

Discover Cosmic Rays

INTERNATIONAL COSMIC DAY

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22 novembre 2022

International Cosmic Day

Discover Cosmic Rays

INTERNATIONAL COSMIC DAY

HOME ABOUT ACTIVITIES MAP REGISTRATION MEDIA Find us on ORGANISATION

Welcome

The 11th International Cosmic Day takes place on **November 22, 2022**.

International Cosmic Day (ICD) is dedicated to cosmic rays, which constantly surround us but always go unnoticed. So let's spend a day exploring the world of cosmic rays and discovering what secrets they hold.

On this day, students, teachers and scientists around the world will come together to talk and learn about cosmic rays. Questions that can be discussed are:

- What are cosmic particles?
- Where do they come from?
- How can they be measured and what can we learn from them?

Curious about what the ICD is all about? Watch this video about the ICD's 10th anniversary!

Discover Cosmic Rays

INTERNATIONAL COSMIC DAY

November 22 | 2022
09:00 - 13:00

Cosmic particles, these unnoticed particles that surround us all the time, are the focus of this day. Students, teachers and scientists get together to talk and learn about Cosmic Rays and answer questions like:

What are cosmic particles?
Where do they come from?
How can they be measured?
And what can we learn from them?

Become a Scientist for a Day
Discover the world of cosmic rays like an astroparticle physicist.

Organizers: P. Bernardini, E. Casali, G. Cataldi, G. Chiarello, M. Conicella, M. Corvino, F. de Palma, E. De Vito, R. Della Torre, U. Giacari, D. Marilino, Y. Maruoka, A. Nucle, L. Perone, C. Pinto, V. Schenno, A. Serio

More information and registration:
<https://icd.desy.de>
<https://agenda.infn.it/event/15164/>

