I AM a Physicist

Tammy Walton, Ph.D.

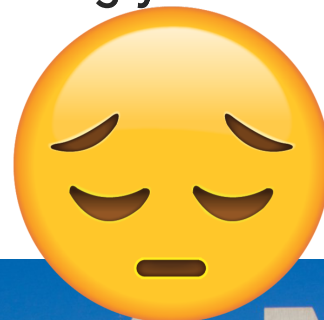
Superheroes in STEM 2021

May 1, 2021

Welcome to the Superheroes STEM Conference!

Welcome to the Superheroes STEM Conference!

I miss NOT meeting you at Fermilab in person!



Welcome to the Superheroes STEM Conference!

Fermilab

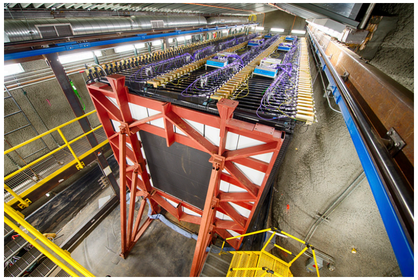
Welcome to the Superheroes STEM Conference!

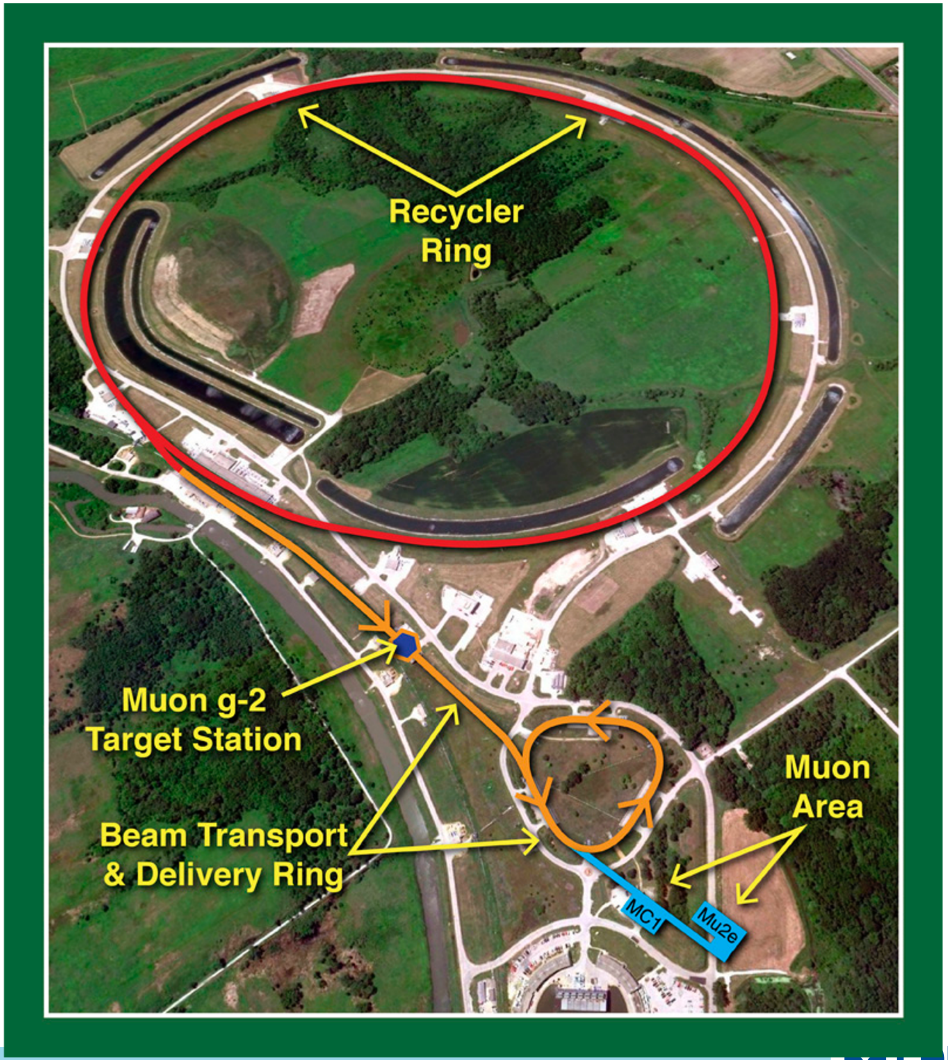
Welcome to the Superheroes STEM Conference!

Fermilab hosts many experiments

MicroBooNE

NOvA





Welcome to the Superheroes STEM Conference!

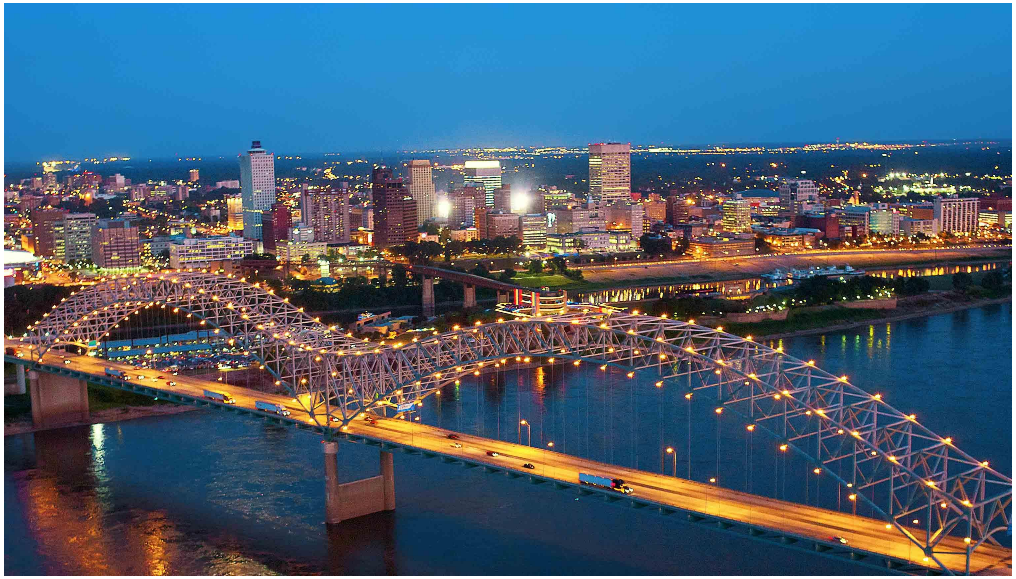
Collaborate with institutions all over the world

Fermilab is amazing and successful because of the laboratory staff and users!

My Road to Fermilab

Who am I?

- Born in Memphis, TN



Fermilab

Who am I?

- Born in Memphis, TN
- Many siblings
  - 2nd oldest of 8
  - Eldest girl of 5

Experienced tragedies at very young age

- *Lost parents and other family members*

Who am I?

High school physics principal introduced me to physics

- Life Experiences
  - Attracted to art
  - Voted Most Artistic In High School
  - Discovered Physics

Who am I?

- Education
  - Undergraduate physics degree from the University of Tennessee

Who am I?

- Education
  - Undergraduate physics degree from the University of Tennessee

Undergrad Beginning

- Family Obligations
- Working
- Struggling with Courses
- New Environment

Who am I?

