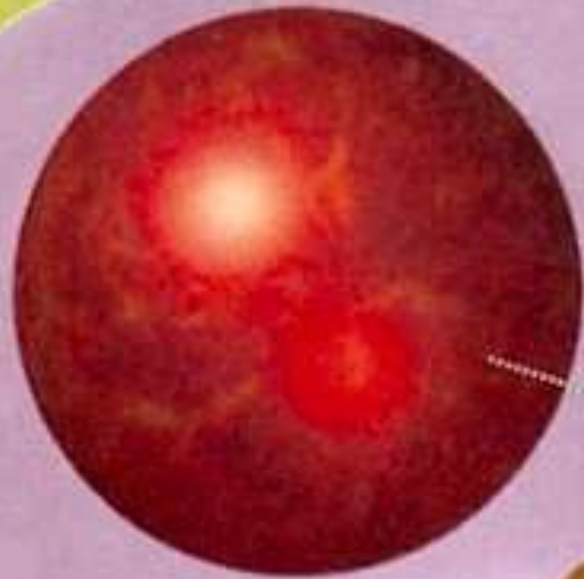


Second class of Parallel Universes

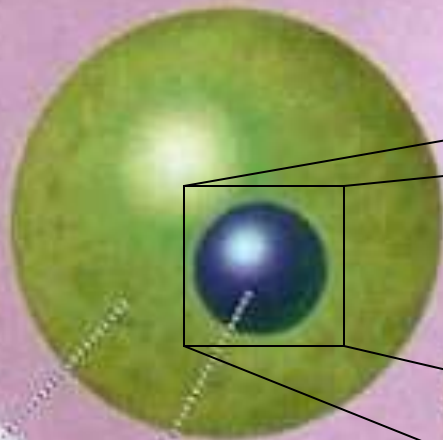
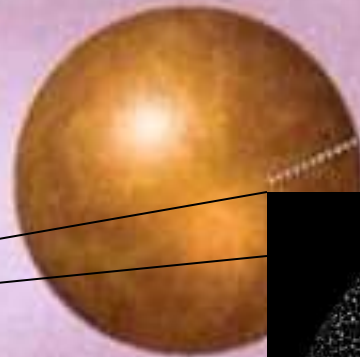
They are DIFFERENT one w.r.t the other one –
with different PHYSICS since the very beginning



Multiverse



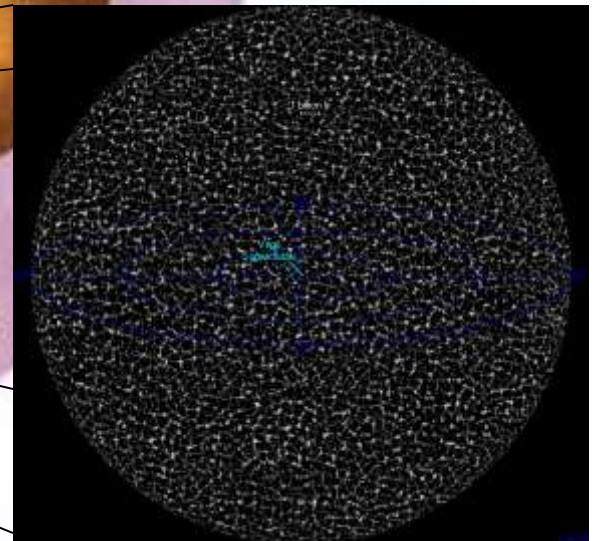
Other universes (Island universes)

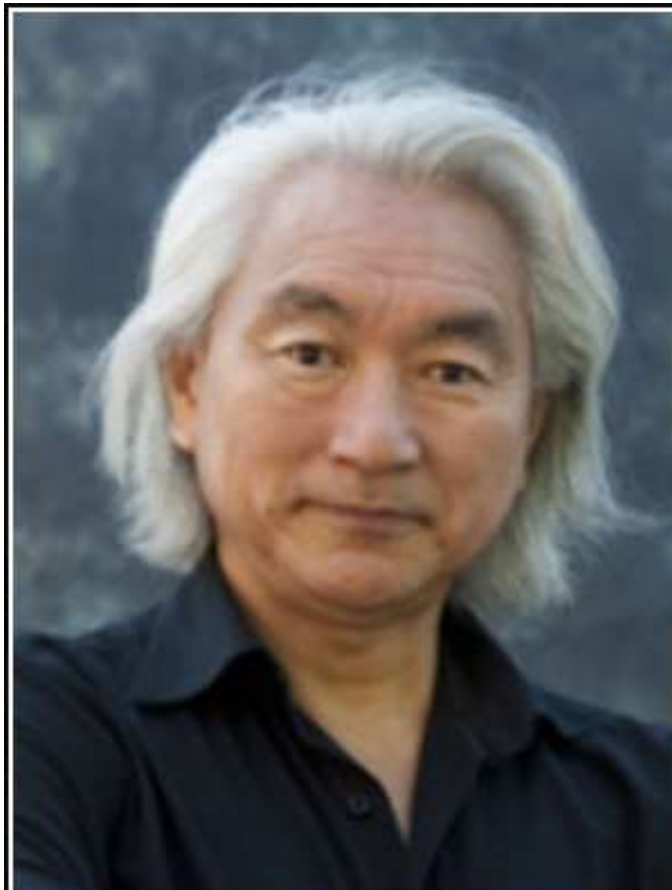


Our universe

Eternally inflating false vacuum

Part visible to us (Observable universe)

