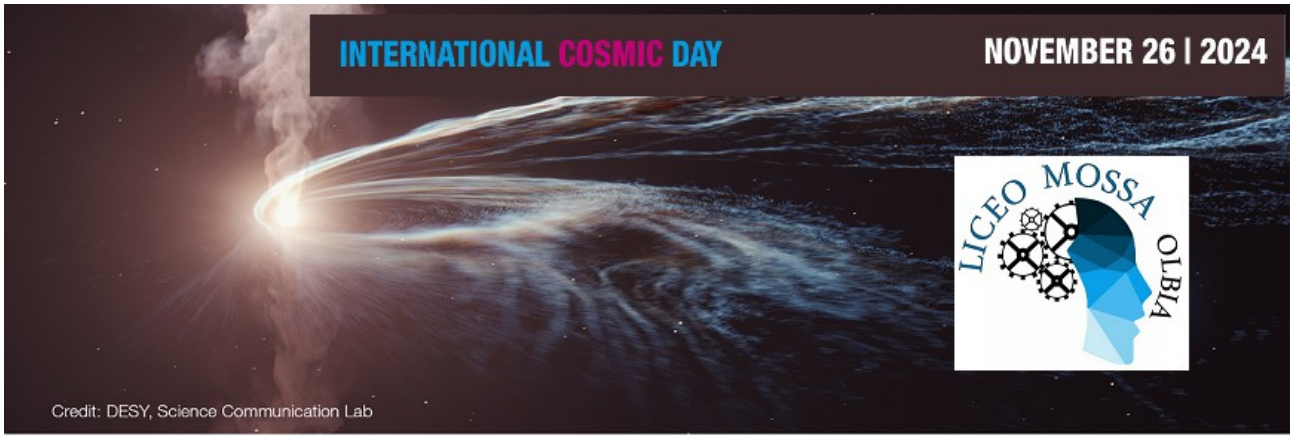


Introduction

We are a group of students from the Mossa High School in Olbia, located in northern Sardinia, interested in studying cosmic rays. Last year, we examined the distribution of cosmic ray flux as a function of zenith angle. This year, we attempted to replicate the experiment conducted by the Italian physicist Domenico Pacini more than 100 years ago, which, along with Hess's experiments, demonstrated the existence of cosmic rays. Pacini used electroscopes to measure the ambient electric charge in the sea at various depths, showing that it decreased, thus hypothesizing the presence of a significant ionizing cause in the atmosphere, involving penetrating radiation, independent of the direct action of radioactive substances in the ground.



Geiger counter inside the waterproof container

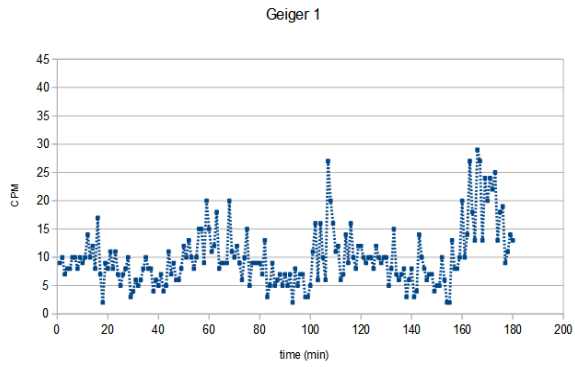
Experimental Set-up

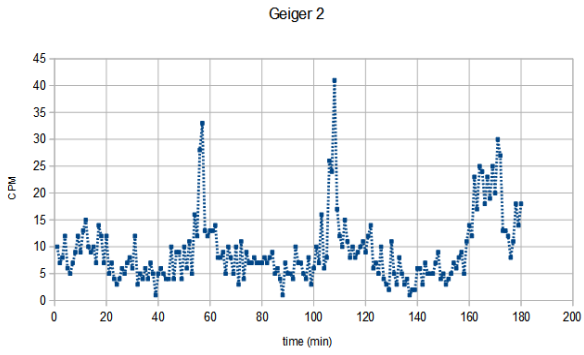
The technology used to reproduce the experiment is vastly different from what was available 100 years ago. We used two GammaScout Geiger counters, which can record the number of signals detected per minute, store the data, and later transfer it to a PC.