- Education
  - Undergraduate physics degree from the University of Tennessee

Undergrad Beginning

Undergrad Ending

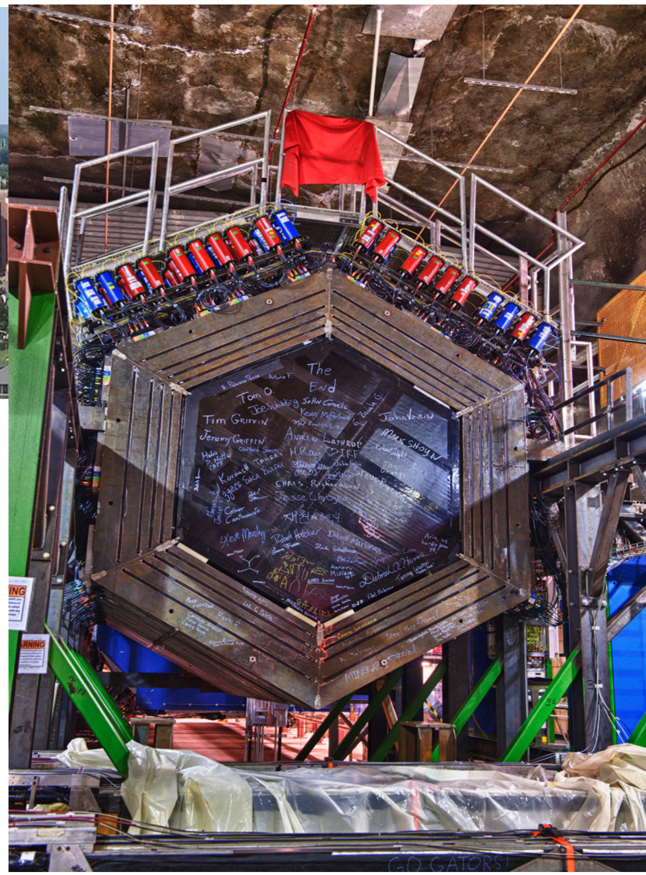
- Succeeding with Upper Courses
- Accept into Graduate School
- First College Graduate In My Family

Who am I?

- Education
  - Graduate physics degree from Hampton University

Who am I?

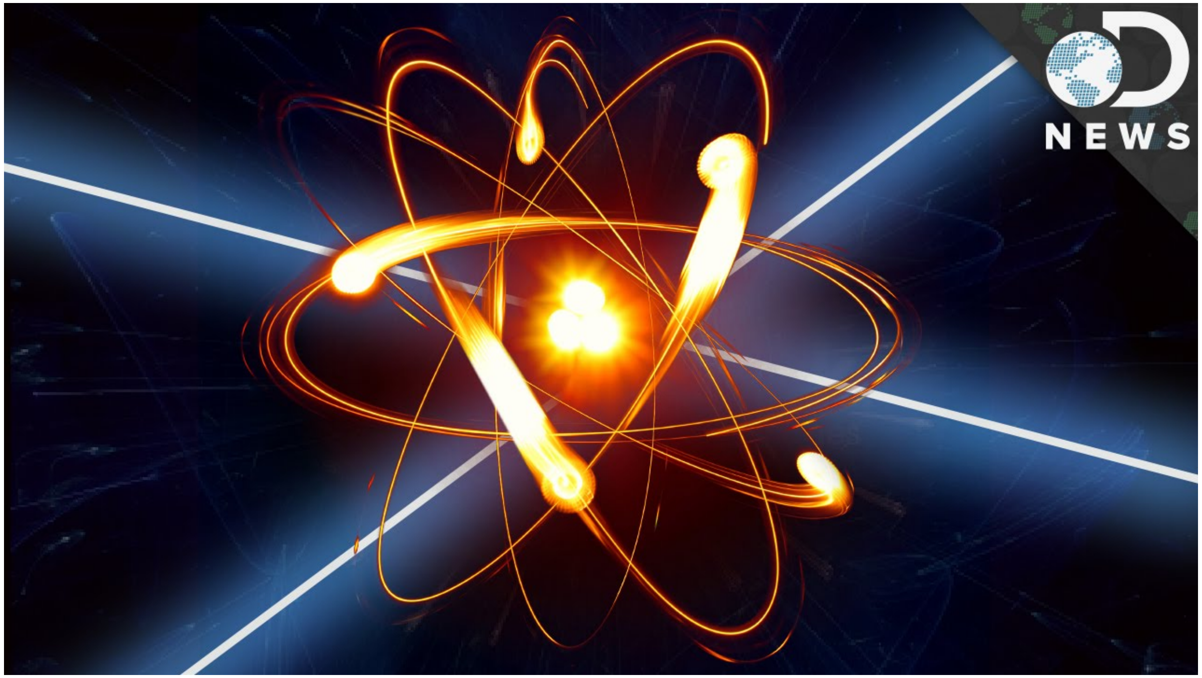
- Education
  - Graduate physics degree from Hampton University



- MINERvA Experiment
  - Located at Fermilab
  - First Generation Graduate Student

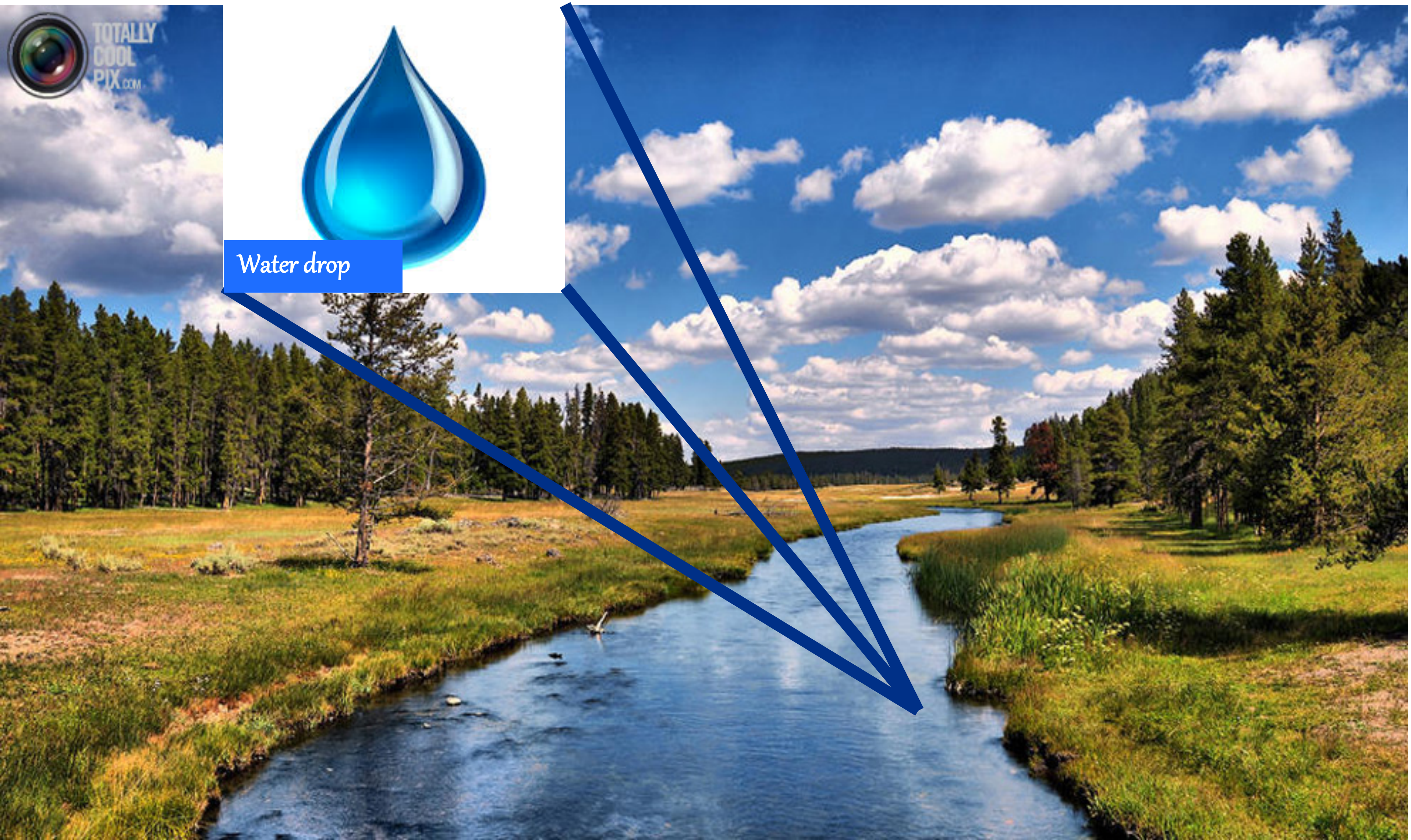
What is MINERvA?