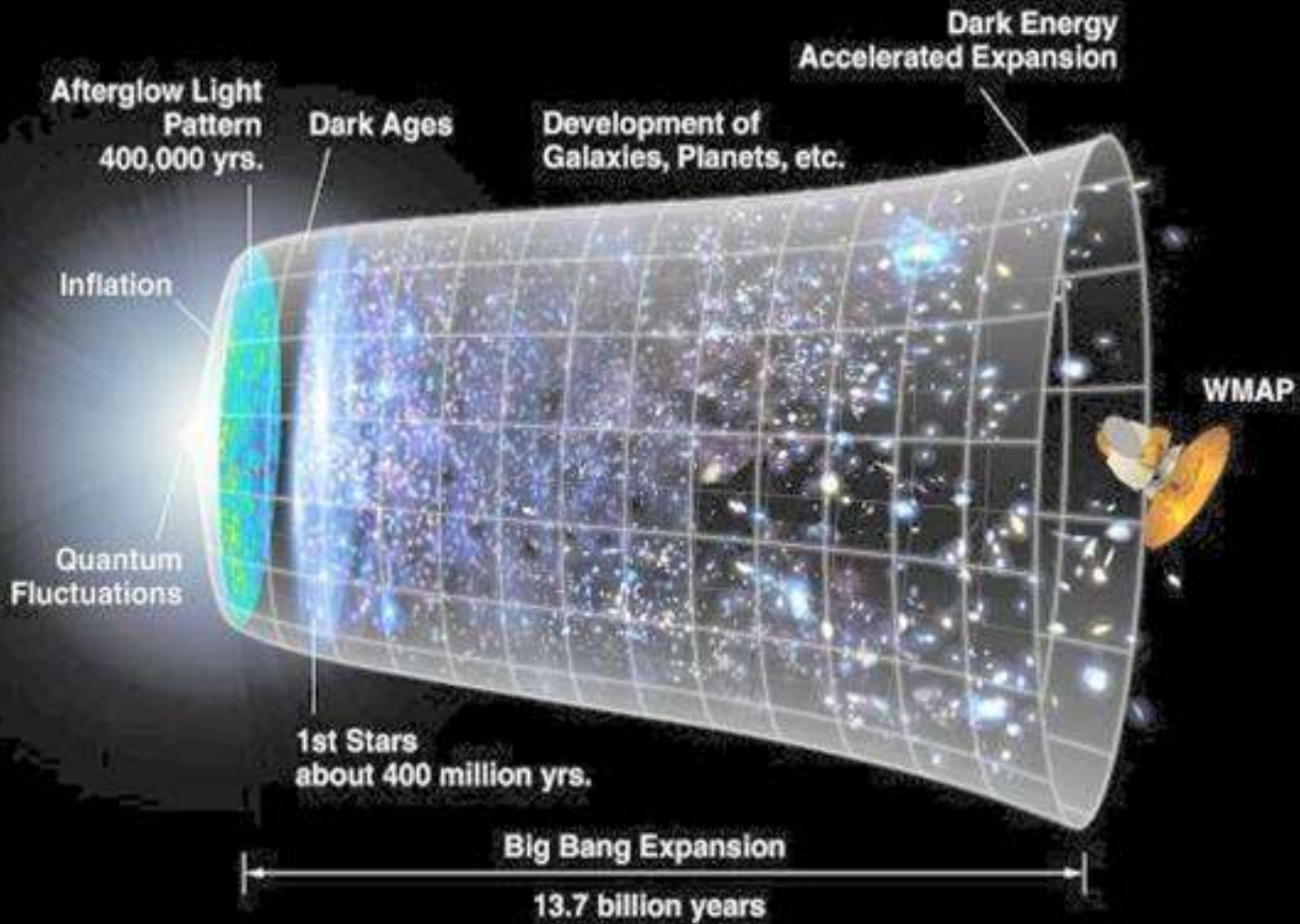




However, one new theory says that dark matter may be ordinary matter in a parallel universe. If a galaxy is hovering above in another dimension, we would not be able to see it. It would be invisible, yet we would feel its gravity. Hence, it might explain dark matter.

