# Undergraduate Research Assistants Program

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Student:
Period of Research: Start: 25 Aug 2006 End: 1 December 2006.
Wage: $12.00/hr.

## Design and Development of a Novel Instrument for Measuring the Muon's Gyromagnetic Ratio

Measurement of the intrinsic features of a fundamental particle is particularly challenging since it involve quantum mechanics, humanity's most sophisticated theory of how the physical universe behaves. However, one such fundamental particle, the muon, is relatively amenable to measurement and is copiously produced in nature. The muon, roughly analogous to a radioactive heavy electron, is produced in our upper atmosphere and can be detected readily at ground level. Its "gyromagnetioc ratio," a kind of measure of its intrinsic rotational and magnetc properties, is calculated by quantum mechanics to be twice as large as the value predicted by classical physics. We will build the experiment to see for ourselves which theory, classical or quantum, agrees with data.

The student, with appropriate guidance, will design and construct the instrument to measure the muon's gyromagnetic ratio. This will involve practically constructing a solenoidal magnet, making magnetic field measurements, use of photomultiplier tubes, computer programming and learning a variety of data reduction techniques. The student will be able to run the experiment, reduce the data and to determine optimum running conditions. It is envisioned that the results will be written up and published in some appropriate venue. This project builds on successful work completed by various undergraduates who concentrated on different aspects of the same project.