INTERNATIONAL COSMIC DAY

INFN

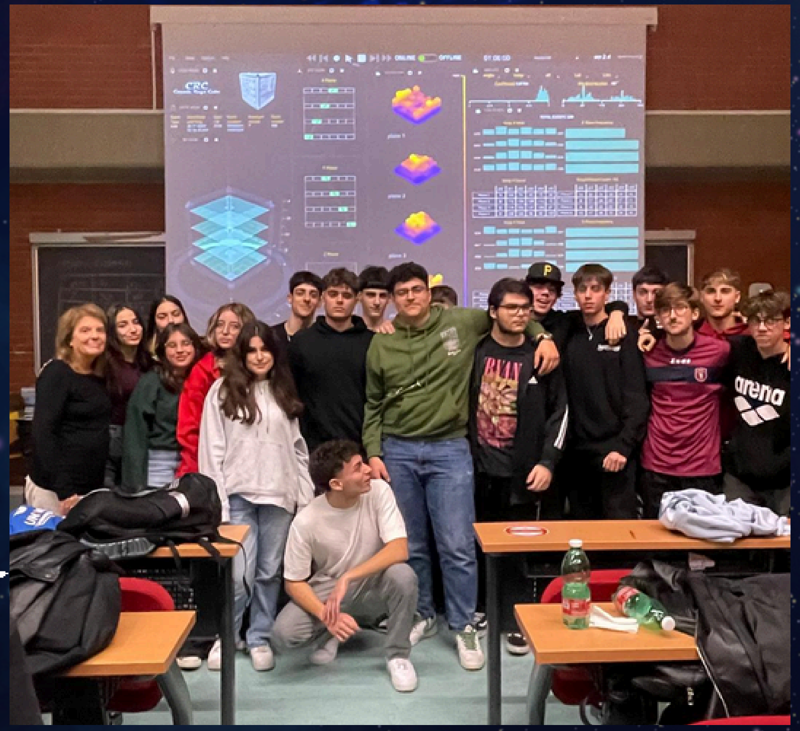
PHYSICS DEPARTEMENT OF FEDERICO II, NAPLES

NOVEMBER 26, 2024

PARTICIPATING SCHOOLS

LICEO TELESI@ DI TELESE TERME

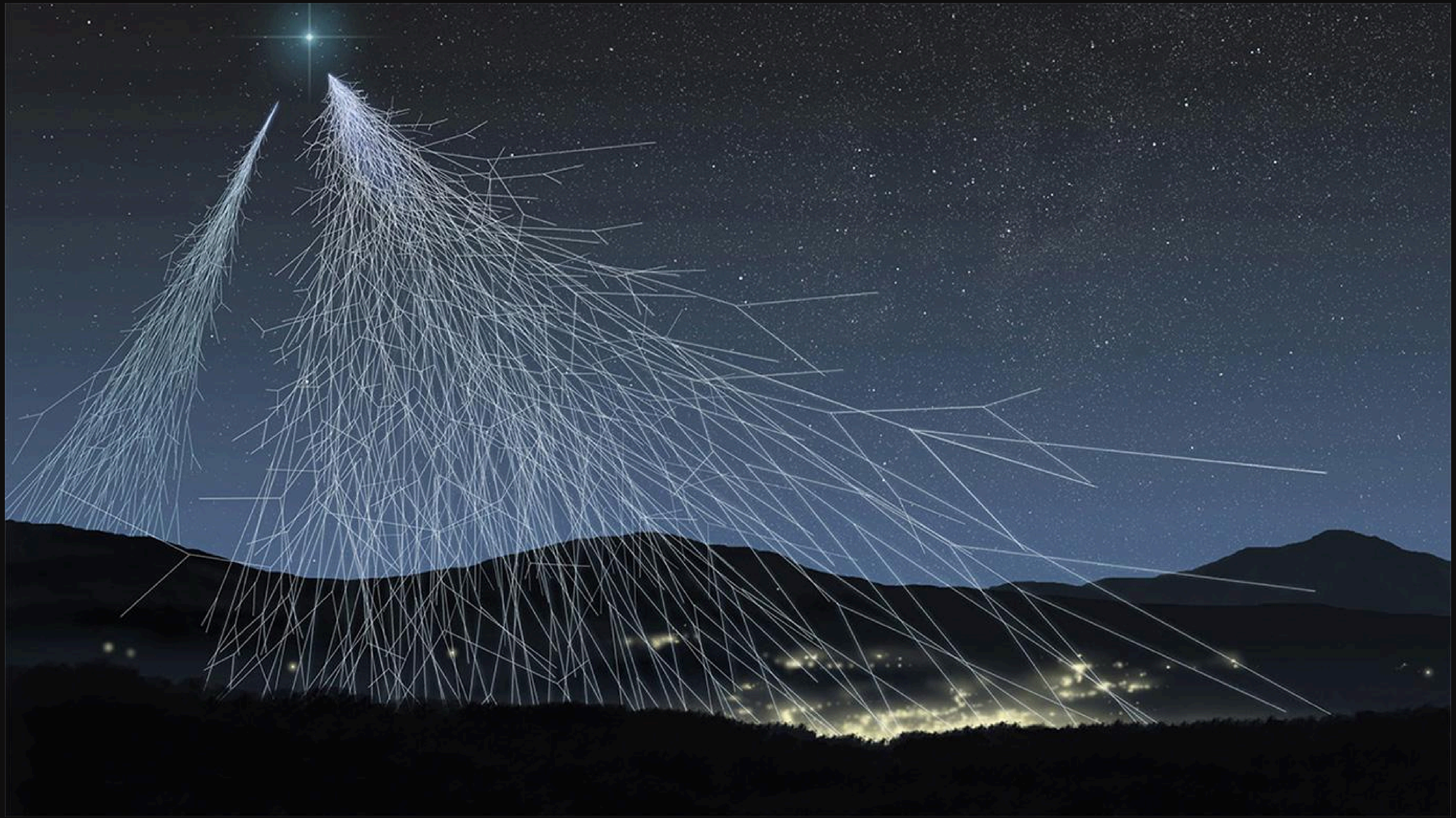
LICEO GALILEI DI NAPOLI



LICEO NOBEL DI TORRE DEL GRECO


INTERNATIONAL COSMIC DAY
La fisica dei raggi cosmici
