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Toward a sub-ppm measurement of G_F

mercredi 10 mars 2010 17:00 (15 minutes)

The weak coupling constant, G_F, is determined most precisely from the mean life of the positive muon, τ_μ. Advances in theory have reduced the theoretical uncertainty on G_F as calculated from τ_μ to a few tenths of a ppm. The remaining uncertainty on G_F is entirely experimental, and is dominated by the uncertainty on τ_μ.
The MuLan experiment is designed to measure the muon lifetime to a precision of 1 ppm, a twenty-fold improvement over the previous generation of experiments.
In 2007, we reported an intermediate result, $\tau_\mu = 2.197013(24)$ μs (11 ppm), which is in excellent agreement with the previous world average. This mean life was measured using a pulsed surface muon beam stopped in a ferromagnetic target, surrounded by a symmetric scintillator detector array. Since this intermediate measurement, the detector was instrumented with waveform digitizers, the muon beam rate and beam extinction were increased, and two data sets were acquired on different targets, each containing over 10^{12} muon decays. These data will lead to a new determination of G_F to better than a part per million.

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