First, a brief introduction into particle physics!

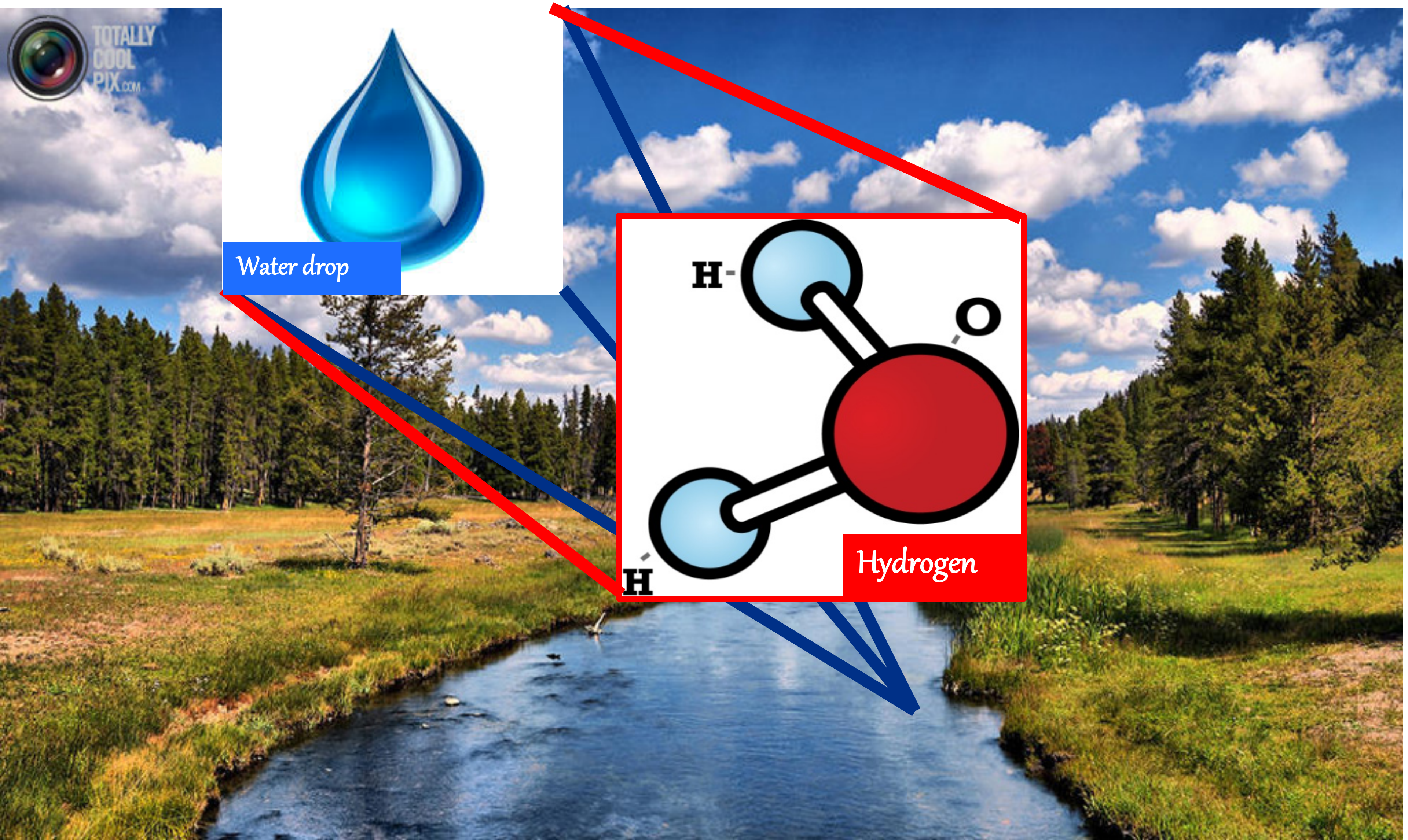


Everything is Composed of Particles!

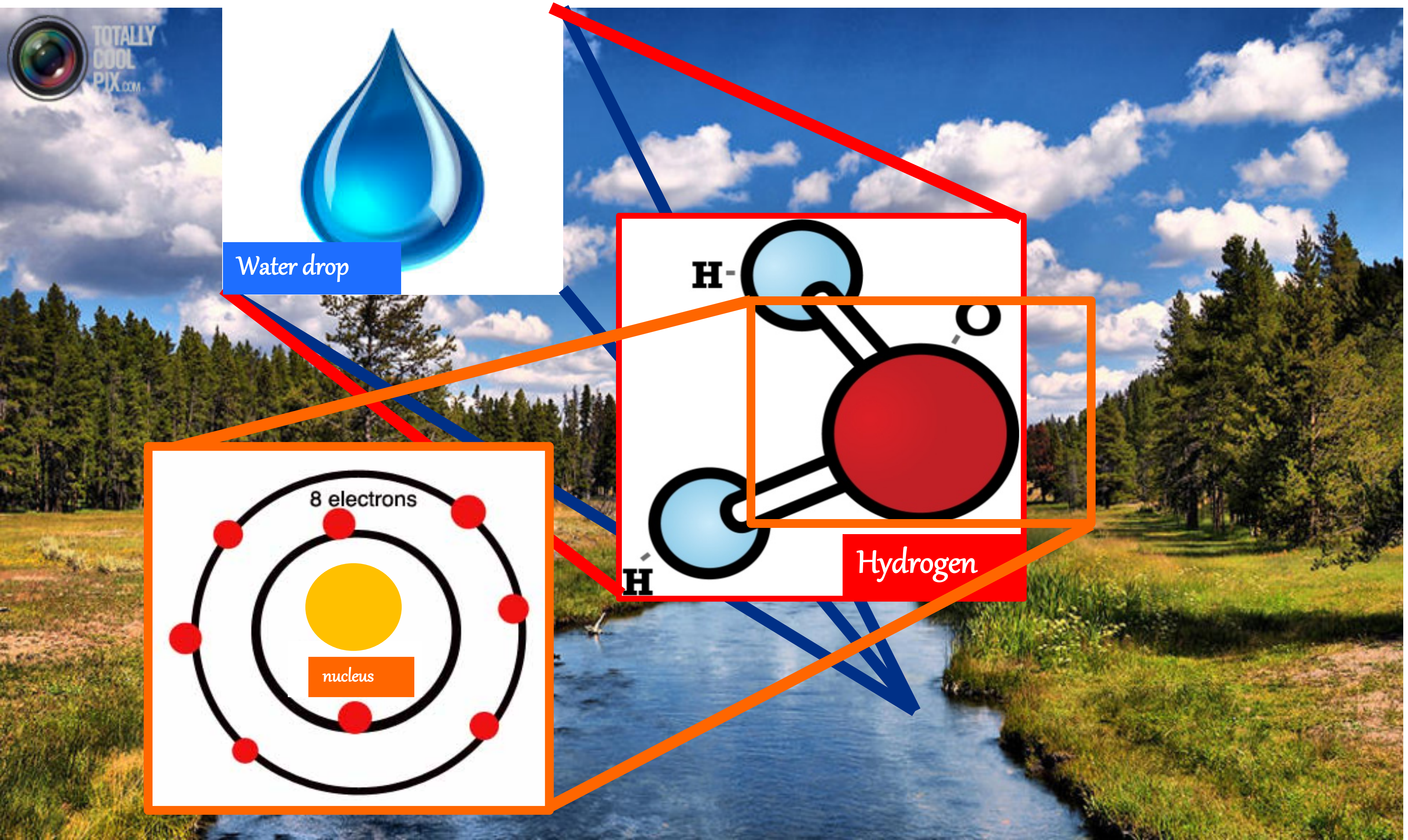
Everything is Composed of Particles!