Prof.ssa Laura Valore
Università di Napoli Federico II
INFN Sezione di Napoli
26 Novembre 2024
DESY.
INFN OCRA
In cooperation with
many networks and partners

WHAT ARE COSMIC RAYS?



Atomic nuclei produced in the cosmos that reach us on Earth

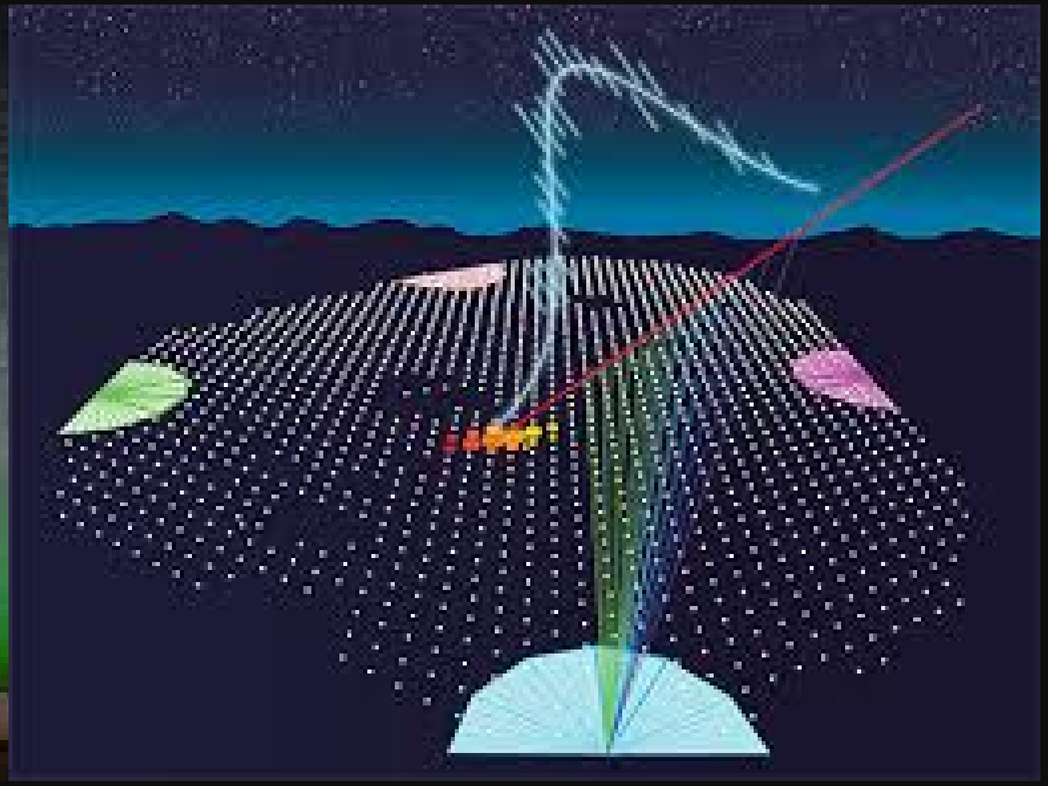
HOW DO WE DETECT AND STUDY COSMIC RAYS?