www.maffis.unisalento.it
www.le.infn.it

In cooperation with many networks and partners

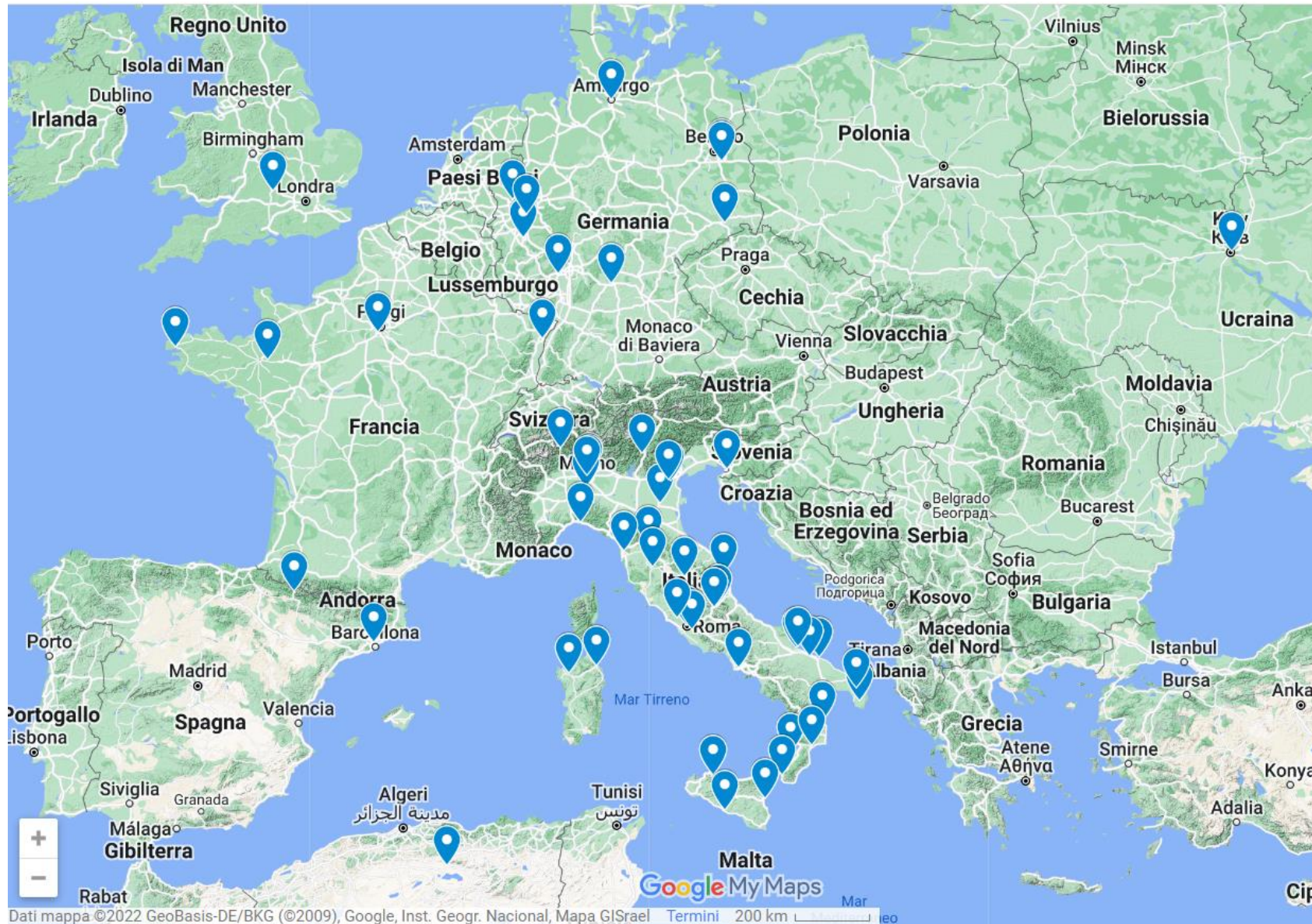
- Progetto internazionale per gli Istituti Superiori organizzato da DESY Accelerator Laboratory (Amburgo), FERMI National Laboratory (Chicago) e CERN (Ginevra)
- Gli studenti entrano in contatto con le attività di ricerca:
 - Portano a termine un piccolo esperimento sui raggi cosmici
 - Analizzano i dati
 - Confrontano i propri risultati con gli altri gruppi collegati da altre università o centri di ricerca nel mondo
 - Lavorano per un giorno come in una collaborazione internazionale

<https://icd.desy.de/>

Mappa ICD 2022



Mappa ICD 2022 - Europa



ICD 2022 @ INFN Lecce

- **Seminario Prof. Paolo Bernardini**
- **Introduzione al Rivelatore Matteo Conte**
- **ICD**
- **Presi dati e analisi dati Francesco de Palma e Elisabetta Casilli**
- **Stage OCRA Eufemia Fantastico (Liceo Capece)**
- **Visita Control Room di Auger Ugo Giaccari**
- **Visita Planetario Achille Nucita e Ylenia Maruccia**
- **Le visite al Planetario e alla Control Room dureranno 20 min circa a partire dalle 11.00**
- **I gruppi appartenenti alla stessa scuola verranno divisi in due in modo che chi rimane possa poi spiegare l'analisi dei dati a chi è in giro per le visite.**
- **Collegamenti esterni**
- **Collegamento zoom con Desy ore 14.00**

