

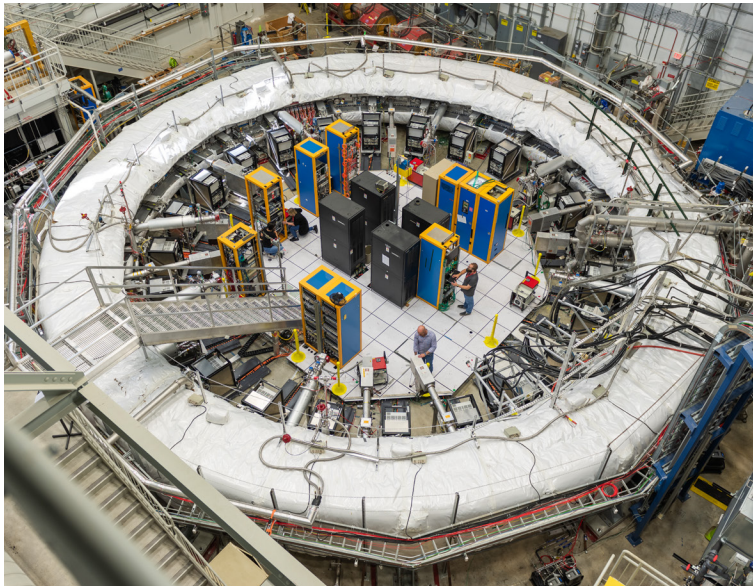
# Muon g-2 Experiment

By studying the properties of muons, scientists at Fermilab hope to learn whether there are elementary particles beyond the ones we know.

## The experiment

The Muon g-2 experiment probes the magnetic properties of the muon — a heavy sibling of the electron — in the search for new physics. Muon g-2 (pronounced gee-minus-two) is an international collaboration between Fermilab and dozens of labs and universities in seven countries.

The Muon g-2 experiment studies the precession or “wobble” of muons when placed in a magnetic field. Based on what we already know about muons and other particles, scientists can predict with great precision the value of the muons’ wobble. If the experiment comes up with something different, it means that our current understanding of physics is incomplete, and it may indicate the presence of additional particles or hidden subatomic forces. It would open the door to exciting new realms of science.



The announcement on Aug. 10, 2023, marks the second result from the experiment at Fermilab, which is twice as precise than the first result announced on April 7, 2021.

## What are muons?

Muons are subatomic particles similar to electrons, but 207 times heavier.

They carry the same electrical charge as an electron.

They exist for only about 2.2 millionths of a second.

Scientists at Fermilab can make and store large quantities of muons.

When placed in a magnetic field, muons behave much like a gyroscope, and it is this property, called the g-factor, that the Muon g-2 experiment measures.



The new Muon g-2 value bolsters the first result the collaboration announced in April 2021 and sets up a showdown between theory and experiment over 20 years in the making.

## A new ultraprecise measurement

The Fermilab Muon g-2 experiment improves on an experiment at the DOE’s Brookhaven National Laboratory, which concluded in 2001.

The announcement on Aug. 10, 2023, is the second result from the experiment at Fermilab and is twice as precise as the first result announced on April 7, 2021. In 2021, the first experimental result of the Muon g-2 experiment at Fermilab showed strong evidence for a discrepancy between the best experimental result and theoretical result at that time, hinting at the possible existence of new physics.

In 2021, the first results (based on data recorded during year 1, 2018) from the Muon g-2 experiment were released and showed evidence of muons behaving in a way that differs from that predicted by the Standard Model. The results announced in August 2023 contain data analysis from years 2 and 3 (2019-2020), and the results are much more precise than the 2021 results. The number of events collected from Muon g-2 at Fermilab is 21 times the number collected at Brookhaven National Laboratory.

Because of the large amount of additional data that went into the 2023 analysis announcement, the Muon g-2 collaboration expects its result to be twice as precise as the first result announcement in 2021.

## More information

**Muon g-2 experiment website:**

[muon-g-2.fnal.gov](http://muon-g-2.fnal.gov)

If you have questions about this project, please contact the Fermilab Office of Communication, 630-840-3351, or send an email to [fermilab@fnal.gov](mailto:fermilab@fnal.gov).