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Lifetime of Cosmic-Ray Muons and the Standard Model of Fundamental Particles SAHANSHA MUKHERJI, Northern Virginia Community College, Annandale, VA, YASH SHEVDE, University of Virginia, WALERIAN MAJEWSKI, Northern Virginia Community College, Annandale, VA — Muon is one of the twelve fundamental particles of matter, having the longest free-particle lifetime. It decays into three other leptons through an exchange of the weak vector bosons W^+/W^-. Muons are present in the secondary cosmic ray showers in the atmosphere, reaching the sea level. By detecting time delay between arrival of the muon and an appearance of the decay electron in our single scintillation detector (donated by the Thomas Jefferson National Accelerator Facility, Newport News, VA), we measured muon's lifetime at rest. It compares well with the value predicted by the Standard Model of Particles. From the lifetime we were able to calculate the ratio g_w /M_W of the weak coupling constant g_w (an analog of the electric charge) to the mass of the W-boson M_W. Using further Standard Model relations and an experimental value for M_W, we calculated the weak coupling constant, the electric charge of the muon, and the vacuum expectation value of the Higgs field. We determined the sea-level flux of cosmic muons.

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