DIRECT MEASUREMENT

THE FERMI GAMMA-RAY
SPACE TELESCOPE

INDIRECT MEASUREMENT

PIERRE AUGER OBSERVATORY
ARGENTINA

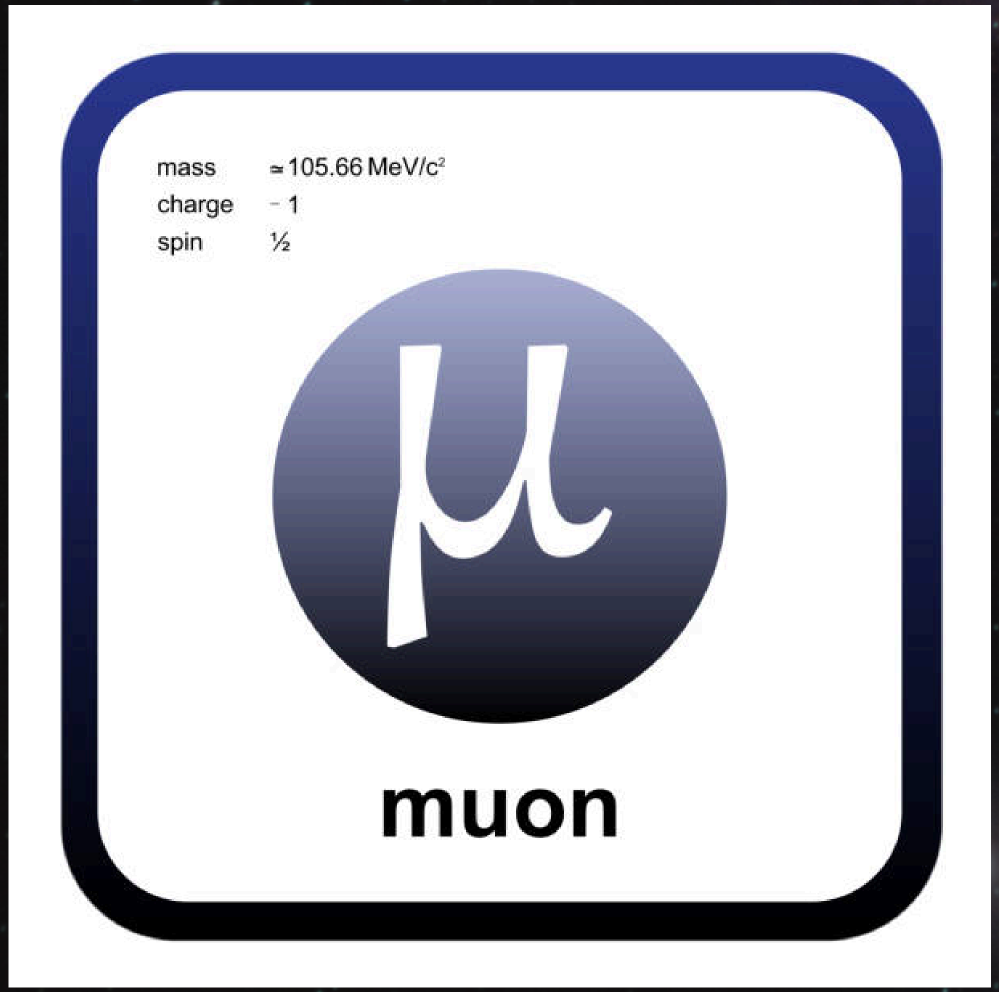


Direct measurement of cosmic rays involves capturing and analyzing high-energy particles using specialized detectors, such as cloud chambers or digital tracking systems. Indirect measurement relies on observing the secondary particles and radiation produced when cosmic rays interact with the Earth's atmosphere

MUONS

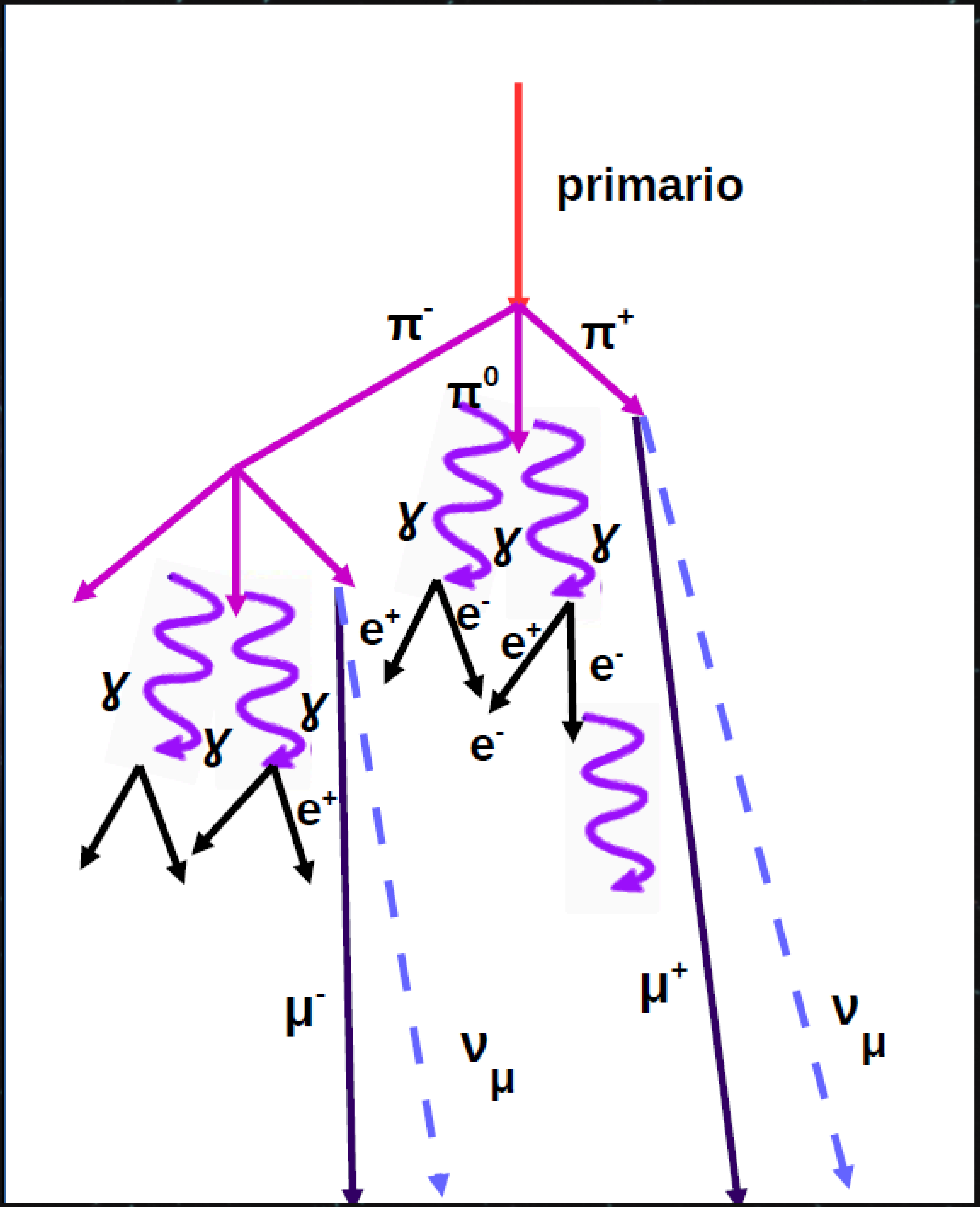
Muons are subatomic particles similar to electrons but with a bigger mass, approximately 200 times that of an electron.