— *Michio Kaku* —

AZ QUOTES



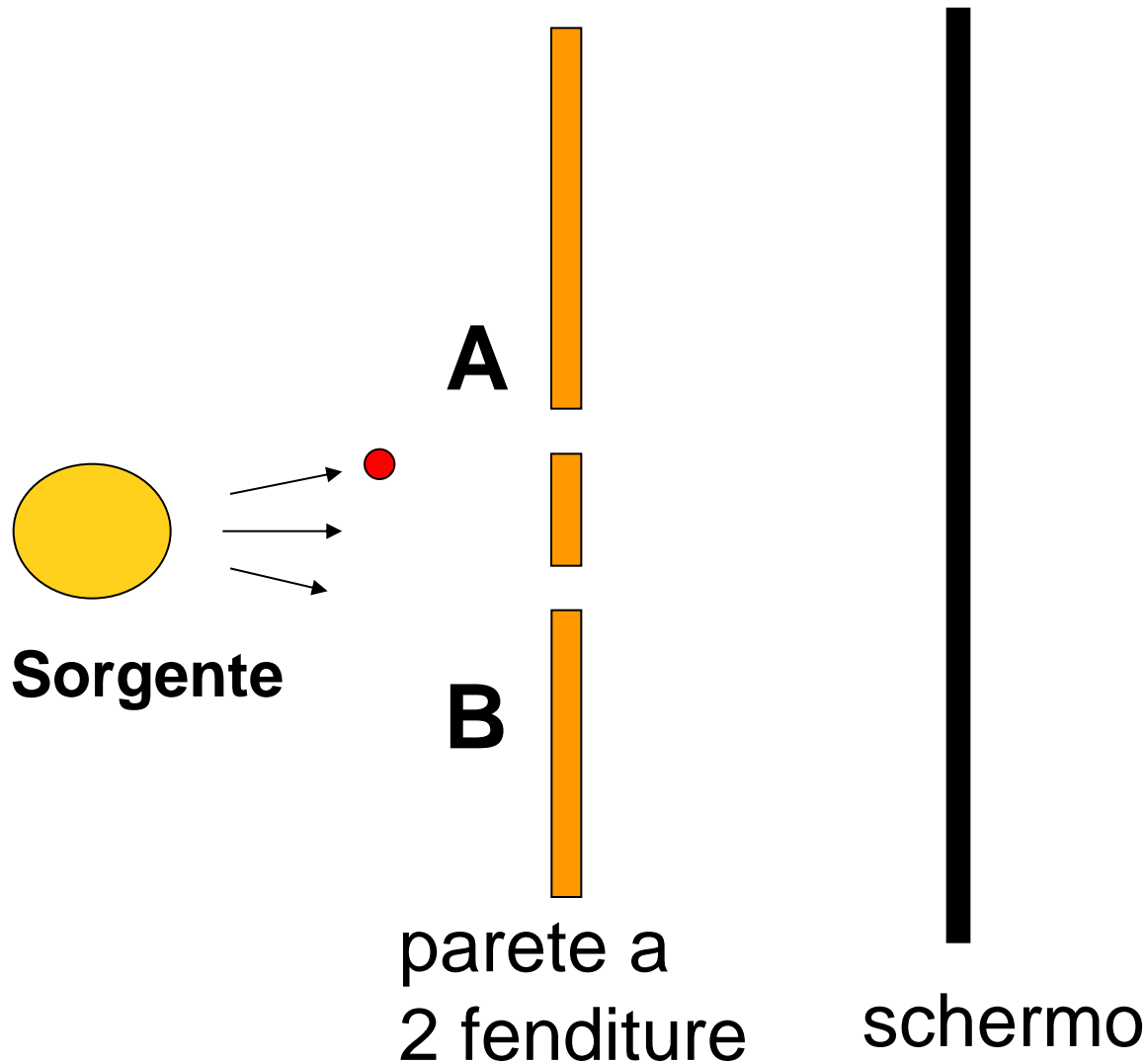
Third type of parallel Universes

Many-world from Quantum Mechanics

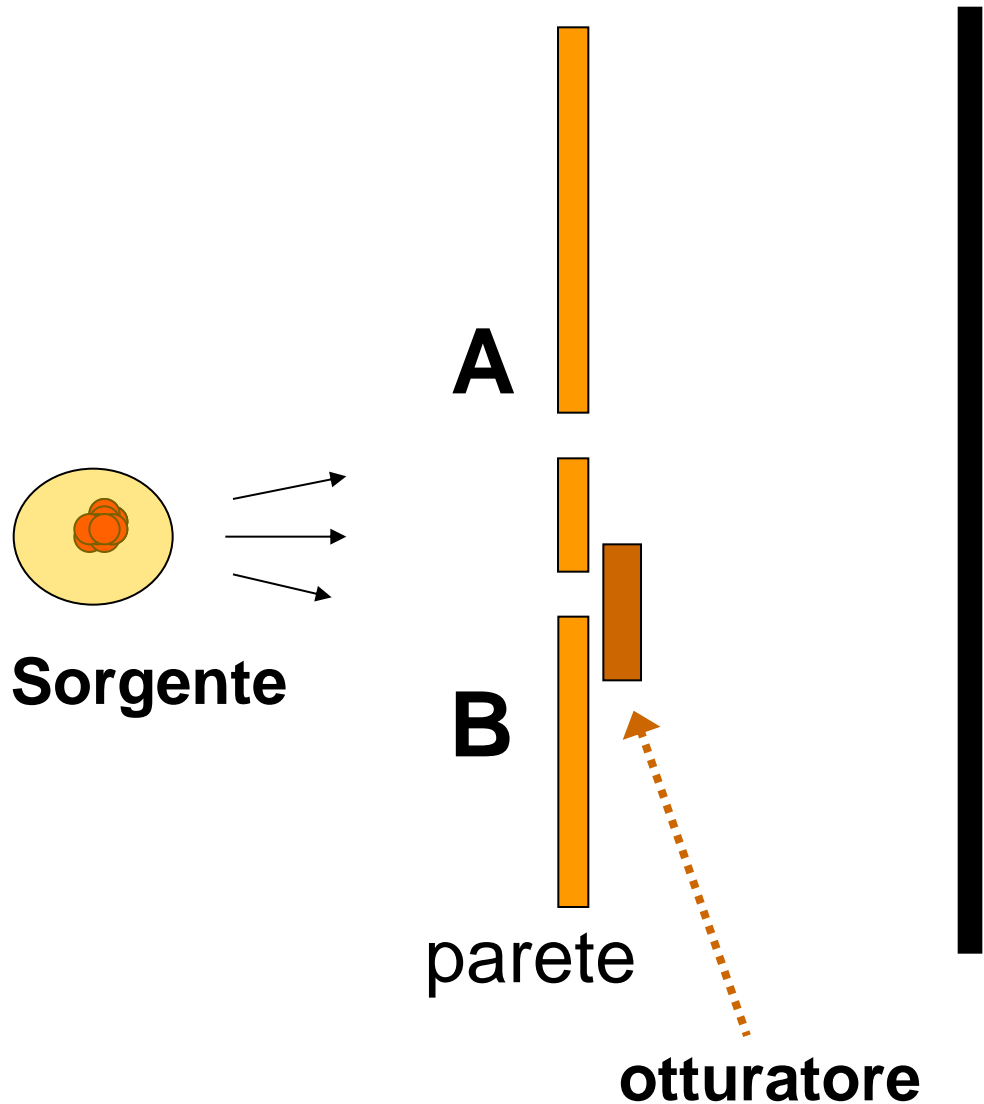


Conferenza di Solvay (1927)