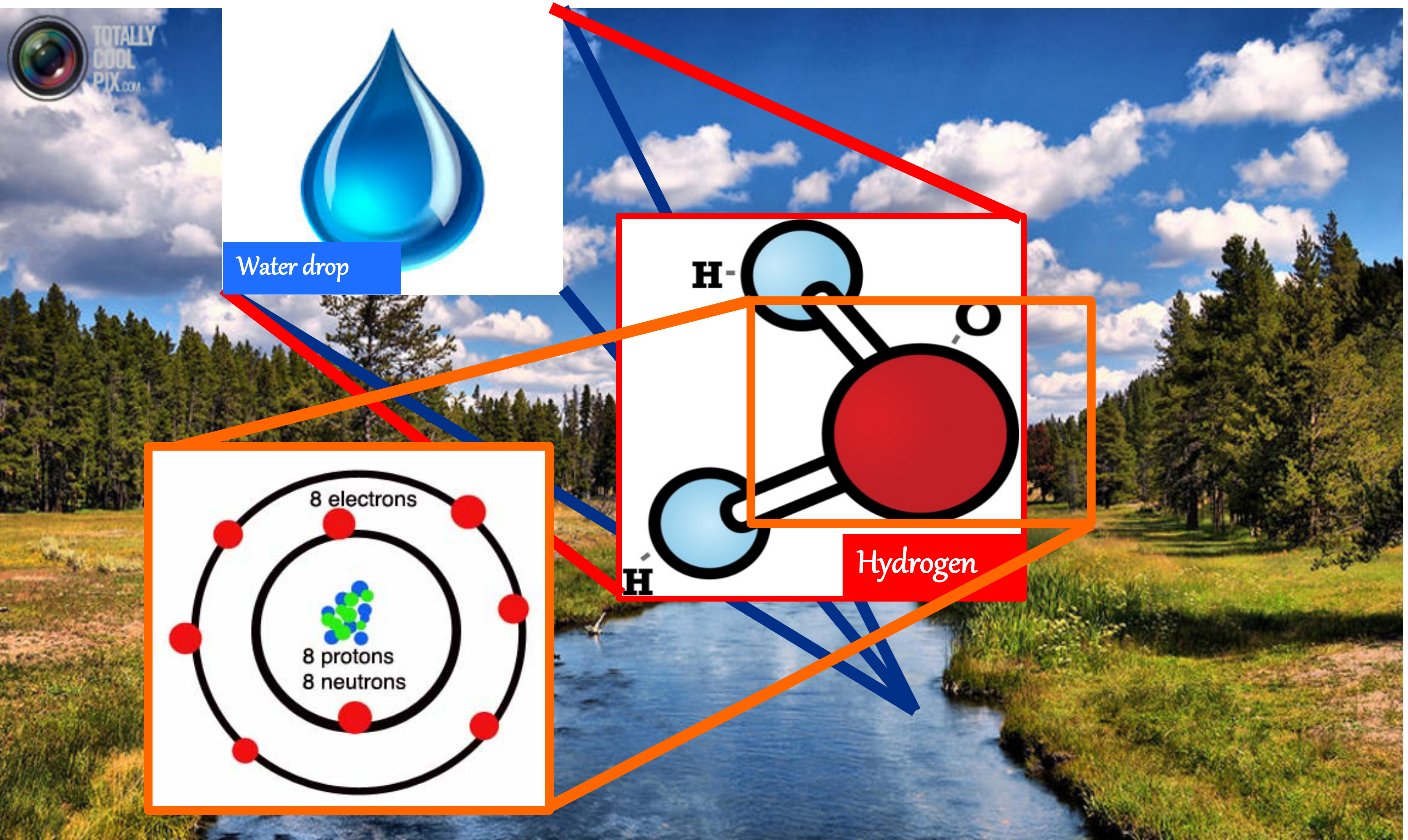
Everything is Composed of Particles!



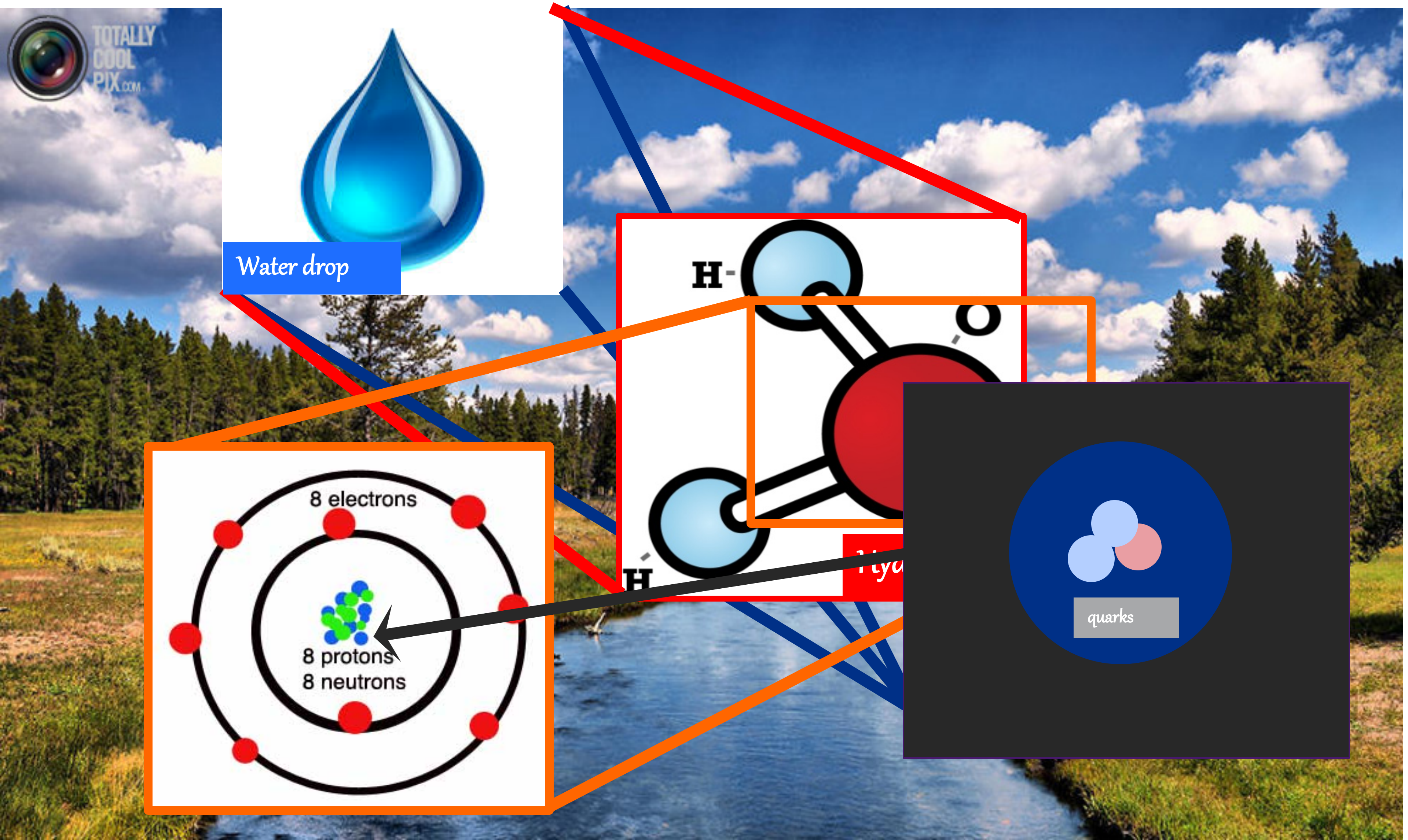
Everything is Composed of Particles!



Everything is Composed of Particles!



Everything is Composed of Particles!