They are classified as leptons and are unstable, decaying into other particles with a relatively short lifetime, about 2,2 microseconds.



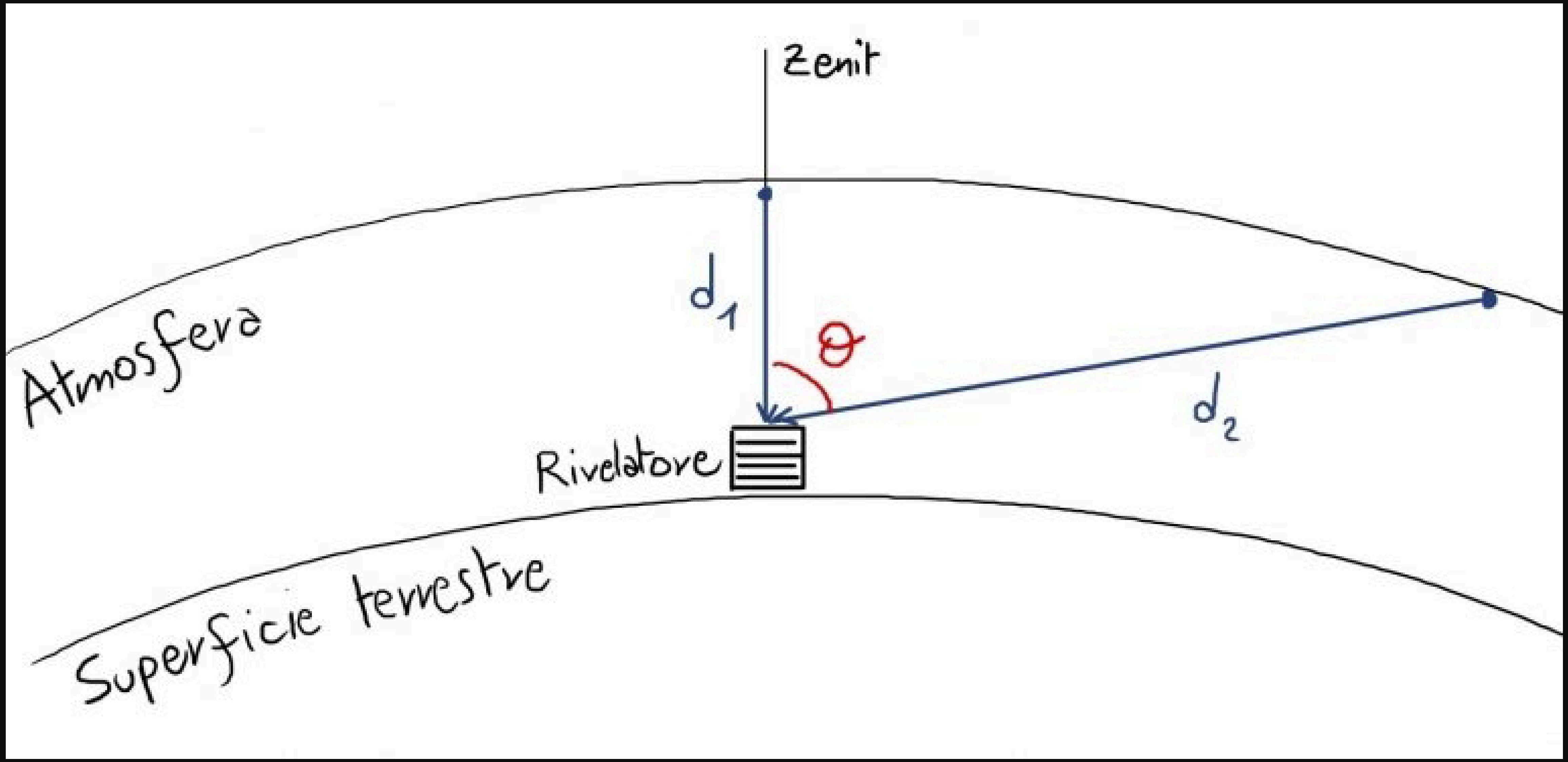
Muons penetrate any matter, better than any other known particles, except neutrinos.

