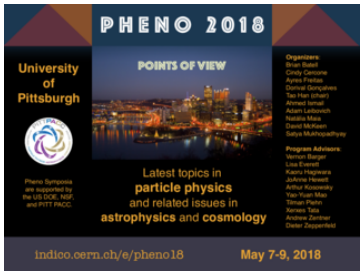

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The new Muon g-2 experiment at Fermilab

Tuesday 8 May 2018 17:30 (15 minutes)

The magnetic moment of a quantum mechanical particle with an angular momentum differs from that of a classical mechanical particle by a factor called the g-factor. For Dirac particles such as electrons, muons, etc., the Dirac theory predicts the g-factor to be 2. There are slight variations from g=2 for these particles because of quantum fluctuations. The anomaly is characterized by the anomalous magnetic moment, $a = \frac{g-2}{2}$. The anomalous magnetic moments for both the electron and the muon have been calculated theoretically and measured experimentally with very high precision. The measurement of the anomalous magnetic moment of the electron agrees very well with the theory predictions. Unlike that of the electron, the anomalous magnetic moment of the muon (a_μ) is more sensitive to heavier physics because of its heavier mass. This also makes a_μ more sensitive to physics beyond the Standard Model. The most precise measurement of a_μ so far is made by the E821 experiment at the Brookhaven National Laboratory and the result disagrees with the theory by 3.5 standard deviations. To better understand the deviation, both theoretical and experimental values need to be obtained with higher precision.

The Muon g-2 experiment at Fermilab aims to measure a_μ to a precision of 140 parts per billion (ppb), which is four times better precision than the E821 experiment. The E821 magnet has been relocated for this experiment and the magnetic field uniformity has been improved threefold by shimming. A completely new set of instruments have been designed, built and installed. The beamline for the experiment has been built and it is designed to give a much higher muon storage fraction. The experiment has begun its first Physics Run in the beginning of FY2018. An overview of the experiment and the current status will be presented.

Summary

Author: Dr GEORGE, Jimin (University of Texas at Austin, Muon g-2 Collaboration)

Presenter: Dr GEORGE, Jimin (University of Texas at Austin, Muon g-2 Collaboration)

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