Questionario Studenti



Pubblicazione sui social

#InternationalCosmicDay

#ocrainfn

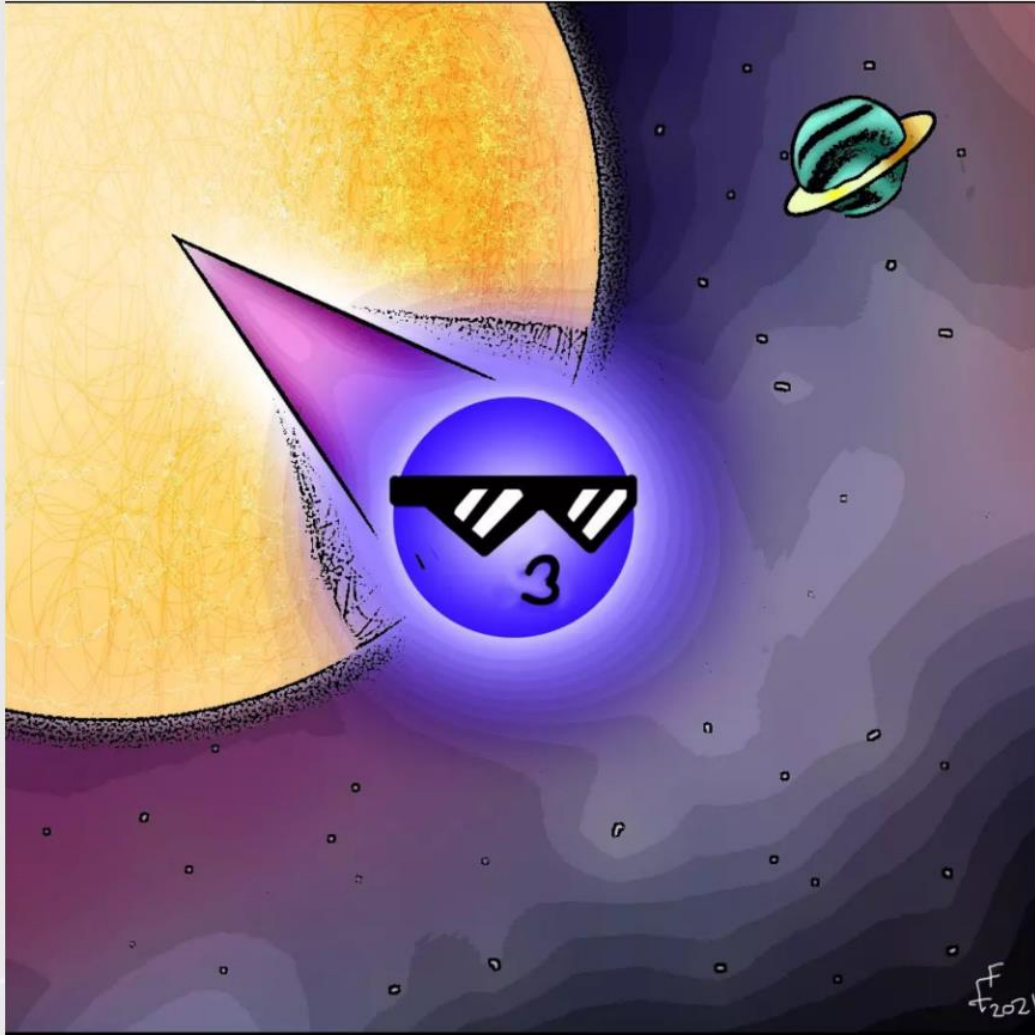
#INFNLecce

In between, get creative with one of our contests and take part in a Kahoot! quiz:

DRAWING CONTEST

Draw your favorite cosmic particle. Post it on Facebook or Instagram and use the hashtag #InternationalCosmicDay. The best one will get a prize!

2021 Farbod from Iran created this picture and won:



SELFIE CONTEST

Take a selfie of you with your detector or your favorite Cosmic Ray plot. Post it on Facebook or Instagram and use the hashtag #InternationalCosmicDay. The best one will get a prize!

For inspiration, the winning photo of 2019, a group from INFN Gran Sasso:



Pagina per Pubblicazione su Booklet



Who are you?

What have you done?

What did you find out?

What's your take-home message?

International Cosmic Day 2020
Leonardo da Vinci - Maglie - Italy

Abstract International Cosmic Day is a great opportunity for students like us to approach to the particle physics world with real time measurements of the cosmic rays flux. These measurements, performed with CoSiAM setup developed at INFN Lecce laboratory, have been carried out together with scientists who also guided us in the analysis of the collected data and the discussion of the results. The main goal has been to verify the cosmic ray flux dependence on the zenith angle. In this poster, after a brief introduction to the history of the discovery of cosmic rays, we focused on the experimental setup description and on the measurements performed with the latter. The obtained results are then succinctly discussed.