When subatomic particles like protons enter the Earth's atmosphere, they create a secondary shower of particles, including MUONS that make up a large portion of the background radiation present on the Earth's surface.



"MUON'S FLUX DEPENDS ON THE ZENITH ANGLE."

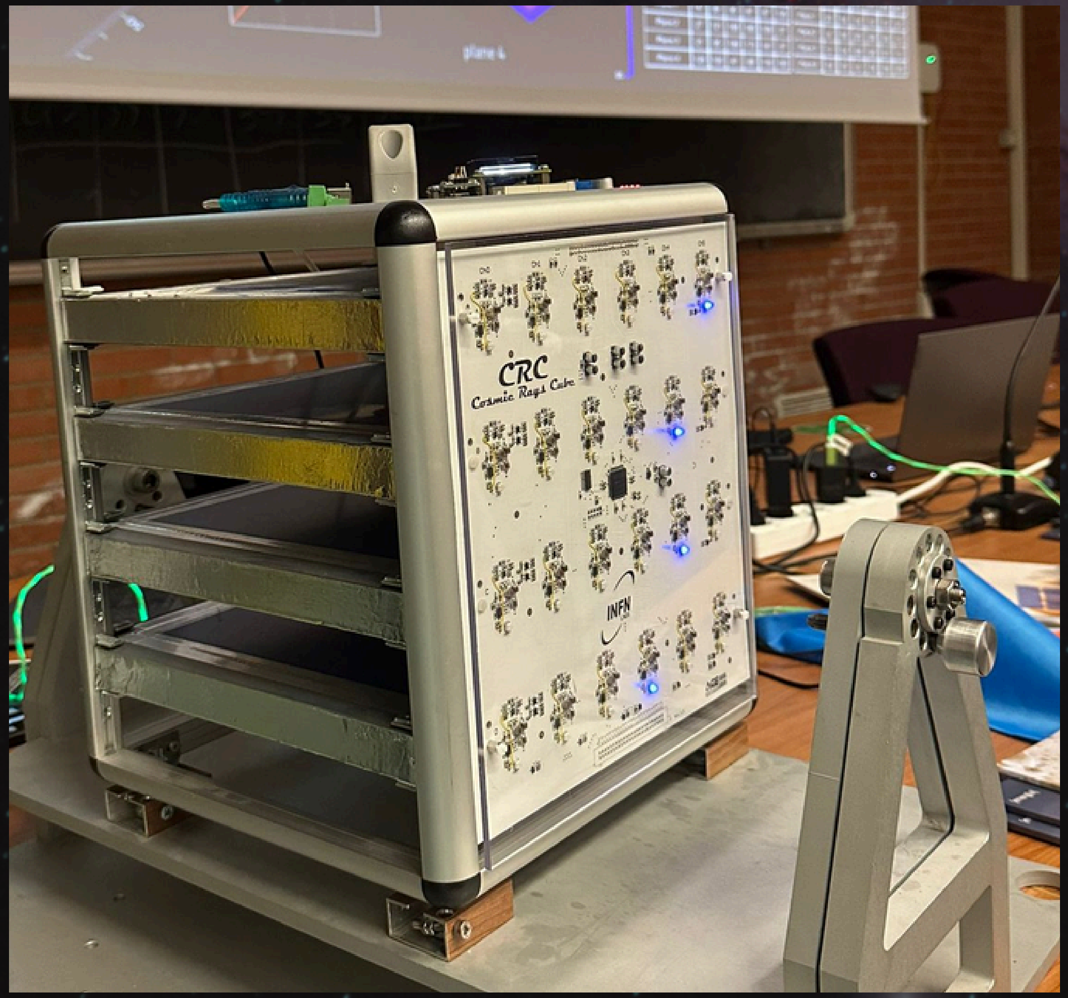
Muons that arrive perpendicular to the Earth's surface (arriving along the direction of the local zenith), travel the shortest distance in the atmosphere, while, for high angles of incidence, with respect to the zenith, the distance to travel is longer.

