

Abstract

Every particle has an intrinsic magnetic moment due to its spin angular momentum characterized by a constant g , called the gyromagnetic ratio, that is very close to the value 2. The experimental measurement of this quantity to a very high accuracy has made it one of the most precisely measured quantities in particle physics. This measurement when compared with the theoretical predictions of the Standard Model of particle physics shows a difference in the order of 3 standard deviation which suggests the possibility of new physics. The goal of this review is to describe the measurements done in the past, and the improvements that the Fermilab g-2 experiment will achieve.

Plan:

Introduction

Why g-2 theory

Measurement of g-2

Improvements with fermilab

Possibilities: if theory and experiment are different ...

Introduction

The projects main areas are: accelerator, storage ring, and detectors.

A team responsible for the disassembly and transport of E821 equipment from BNL to Fermilab. g-2 uses existing elements used in the equivalent experiment at BNL. Such parts are Accelerator: high-purity muon beam of 3.1GeV/c to g-2

Storage Rings: The measurement of the magnetic field via NMR and calibrations should be better than 0.1ppm with an averaged uncertainty of 0.07ppm.

Detectors: The detectors need to measure the spin precession of the muon to a statistical error of 0.1 ppm and systematics on ω_a to 0.07ppm.

g-2 uses superconducting coils from E821, the Brookhaven experiment. These 50 ft in diameter coils had to be transported from Brookhaven in Long Island to Fermilab near Chicago via ground transportation and a barge that travelled along the Atlantic coast, the Gulf of Mexico, then the Illinois Waterway to the point of closest approach to the lab.

Muon g-2 data in 2016

Chapter 1:

Chapter 2:

Conclusion

Appendix

1. Appendix 1:
2. Appendix 2:
3. Appendix 3:

Terminology

wbs work breakdown structure

storage ring: circular particle accelerator that maintains particles at the same energy for a long period of time.

Radio-frequency cavities are used to replace the lost energy. cryogenic: production of very low temperature and the behavior of material in them

Septum (pl septa): A magnetic or electrostatic device used to deflect charged particles along one of two paths.// Inflector : A magnetic or electrostatic device to apply a transverse force to a beam. Most often the term is applied to the pulsed septa which bend the injected beam onto the equilibrium orbit of a circular accelerator.

yoke ?

1. Magnet
2. Inflector
3. Storage ring Vacuum
4. Kickers: electromagnetic device that place the injected muon beam onto a central orbit.
5. Quadrupoles: a magnet consisting of four poles that focuses a beam in one plane.
6. Collimator : A movable, solid block of material which can be used to limit beam size or to stop it altogether.