Cosmic Rays Cosmic rays are high energy particles that come from outer space and reach the planet Earth. They originate from the Sun, but most of the cosmic rays are produced by supernovae and other high energy astrophysical processes. Cosmic rays are composed of about 90% protons, 9% alpha particles, and 1% heavy nuclei. They are also composed of electrons, positrons, and neutrinos. Cosmic rays are ionizing radiation and can be harmful to living organisms. They are also a source of background noise for many scientific experiments.

Analysis The cosmic ray flux is measured as a function of the zenith angle. The zenith angle is the angle between the direction of the cosmic ray and the vertical direction. The flux is measured in units of particles per square meter per second per steradian. The flux is expected to decrease as the zenith angle increases. This is because the cosmic rays have to travel a longer path through the atmosphere before reaching the Earth's surface. The flux is also expected to increase as the atmospheric pressure decreases. This is because the cosmic rays are less attenuated in the thinner atmosphere. The flux is measured using a detector that consists of a silicon detector and a scintillator detector. The silicon detector is used to measure the energy of the cosmic ray and the scintillator detector is used to measure the direction of the cosmic ray. The data is analyzed using a software package that calculates the flux as a function of the zenith angle.

Experimental Setup The CoSiAM setup consists of a silicon detector and a scintillator detector. The silicon detector is a 30x30 cm² silicon strip detector. The scintillator detector is a 30x30 cm² plastic scintillator detector. The silicon detector is connected to a readout electronics and the scintillator detector is connected to a photomultiplier tube. The readout electronics is connected to a computer that records the data. The CoSiAM setup is used to measure the cosmic ray flux as a function of the zenith angle. The zenith angle is measured using a goniometer. The CoSiAM setup is also used to measure the cosmic ray energy spectrum. The energy spectrum is measured by measuring the energy deposited in the silicon detector. The energy spectrum is also used to identify the different components of the cosmic ray flux.

Conclusions In this poster we presented a measurement of the cosmic ray flux as a function of the zenith angle. The flux was measured using the CoSiAM setup. The flux was found to decrease as the zenith angle increases. This is in agreement with the expected behavior of the cosmic ray flux. The flux was also found to increase as the atmospheric pressure decreases. This is also in agreement with the expected behavior of the cosmic ray flux. The CoSiAM setup is a simple and effective way to measure the cosmic ray flux. It can be used in schools and universities to perform experiments in particle physics.

Acknowledgements We are grateful to the organizers of the International Cosmic Day 2020 for providing us with the opportunity to participate in this event. We also thank the INFN Lecce laboratory for providing us with the CoSiAM setup. We are also grateful to the staff of the INFN Lecce laboratory for their kind hospitality.

INTERNATIONAL COSMIC DAY NOVEMBER 4 | 2020

INTERNATIONAL COSMIC DAY
Liceo "Galileo Ferraris", Taranto

Abstract Cosmic Rays, discovered by Hess in 1912, are charged particles and atoms nuclei that hit the Earth every day (with almost uniform way). They are high-energy particles originating from astrophysical objects, both galactic and extragalactic, through extremely violent processes, like the explosion of a star in a supernova or like the collisions of galaxies. When a cosmic ray enters the terrestrial atmosphere, it interacts with its nuclei. In these collisions are produced new particles that in turn interact or decay creating new others. The result is a kind of shower of particles called "Extensive Air Shower". The most energetic secondary particles can reach Earth's surface: they are very abundant in nature (about 300 particles/cm²) and they make up about 20% of natural radioactivity.