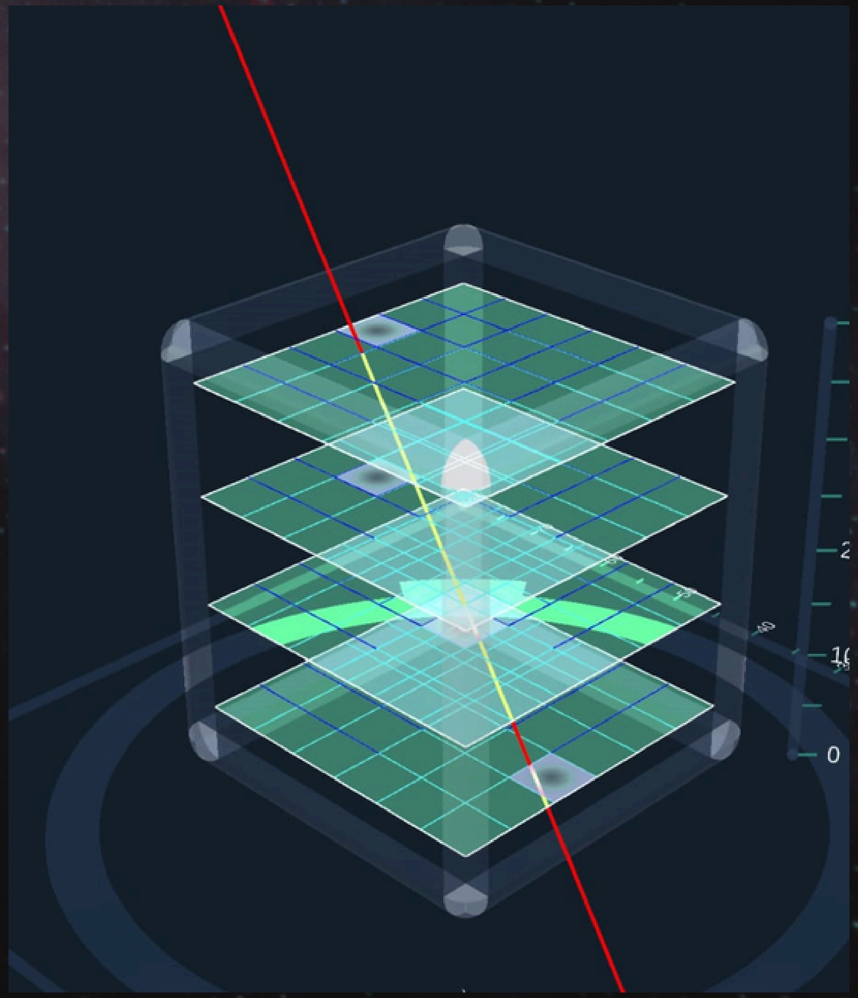


The greater the theta angle, the greater the distance traveled, and consequently, greater is the probability that the muons decay before reaching the Earth's surface, and the flux is lower.

COSMIC RAYS CUBE

The Cosmic Ray Cube (CRC) is a portable device that detects muons.
It measures particle flow and angles at different altitudes.
It consists in four modules with two layers of scintillator bars arranged at right angles and has LEDs to show when particles pass through.