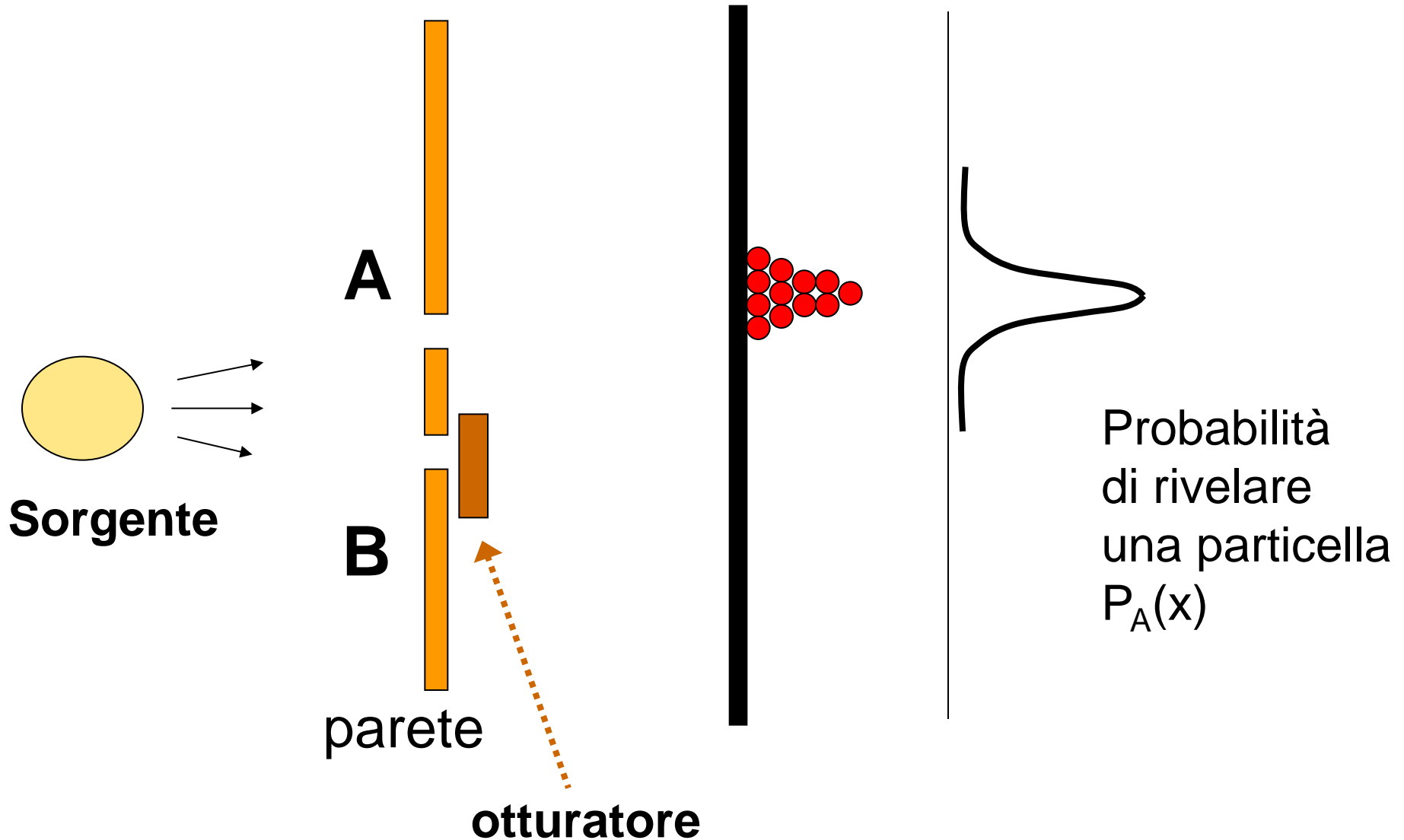
Single particle interference



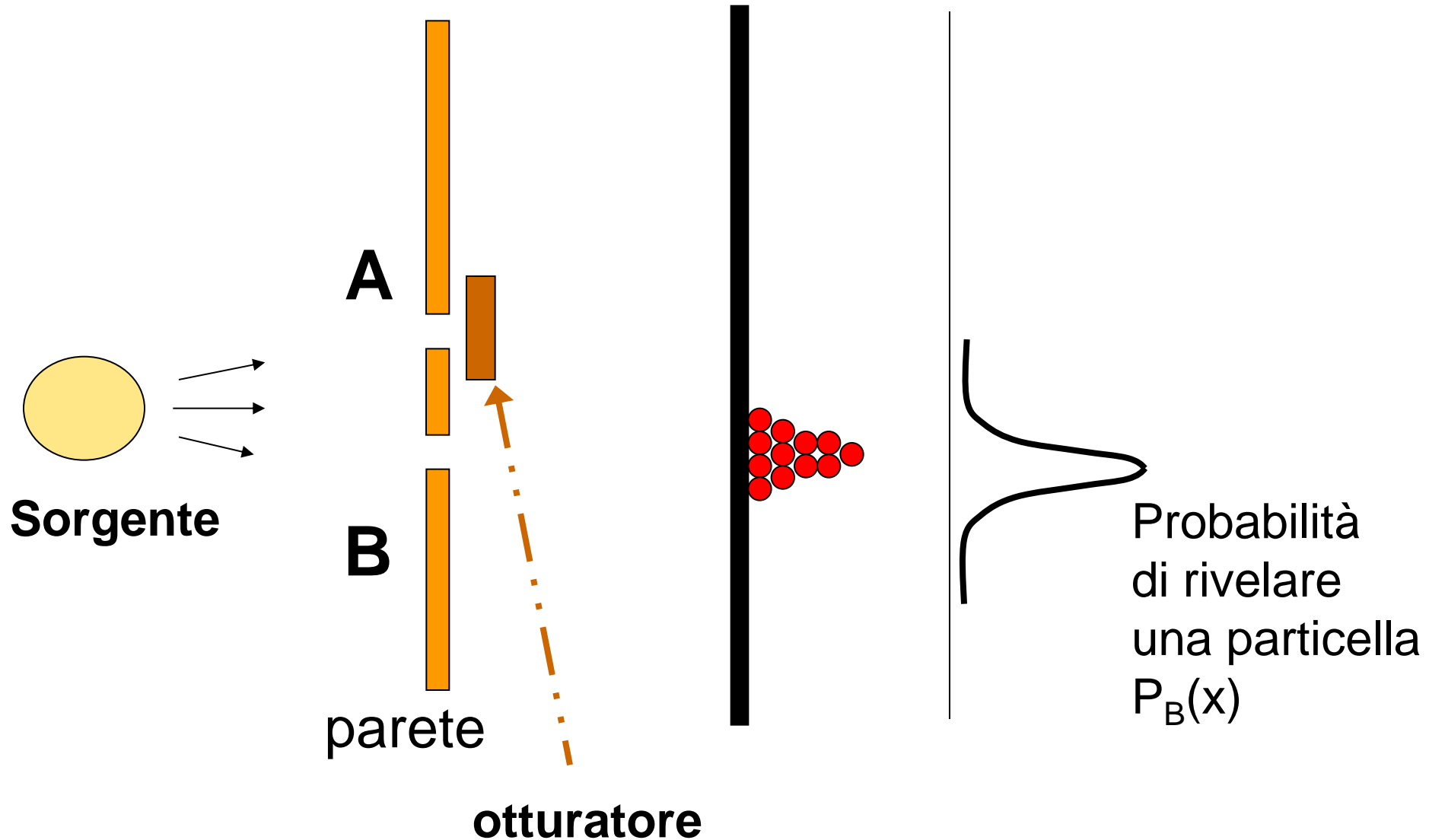
Single particle interference



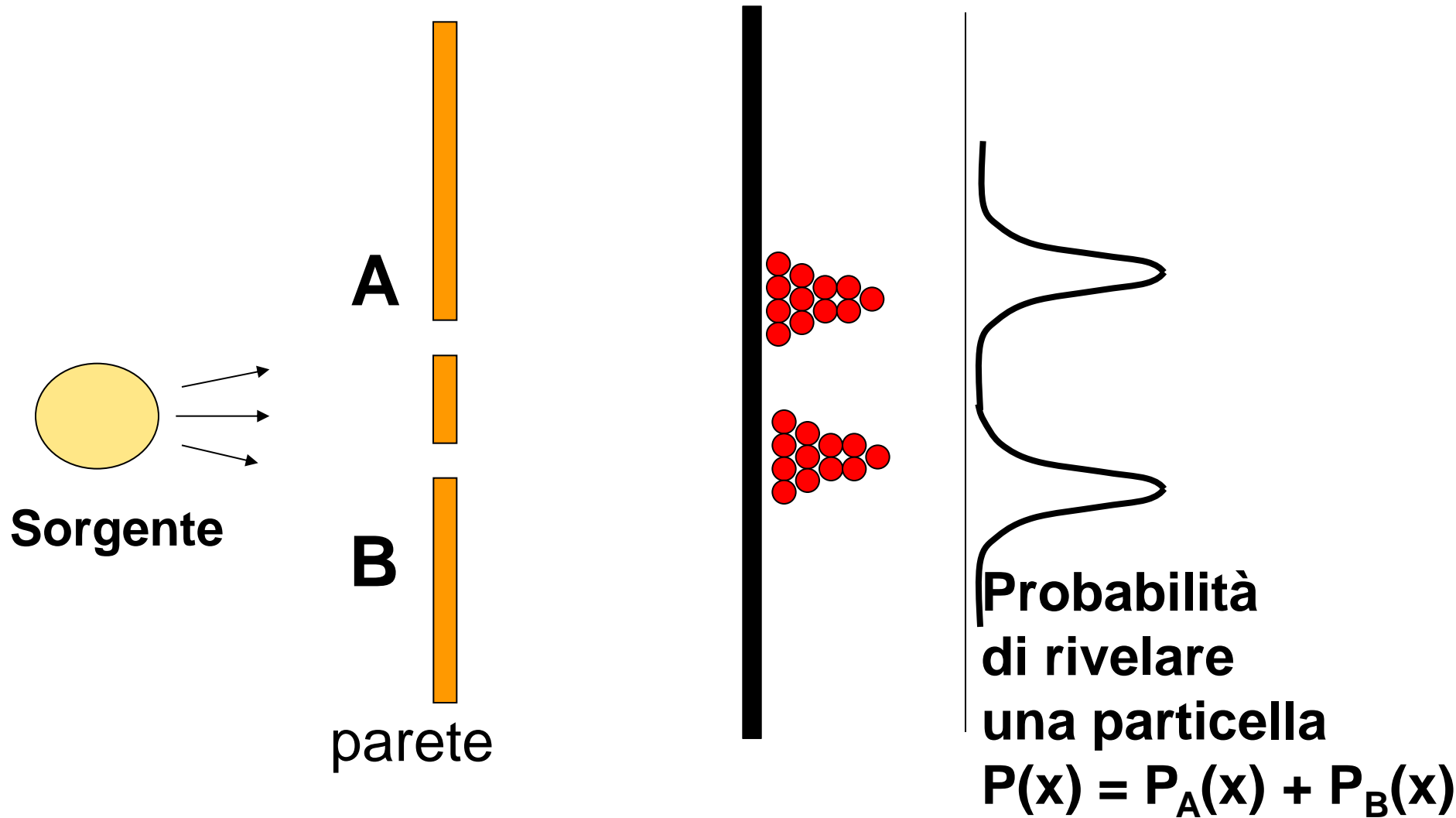