Elementary Particles

Leptons

e

electron

Quarks

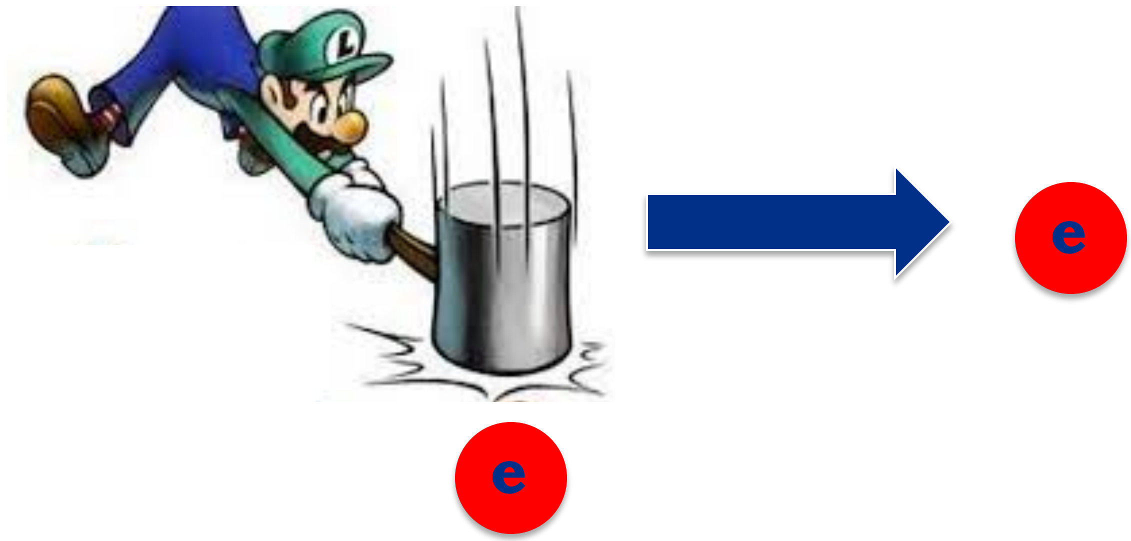
u

up

d

down

What does elementary means?