Experimental setup We used a device called CoSiAM (Cosmic Ray Mission). CoSiAM is composed by four layers of scintillation detectors capable of emitting pulses of light during the passage of a particle. The pulses of light are converted into electrical signals by two photo-detectors. The scintillators are alternated to sheets of iron, called absorber, used to select the most penetrating particles, usually muons. The device records the signals of the scintillators at regular intervals of time, and shows the rate of single double, triple and quadruple coincidences coming respectively from only one layer or two, three and four adjacent layers. The rate is the ratio of the number of cosmic ray incidents in the detector in a time interval Δt and $\Delta \Omega$. The device measures the rate of cosmic rays that pass through the detector in function of the zenith angle. We changed the measurement angle, from 0° to 90° rotating the detector every thirty minutes. The distribution of coincidences is shown through a graphic interface in the form of histograms. We reported the rate of double, triple and quadruple coincidences in a table, we divided the arithmetic averages by 3 to have the rate of counts in Hz and we represented the data in a graph to show the relationship between the rate of cosmic rays and the zenith angle. Finally through another graph we saw how the rate of counts in Hz changes in function of $\cos^2 \theta$.

Analysis The cosmic ray flux is measured as a function of the zenith angle. The zenith angle is the angle between the direction of the cosmic ray and the vertical direction. The flux is measured in units of particles per square meter per second per steradian. The flux is expected to decrease as the zenith angle increases. This is because the cosmic rays have to travel a longer path through the atmosphere before reaching the Earth's surface. The flux is also expected to increase as the atmospheric pressure decreases. This is because the cosmic rays are less attenuated in the thinner atmosphere. The flux is measured using a detector that consists of a silicon detector and a scintillator detector. The silicon detector is used to measure the energy of the cosmic ray and the scintillator detector is used to measure the direction of the cosmic ray. The data is analyzed using a software package that calculates the flux as a function of the zenith angle.

Participants Student: Giulia Compagnone, Cristiano Cervero, Aurora De Donno, Cristiano De Pasquale, Sara Marchionni, Iuli Vassilova, Greta Papaneri, Sara Pomas, Davide Santo, Denise Sgrignola, Teacher: Salvatore Spinelli.

Conclusion Observing the first graph, it is possible to notice that the cosmic ray flux decreases as the zenith angle increases. The flux is maximum when the angle measures 0° and the direction of particles is perpendicular to the Earth's surface. While the flux is minimum when the angle measures 90°. This happens because a greater angle corresponds to greater distance traveled by the particles and to higher possibility that they are absorbed in the atmosphere before reaching the Earth's surface. Observing the second graph, it is possible to notice that the data is arranged approximately along a straight line: the rate of cosmic rays is directly proportional to the cosine squared of the zenith angle.

INTERNATIONAL COSMIC DAY NOVEMBER 4 | 2020

INTERNATIONAL COSMIC DAY
Liceo Statale « Tito Livio » - Martina Franca
ITALY

Abstract On November 4th, 2020 we participated to the International Cosmic Day together with the researchers of INFN Lecce and University of Salento. We learned about cosmic rays and we performed an experiment to measure the cosmic rays flux as a function of the zenith angle. We analysed the data and here we present the results.

Experimental Setup To perform the measurements of the cosmic rays flux we used a detector named CoSiAM (Cosmic Ray Mission) made with 4 scintillator layers interposed with iron absorbers. The plastic scintillators emit light when a particle pass through the light is collected by optical fiber (WLS) and is sent to 2 "photo-detectors" (PMT). The iron absorbers allow to select the most energetic particle.

Analysis We recorded the single counts from every detector layers named X, Y, Z, W starting from the top. We also recorded the twofold, threefold and fourfold coincidences that is the signals due to the fact that two, three and four layers detect an event at the same time.

Conclusion We measured the cosmic ray flux versus the Zenith angle. We saw from the data that the flux decreases as the angle increases as expected because for bigger angles the cosmic rays pass through a wider atmospheric layer and are absorbed.

INTERNATIONAL COSMIC DAY NOVEMBER 4 | 2020

Termine ultimo per la consegna 10 Dicembre 2022
Deadline Desy 16 Dicembre 2022

Buon Lavoro!!!!

