Abstract Submitted
for the APR17 Meeting of
The American Physical Society

The Atmospheric Muon Lifetime, with the Lead Absorption Potential for Muons and References to the Standard Model of Particle Physics CIOLI BARAZANDEH, ANGEL GUTARRA-LEON, WALERIAN MAJEWSKI, Northern Virginia Community College — Muon is one of twelve fundamental particles and has the longest free-particle lifetime. It decays into three leptons through an exchange of weak vector bosons W+/W-. Muons are present in atmospheric secondary cosmic rays and reach the sea level. By detecting the time delay between arrival of muons and appearance of decay electrons in a scintillation detector, we will measure muon's lifetime at rest. From the lifetime we can find the ratio g_w /M_W of the weak coupling constant g_w (a weak analog of the electric charge) to mass of the W-boson M_W. Vacuum expectation value v of the Higgs field, which determines masses Standard Model (SM) particles, can be calculated as $v=2M_W c^2/g_w = (\tau m_\mu c^2/6\pi^3 \hat{h})^{1/4} m_\mu c^2$ regarding muon mass m_μ and muon lifetime τ only. Using the experimental value for $M_W c^2 = 80.4$ GeV, we will find weak coupling constant g_w. With the SM relation $e=g_w \sin\theta\sqrt{hc\varepsilon_0}$ and experimental value of the Z_0-photon weak mixing angle $\theta = 29^o$ we use our muon lifetime to find the elementary electric charge e value. In this experiment we will also determine the sea level fluxes of low-energy (<160 MeV) and high-energy cosmic muons, then will shield the detector with varying thicknesses of lead plates and from the new values of fluxes find the energy-dependent muon stopping power in lead.

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Date submitted: 27 Sep 2016 Electronic form version 1.4