Elementary Particles

Leptons

e

electron

Quarks

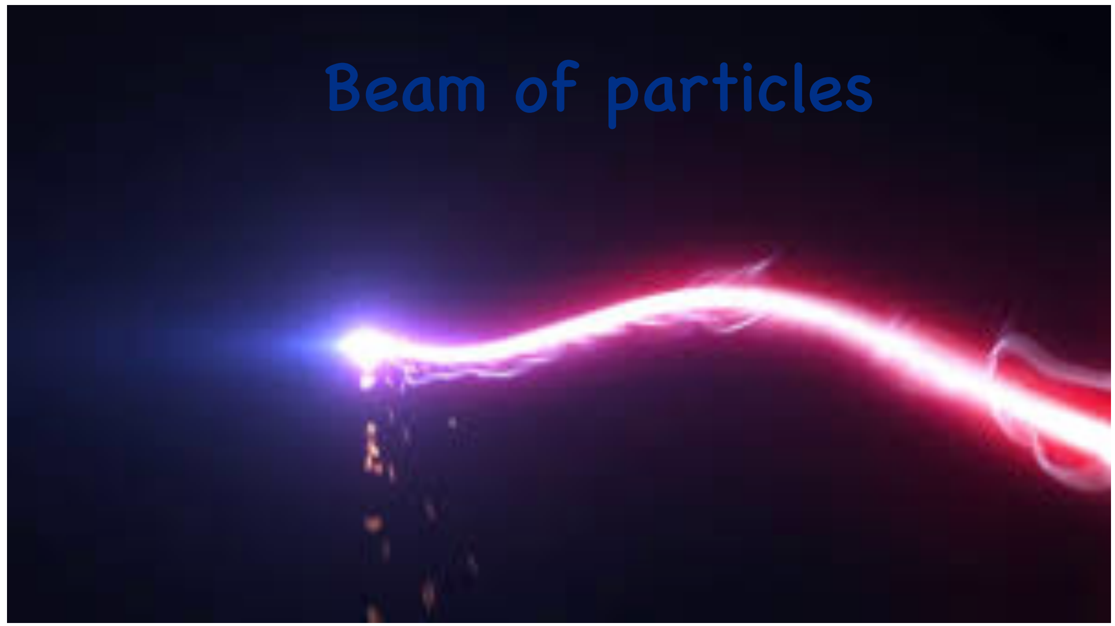
u

up

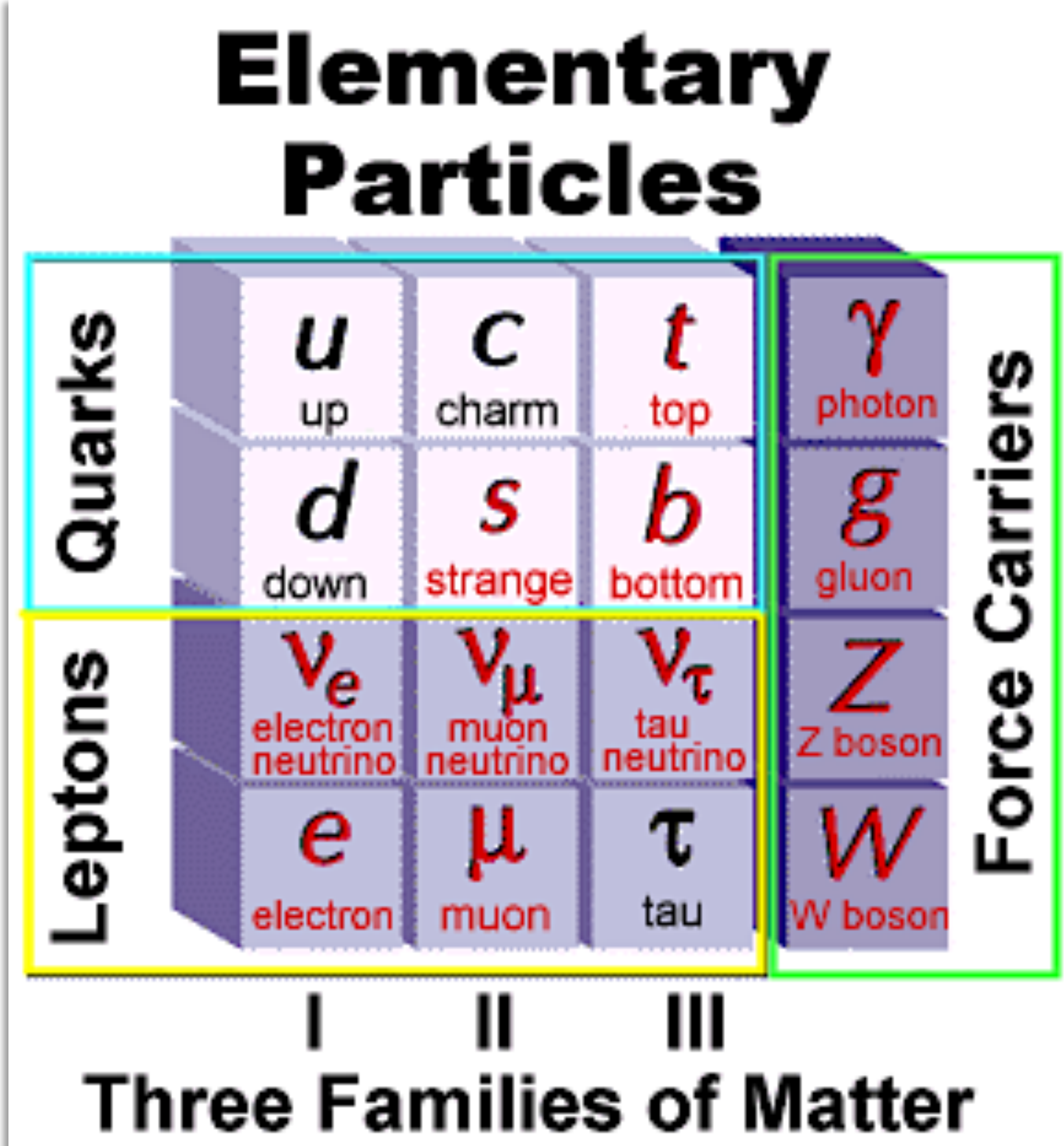
d

down

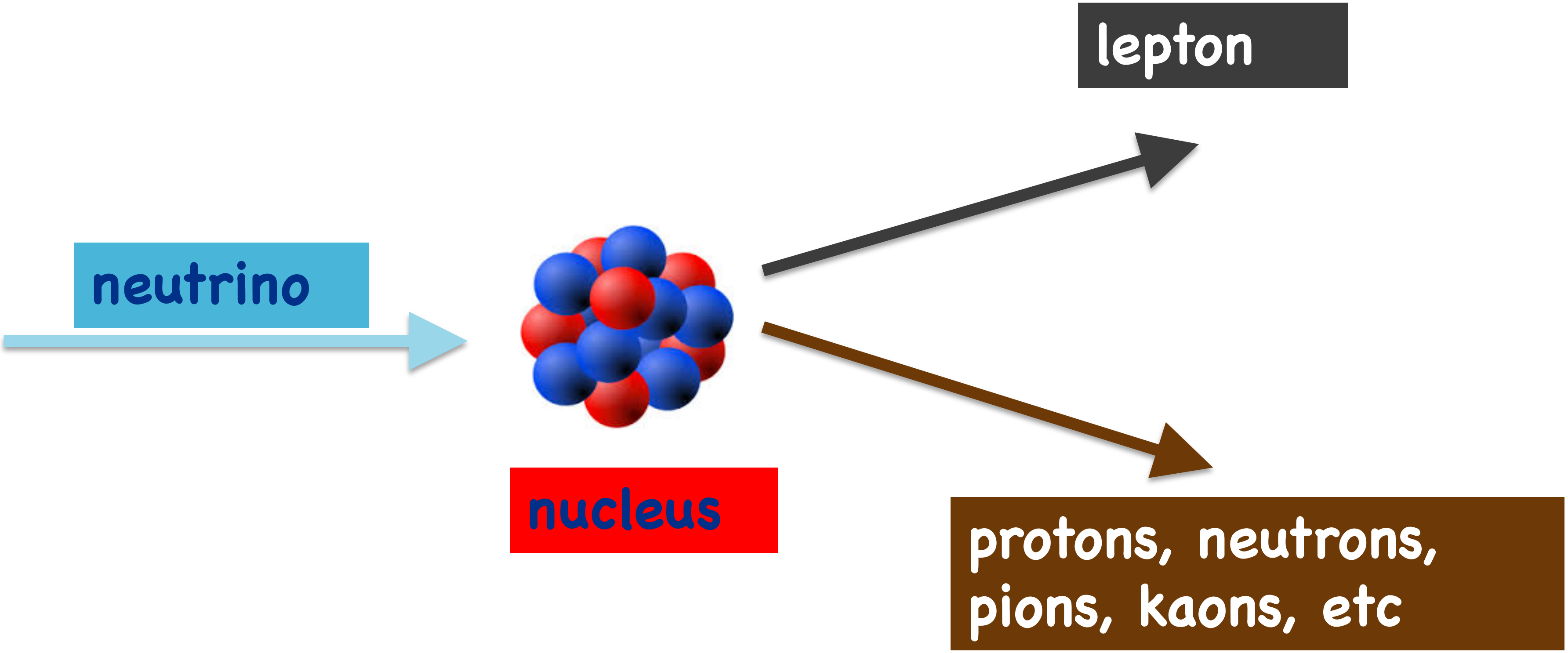
A particle physicist's hammer



Fermilab

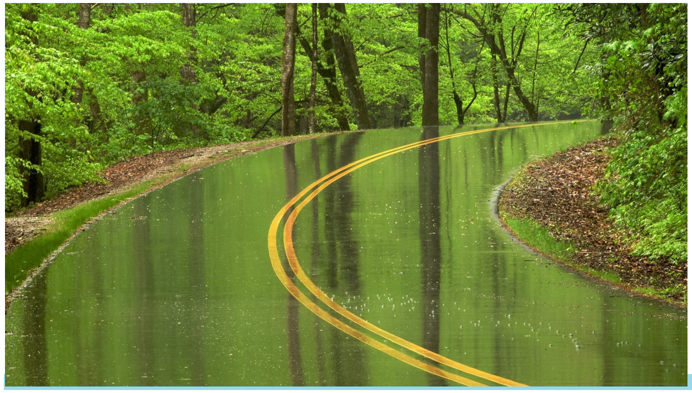

Elementary Particles
Quarks
u
up
c
charm
t
top
d
down
s
strange
b
bottom
Leptons
νe
electron neutrino
νμ
muon neutrino
ντ
tau neutrino
e
electron
μ
muon
τ
tau
Force Carriers
γ
photon
g
gluon
Z
Z boson
W
W boson
I
II
III
Three Families of Matter

What is MINERvA?



Who am I?

- Education
  - Graduate physics degree from Hampton University
  - Ph.D. work focused on MINERvA physics



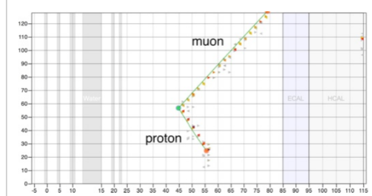
Who am I?

- Education
  - Graduate physics degree from Hampton University
  - Ph.D. work focused on MINERvA physics
  - Graduated in 2014
  - Fermilab Wine & Cheese

A neutrino tale as told by a proton

May 16, 2014 | Minerba Betancourt

Share Tweet Email



In this candidate event from data, the neutrino scatters off a nucleon and produces a muon and a proton. The muon exits through the side of the

Para una versión en español, haga clic aquí. Para a versão em português, clique aqui.

Neutrinos are difficult to study because their interaction with matter is extremely rare. Nonetheless, neutrino experiments do what they can to improve the odds: They use a neutrino beam with as high an energy as possible and build detectors filled with as many protons and neutrons as possible. One thing these detectors have in common is that they see nothing coming in, only something going out when a neutrino does interact in the detector.

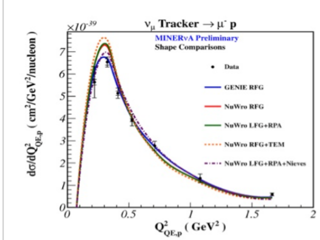
Neutrino scientists have to work their way back from those end products to study the neutrino and its interaction with matter. One of these interactions, known as a quasielastic interaction, takes place when the neutrino completely scatters off a neutron in an atom's nucleus, producing a muon and a proton.

Since the 1970s, several experiments have measured the probability of this

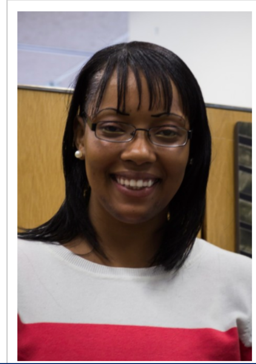
ypes of detectors. Old experiments used deuterium (which contains exactly one proton and one neutron) as a s use more complex nuclei such as carbon (six protons and six neutrons), which makes the study of ry challenging. For example, the end products can interact with other protons and neutrons in the same action, and thus what we measure in the detector is different from what was initially produced. This ery important for neutrino oscillation experiments, and current experiments use this interaction as the signal

is interaction have een data and ar, the MINERvA ything it could he MINERvA measuring the recently made a ormation from the events with a tter which way the etector. It is shown he detector in the

below) gives the roton and muon n of the



This plot shows the cross section (probability) of producing a proton with respect to Q2, the momentum transferred to the proton (measured using the proton alone). Different models are shown, where each model has been normalized to the data.