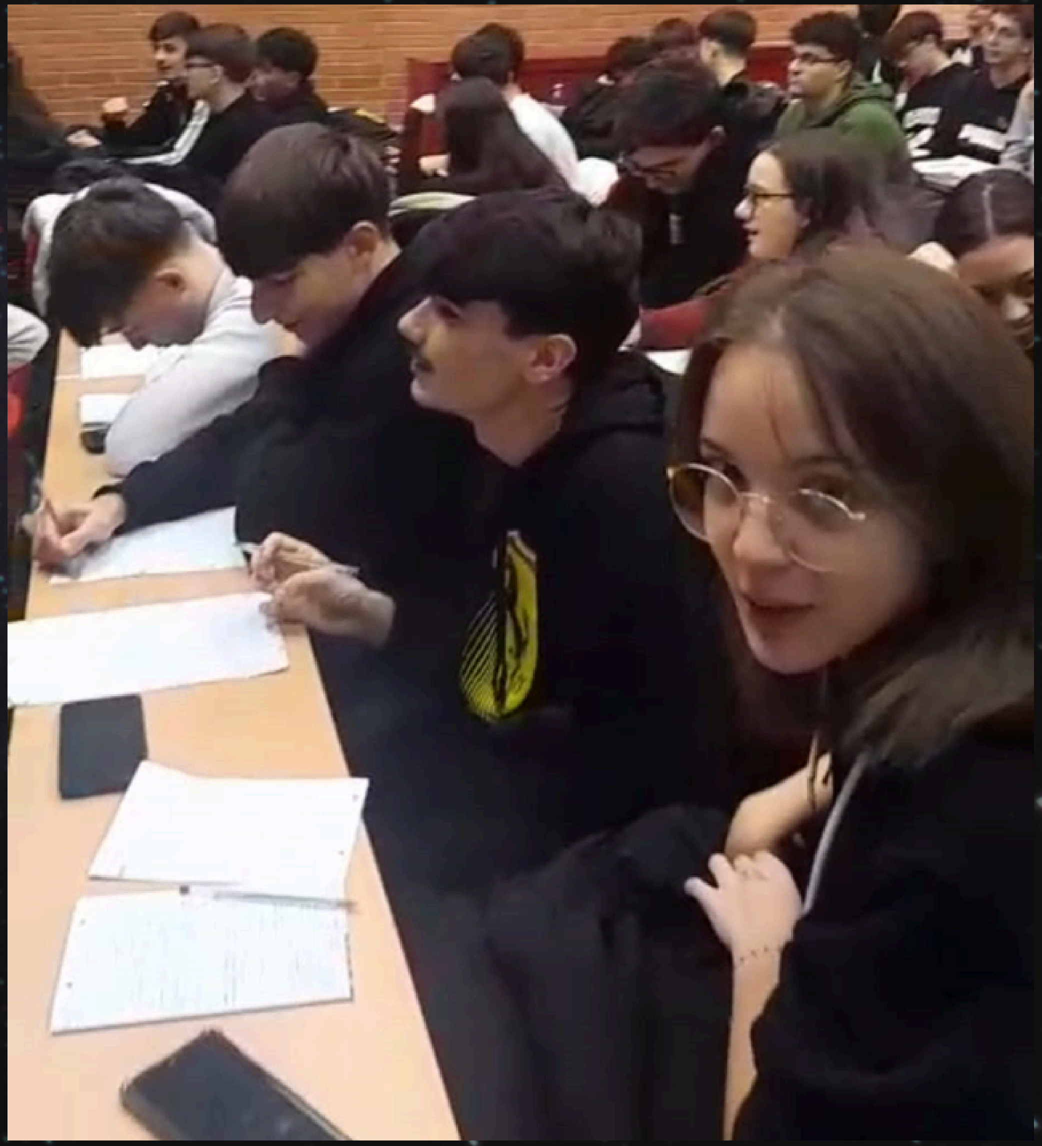
THE EXPERIMENT BEGINS

Each group of students counted the number of muons per minute, then reapeated the mesurements for different angles.

EXPERIMENTAL DATA

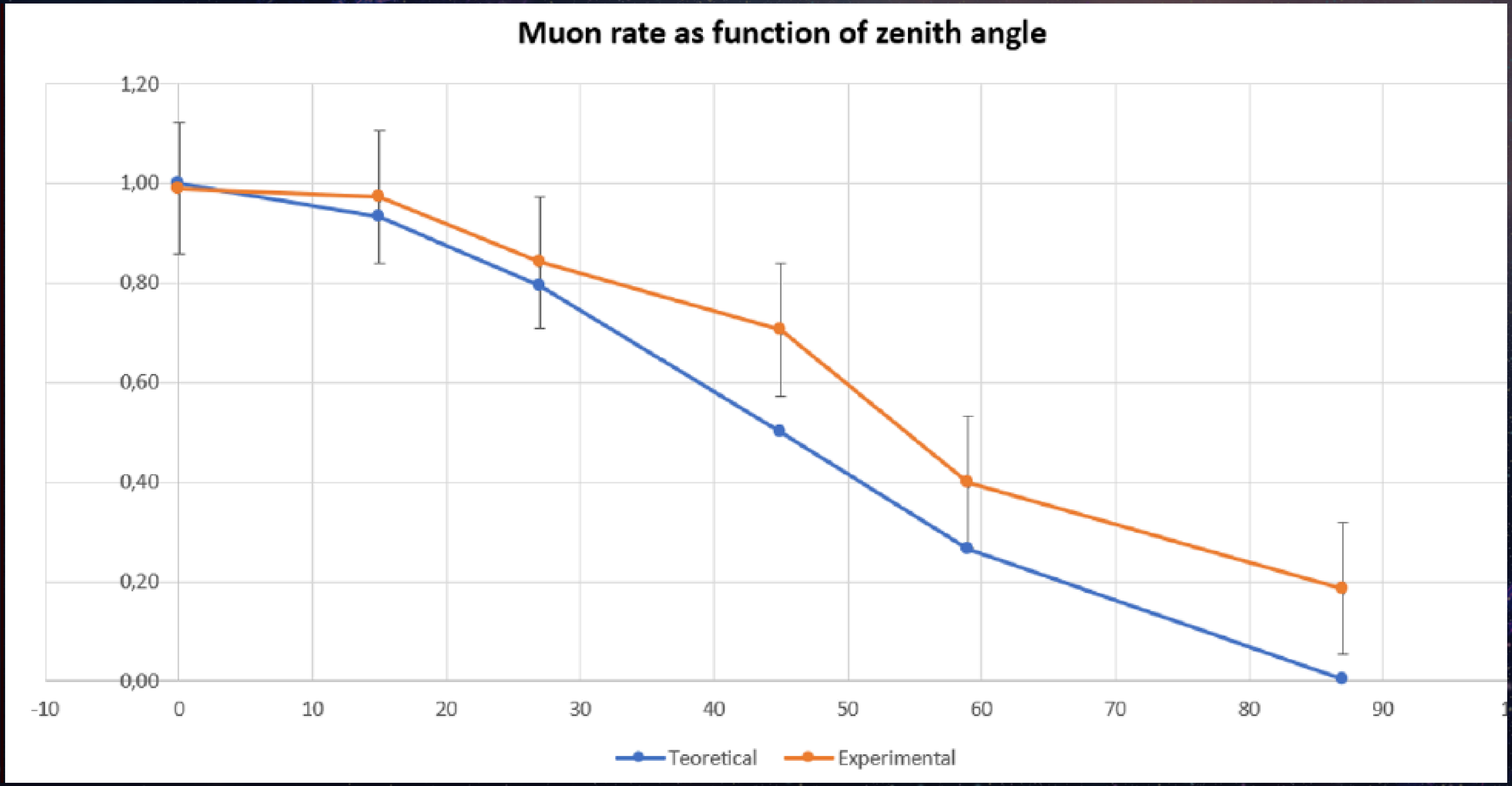
ZENITH ANGLE	MEASUREMENT		
θ (°)	R1	R2	R3
0	50	48	49
15	48	48	47
27	39	38	50
45	39	39	34
59	19	19	19
87	10	10	8
θ (°)	R4	R5	R6
0	51		
15	48	49	52
27	50	39	39
45	34	32	34
59	19	22	22
87	8		

... EXAMINING EXPERIMENTAL DATA ...