Single particle interference



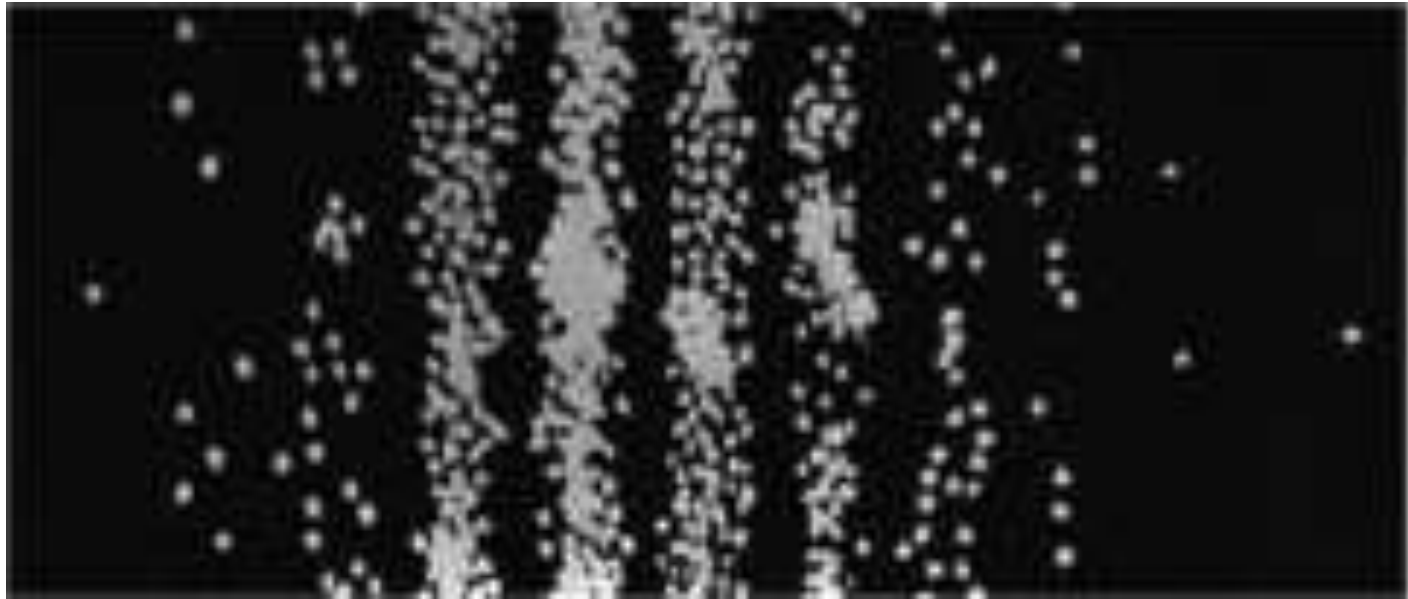
Single particle interference

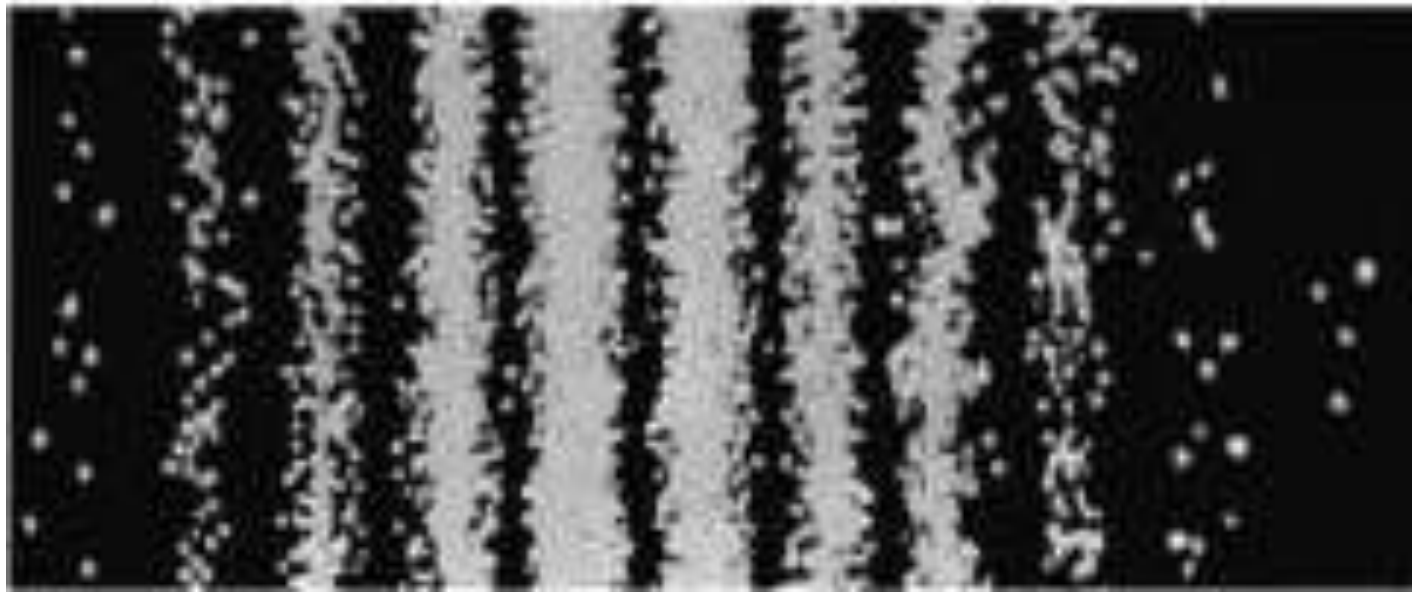


What happens when both “doors” are opened?