PHYSICAL REVIEW D

covering particles, fields, gravitation, and cosmology

Highlights Recent Accepted Collections Authors Referees Search Press About Staff

Rapid Communication

Measurement of muon plus proton final states in ν_μ interactions on hydrocarbon at $\langle E_\nu \rangle = 4.2$ GeV

T. Walton *et al.* (MINERvA Collaboration)
Phys. Rev. D **91**, 071301(R) – Published 1 April 2015

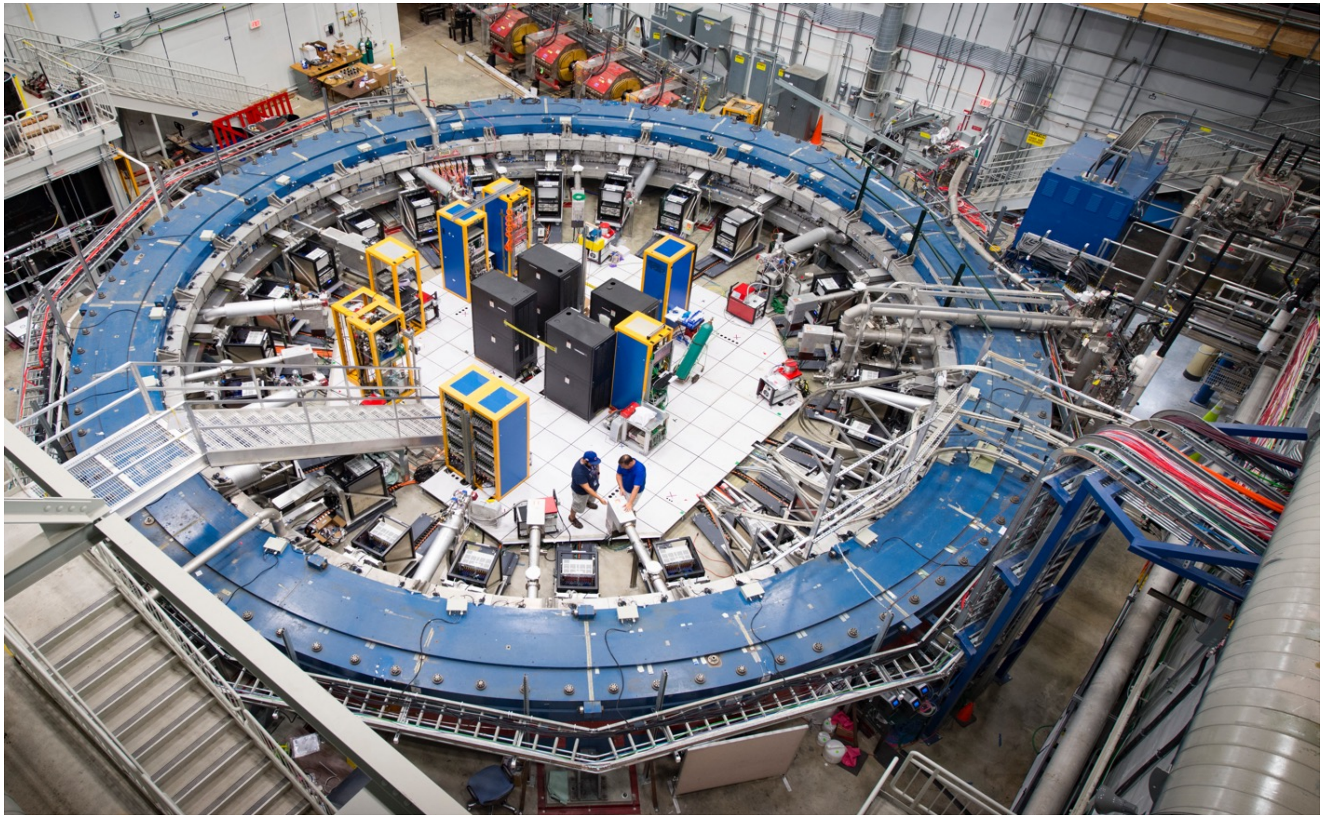
Article | References | Citing Articles (41) | Supplemental Material | PDF | HTML | Export Citation

ABSTRACT

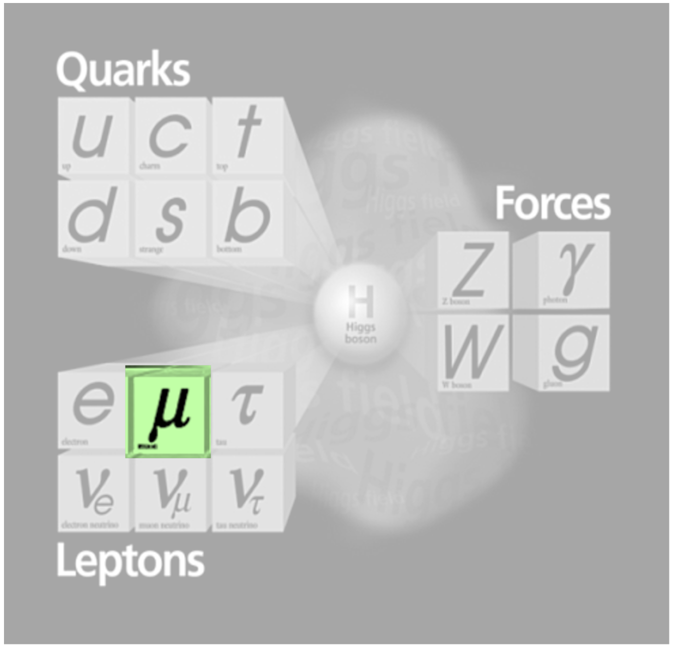
A study of charged-current muon neutrino scattering on hydrocarbon in which the final state includes a muon, at least one proton, and no pions is presented. Although this signature has the topology of neutrino quasielastic scattering from neutrons, the event sample contains contributions from quasielastic and inelastic processes where pions are absorbed in the nucleus. The analysis accepts events with muon production angles up to 70° and proton kinetic energies greater than 110 MeV. The cross section, when based completely on hadronic kinematics, is well described by a relativistic Fermi

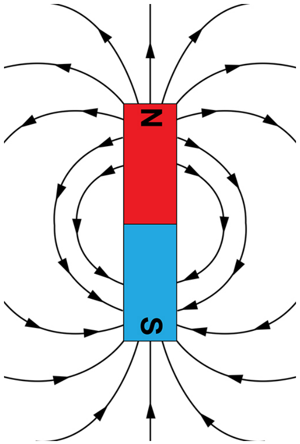
Who am I?

- Who am I today?
  - Associate Scientist
  - Work on Muon g-2 Experiment

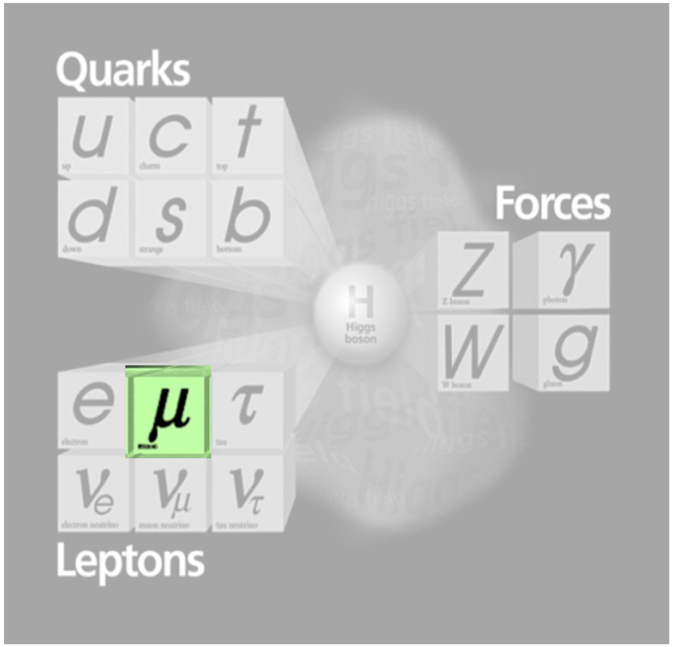


What is Muon g-2?





What is Muon g-2?