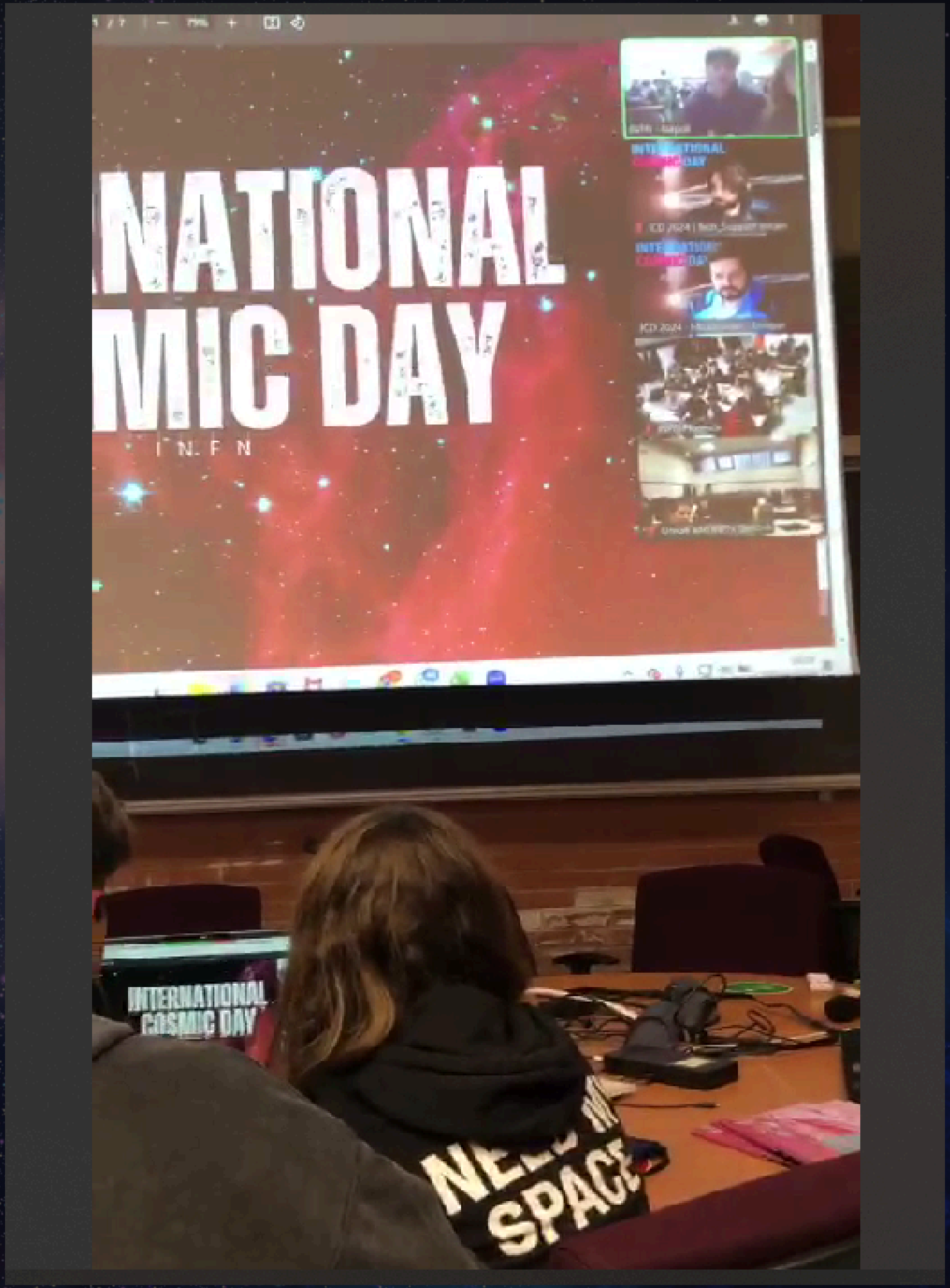
DATA ANALYSIS

As expected, the number of muons per minute decreases, changing the zenith angle according to the **cos** $^2\theta$ law.



θ (°)	Teoratical	Sperimental
0	1,00	0,99
15	0,93	0,97
27	0,79	0,85
45	0,50	0,71
59	0,27	0,4
87	0,00	0,18

SHARING THE RESULTS




CRC
ONLINE
OFFLINE
01:00:00

THANK YOU FOR YOUR ATTENTION

IV S1 AND IV S2 FROM LICEO SCIENTIFICO TELESI@ OF TELESE TERME