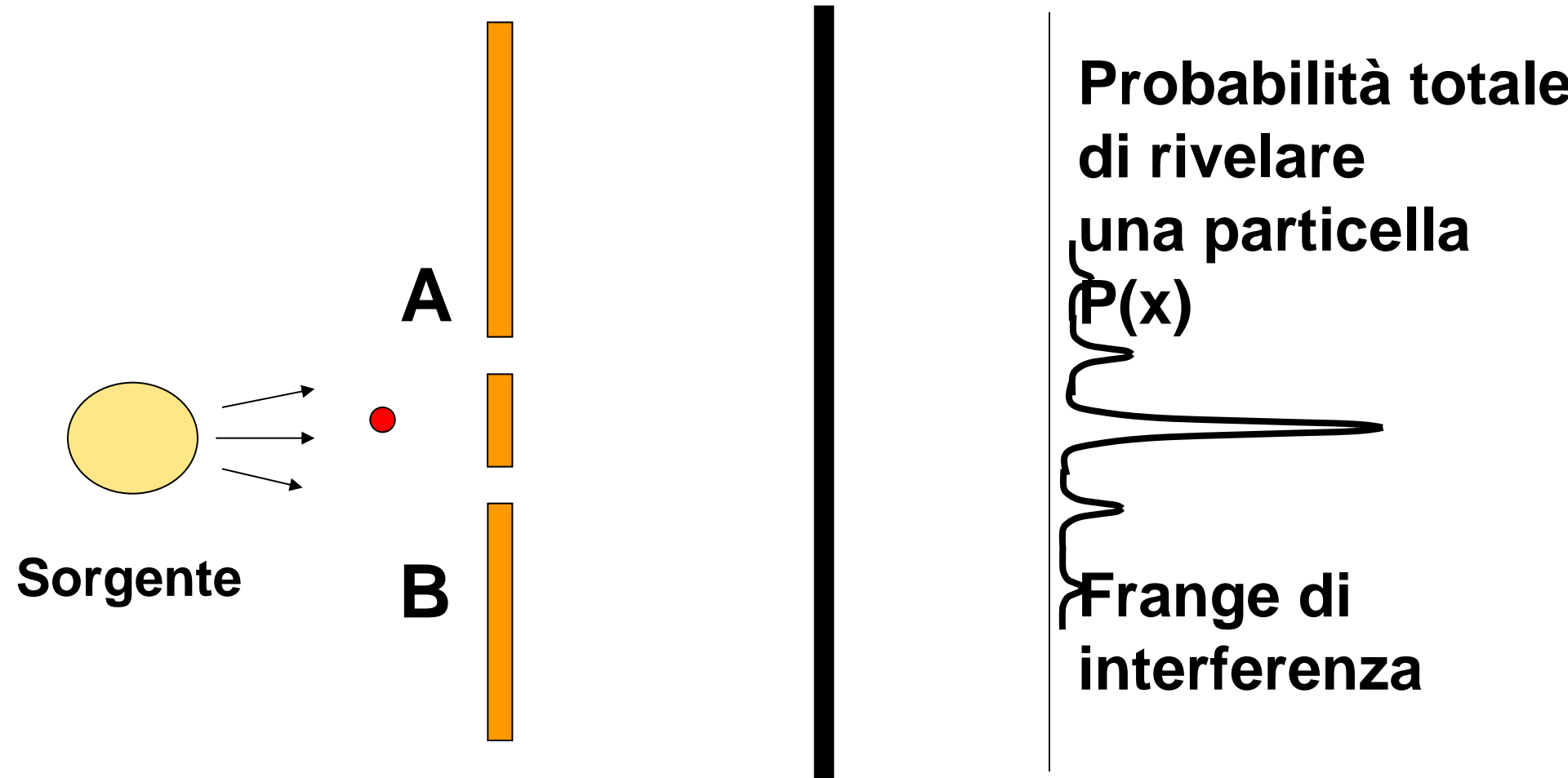




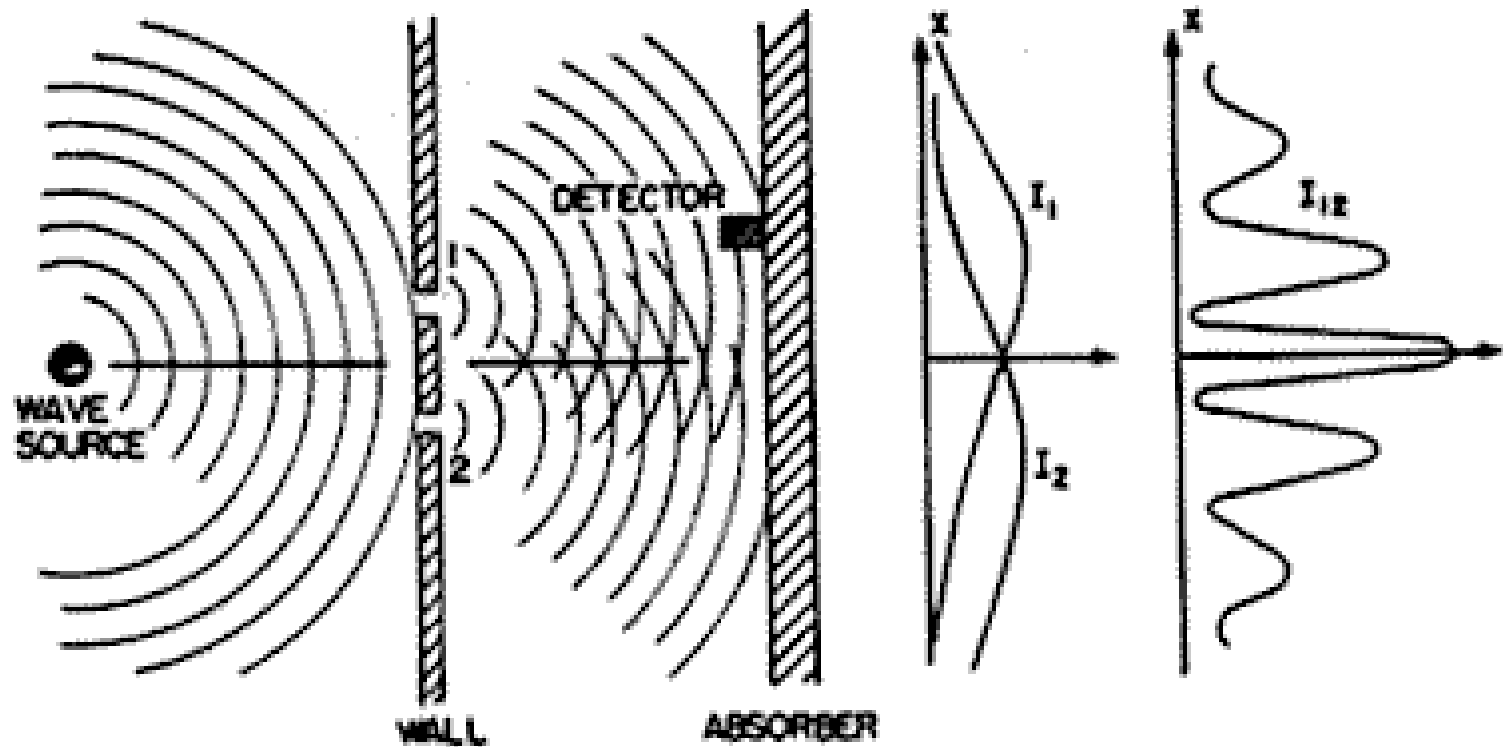


