Extra Radial Muon Orbit Distortion with E821 Beta Function

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The E821 experiment conducted in the national light source synchrotron in 2001 measured the muon's anomalous magnetic moment to a precision of 0.74 ppm, producing a three sigma difference between Standard Model predictions and experimental results. In order to conclusively decide whether the Standard Model needs expansion, a more precise model of the distortion of the muon's orbit was derived, factoring in betatron oscillations and closed orbit distortions using multivariate and differential techniques (including Greene’s theorem and Fourier Analysis). The previous models were compared to this novel model with a numerical baseline generated by a neural network in Python. Analysis in Mathematica and Linux command line verified that the prediction of the pathing of the muon was improved by over ten percent, increasing the precision of the moment to 0.54 ppm, without any investment into physical infrastructure. This allows for a better test of the completeness of the Standard Model and can improve the understanding of muon behavior in energy filled plasmas.

Awards Won:
Third Award of $1,000