TITLE: MUON PHYSICS

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The aims of this project were to determine the charge averaged mean muon lifetime in a polyvinyltoluene-based scintillator, the relative flux of muons as a function of height above sea level and to demonstrate the time dilation effect of special relativity.

The muon's lifetime was measured using the plastic scintillator and a photomultiplier tube (PMT). Muons with a typical energy of approximately 160 MeV present in the atmosphere, will penetrate and come to rest within the scintillator. Muons decay via the weak force and the Fermi coupling constant gives a measure of the strength of this weak force. A decay time distribution was measured for the muons and was expected to follow an exponential curve which was confirmed by our results. A numerical value for the mean muon lifetime in matter was obtained from the exponential curve. The calculated value of the charge averaged mean muon lifetime was found to be 2.122 ± 0.006μs and theoretical value is 2.19703 ± 0.00004 μs. The Fermi coupling constant was also calculated from the muon lifetime

The stopping rate was measured from the total number of observed muon decays in some time interval. This rate is proportional to the flux of muons having a kinetic energy of 160 MeV. A measurement of the muon stopping rate at two different altitudes was used to demonstrate the time dilation effect of special relativity. The average stopping rate was calculated to be 160.51 muon decays per second.