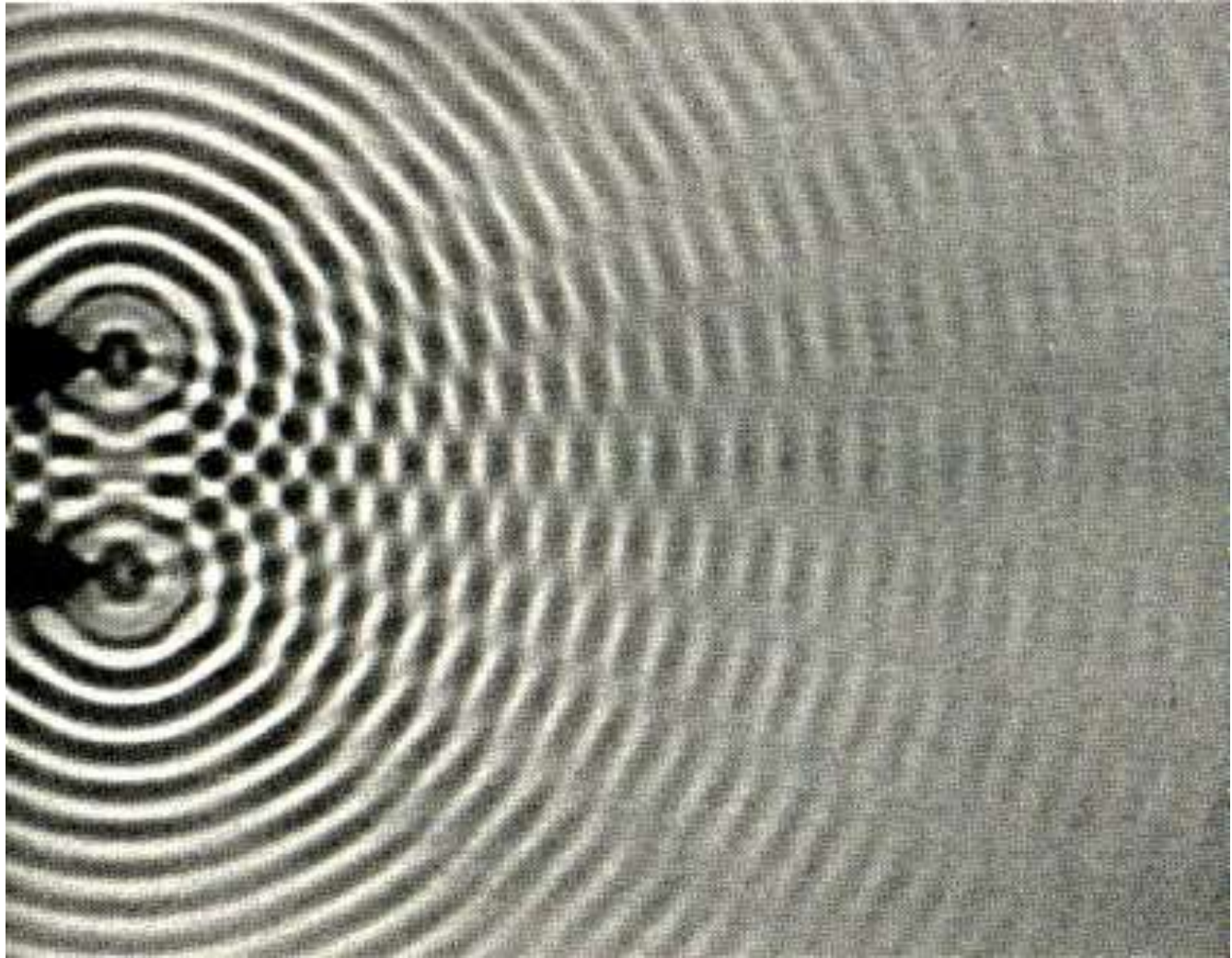


Quantum interference



The particle passes from BOTH doors!!





What is light?

