

The outreach project the New York chapter of the American Physical Society (APS) helped support ran from March through May of 2004. It consisted of four meetings where high school students from the Rochester area helped conduct a cosmic ray experiment. These four meetings included construction of the “Black Box” to contain the experiment, flight of the experiment, data analysis, and presentation at PARTICLE day. The whole program was done in conjunction with the PARTICLE outreach program. The primary goal of the experiment was to give a concrete example of particle physics and relativity in addition to a view into the experimental process.

The primary science objective was to verify relativistic time dilation in muons. Students achieved this by sending their Black Box on a small locally chartered plane. The plane flew at different altitudes so as to see how the flux of muons from cosmic rays varied at different heights.

Students looked at how much the atmosphere slowed our stopped muons and corrected for this by taking into account atmospheric density at different altitudes. An estimate of the velocity or the

Altitude (ft)	Rescaled Rate (#/min)	Predicted Rate (#/min)	Predicted Rate with Time Dilation (#/min)
500	224.4	15.7	224
4000	225.4	48.4	231
7000	233.2	126.7	236
9000	240.9	240.9	240.9

corresponding relativistic quantity gamma was found to help find the amount of time dialation. The students predicted the flux assuming the scenarios that there is time dilation and the scenario that no such effect exists. A table of the students’ results is shown above. The students found great agreement with the hypothesis that relativistic time dilation is taking place.

Participants included students from Byron-Bergen High School and East High School. During a visit to Byron-Bergen, a basic design was hashed out primarily



by the students. The general concept behind the project was also discussed. At the first formal meeting in March, the students constructed the Black Box which contained the scintillating paddles and electronics that would be used to observe the cosmic rays.

Students met again on the day of the flight to see the experiment take off and to discuss some data analysis. Data analysis was done at the third meeting. Students learned some basics of relativity and how to apply the concept of time dilation.



The final portion of the program concluded when the students presented their results at PARTICLE day. PARTICLE day is a meeting of roughly 200 students in the Rochester area who are involved with experiments with cosmic rays through the PARTICLE program.