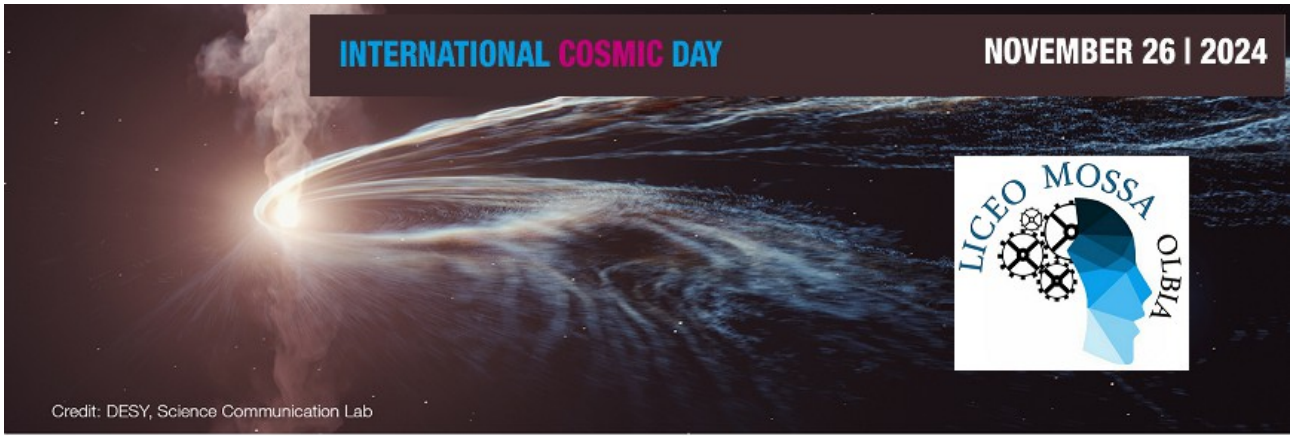
The Geiger counters were placed inside a waterproof container and lowered into the water using a graduated rope marked at 50 cm intervals. Using a dinghy, two teams of students departed from the Olbia Naval League pier. The dinghy was anchored several hundred meters from the shore at a location with a seabed depth of about 6 meters. The Geiger counters were submerged at six different depths, spaced 50 cm apart, for five minutes, down to a maximum depth of 3 meters. Four additional teams of students repeated the measurements at roughly the same location, resulting in a total of six sets of data.

Report of our results

These two graphs show the counts per minute (CPM) measured by the two Geiger counters during the three trips of the dinghy from the pier to the anchoring point and during the measurement phase. The drop in counts during depth measurements and the rise when returning to the pier are evident.







The count-per-minute (CPM) measurements were plotted on a Cartesian graph as a function of depth. One of the most significant data sets is shown in fig.1. It clearly demonstrates a decrease in counts as depth increases, followed by a saturation of values beyond 200 cm.

Depth (cm)	CPM
0	12,4
50	9,0
100	8,6
150	7,0
200	6,0
250	5,8
300	5,8

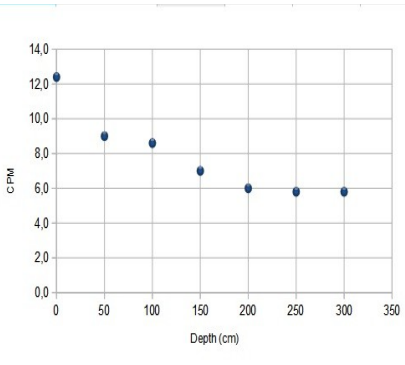


Fig.1

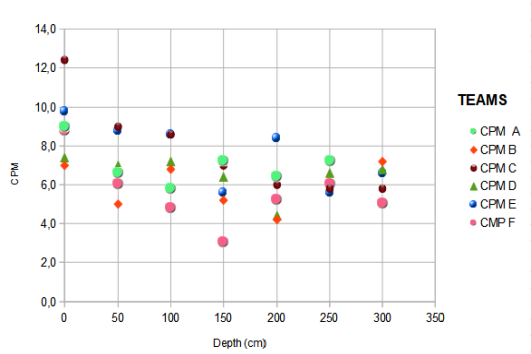
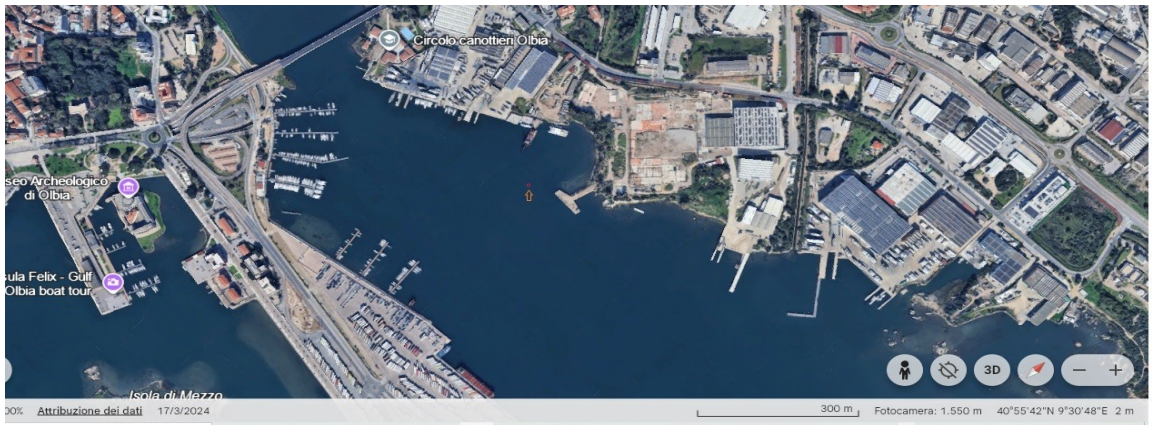


Fig.2

The second graph (fig.2) displays all six sets of measurements from the six teams. Although there is considerable variability among the values, the general trend of decreasing counts with increasing depth is evident.
A relative increase in counts observed at 2 meters could be attributed to the presence of ionizing particles emitted by algae and/or encrustations of marine organisms likely present along the anchor chain of the buoy where the boat was moored. This phenomenon of radioactive elements (i.e. Thorium 232) accumulation by certain marine organisms, such as coralline algae, is well-documented in scientific literature.

Next projects

In the future, we plan to conduct measurements in more open waters with deeper seabeds and, as a countercheck, take measurements near seabeds rich in algae.



Gulf of Olbia