Particle **AND** wave



Interference

***“...the heart of quantum mechanics.
In reality it contains the only mystery
...” R.P.Feynman (1965)***

Schrodinger's cat



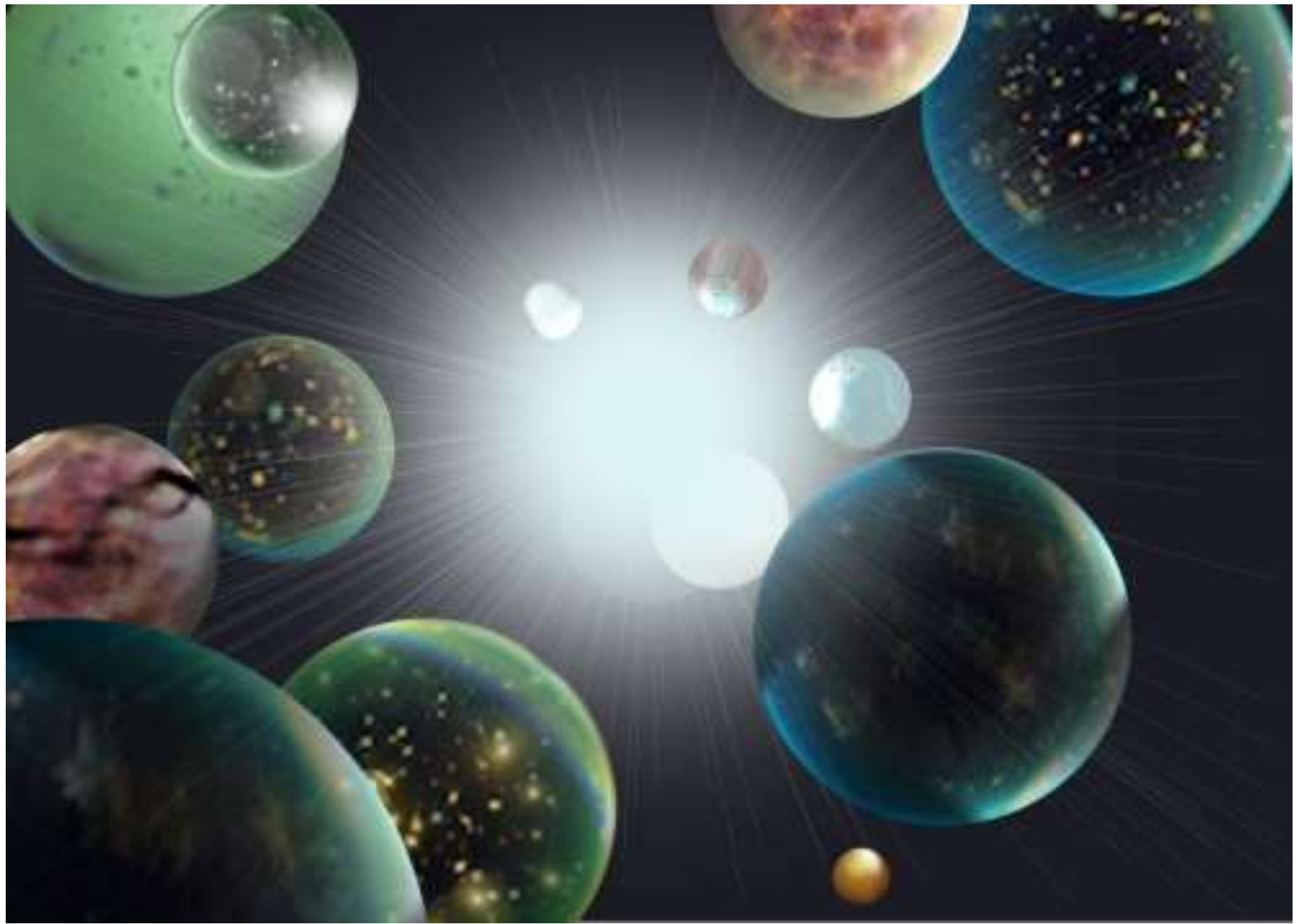


MQ50% dead & 50% alive

Tutta una serie di interpretazioni della meccanica quantistica:

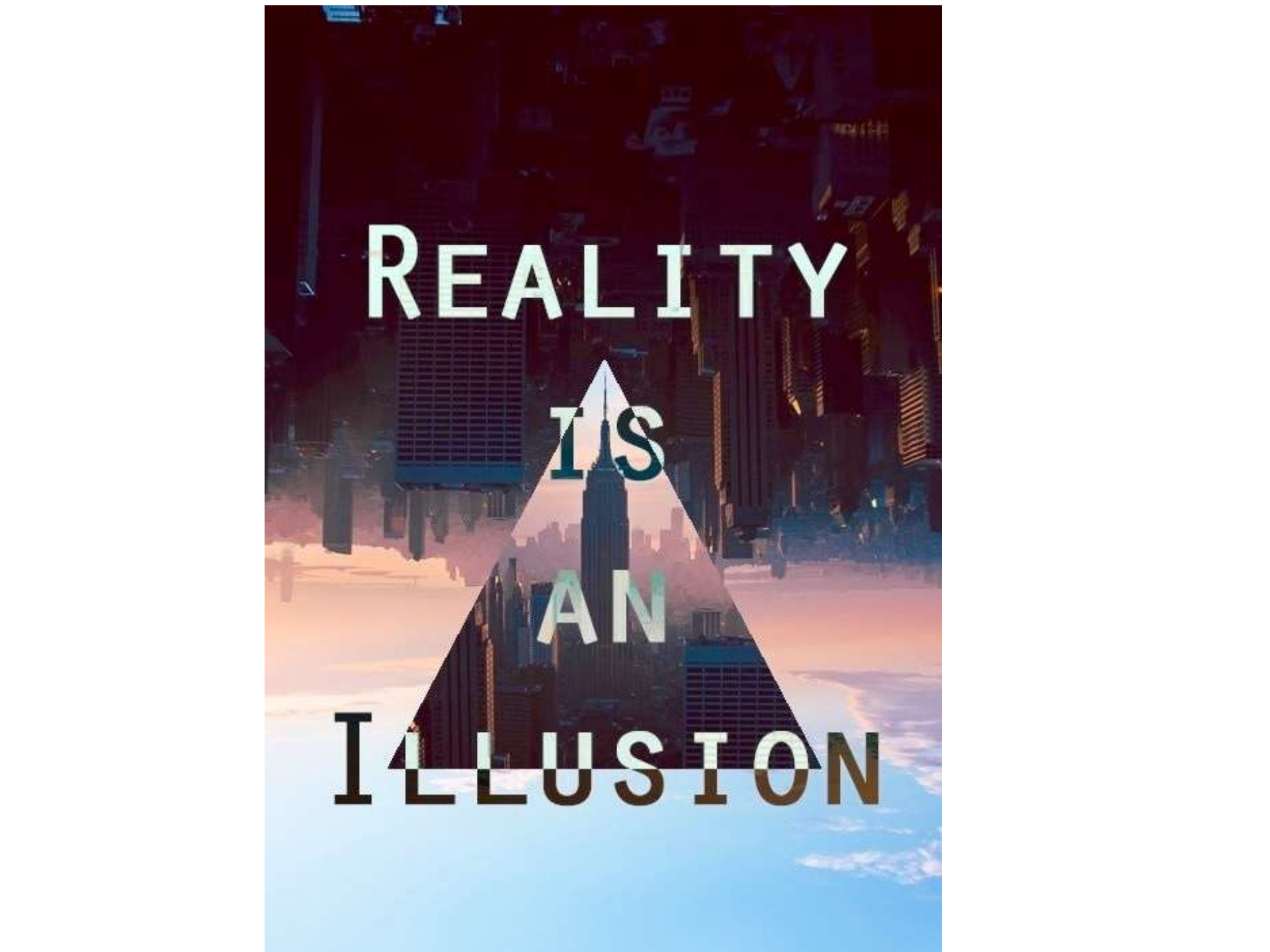
- De Broglie - Bohm
- Many-World Interpretations
- Collasso della funzione d'onda
-






NO Universe exists – ONLY A SIMULATION!




A vertical image featuring a cityscape at sunset. The sky transitions from a deep orange and red at the horizon to a clear blue at the top. In the center, a large, inverted triangle is superimposed over the scene. Inside this triangle, a prominent skyscraper, resembling the Empire State Building, is visible. The text "REALITY IS AN ILLUSION" is overlaid on the image in a bold, sans-serif font. "REALITY" is at the top, "IS" is inside the top of the triangle, "AN" is inside the middle of the triangle, and "ILLUSION" is at the bottom.

REALITY
IS
AN
ILLUSION

A bright, glowing sun or star is centered in the upper half of the image, surrounded by a soft, golden halo. The background is a dark, deep blue sky with wispy, light-colored clouds. The overall mood is contemplative and serene.

When I look up at the night sky, and I know that yes, we are part of this universe, we are in this universe, but perhaps more important than both of those facts, is that the universe is in us. When I reflect on that fact, I feel big.

A faint, dark image of Neil deGrasse Tyson is visible in the lower right corner of the image. He is wearing a dark suit and a white shirt, and his right hand is raised, pointing upwards. The image is very dark and blends into the background.

-Neil deGrasse Tyson

Armonia celeste: la teoria delle corde candidata alla “teoria del tutto”

10⁵⁰⁰ Universi