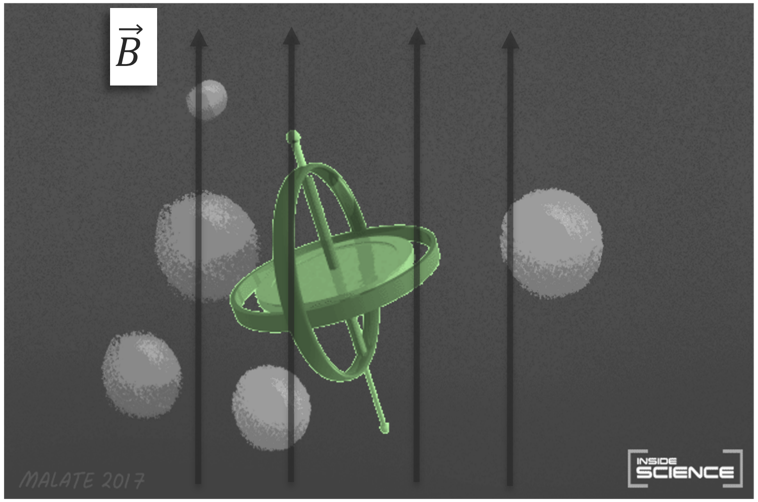
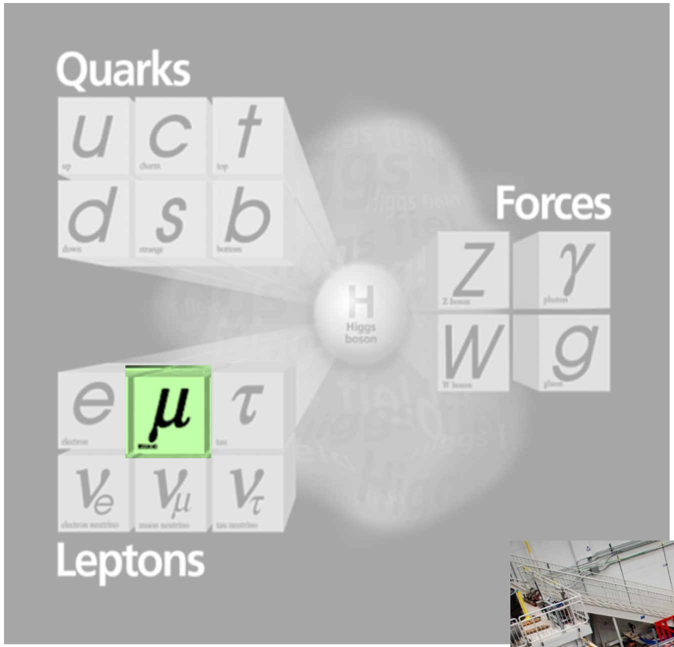


Image credits: Abigail Malate, Staff Illustrator at American Institute of Physics

What is Muon g-2?



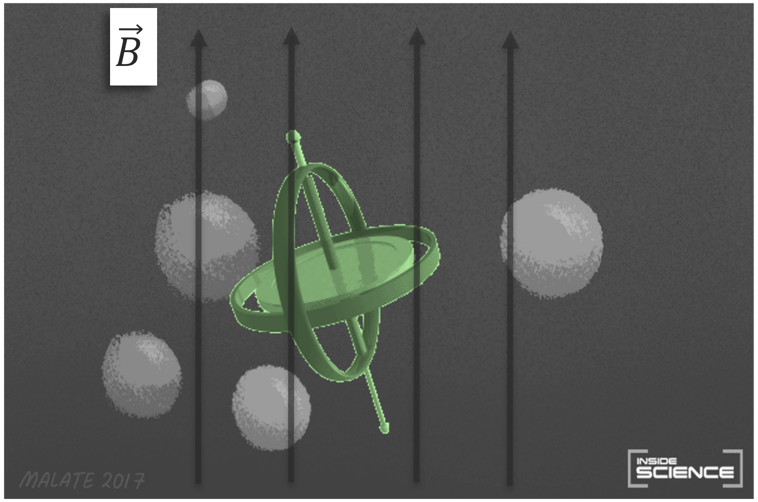
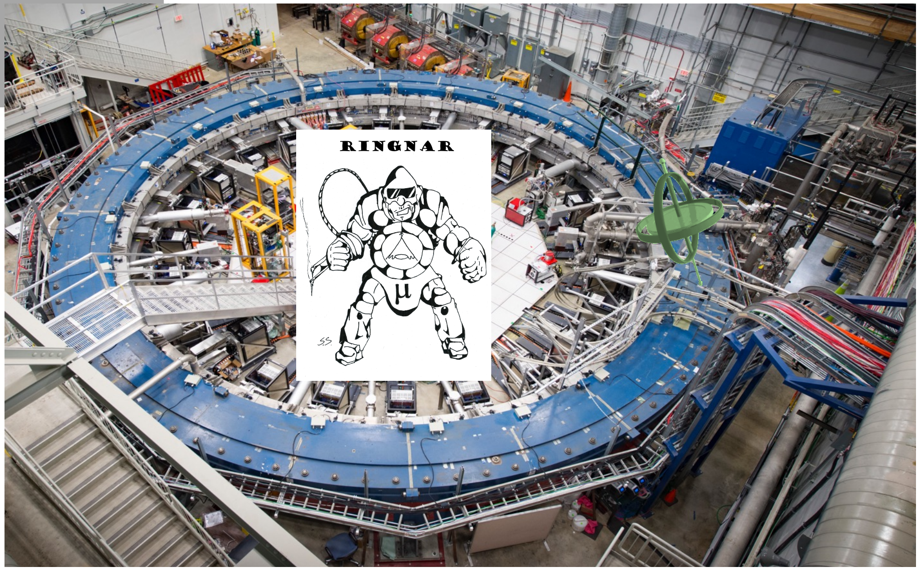
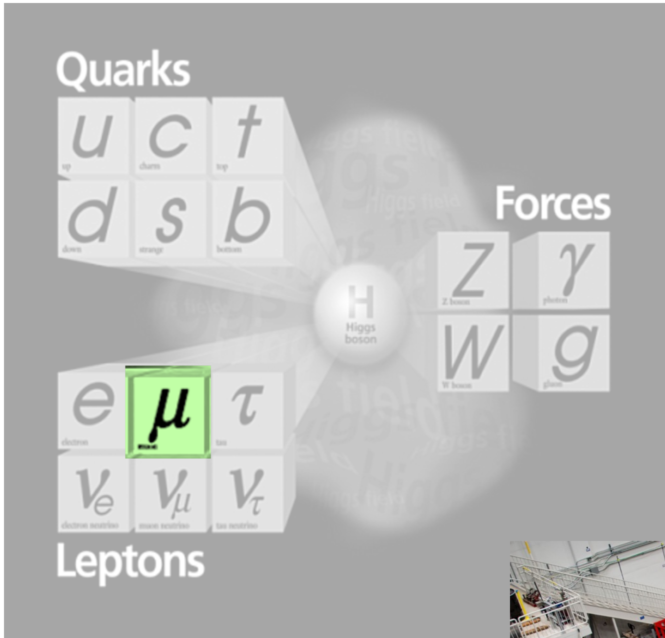


Image credits: Abigail Malate, Staff Illustrator at American Institute of Physics



Art is courtesy of g-2 collaborator

What is Muon g-2?



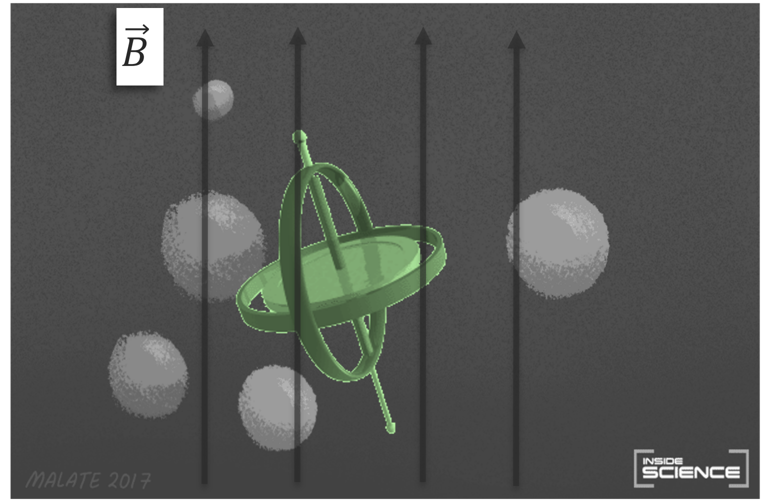
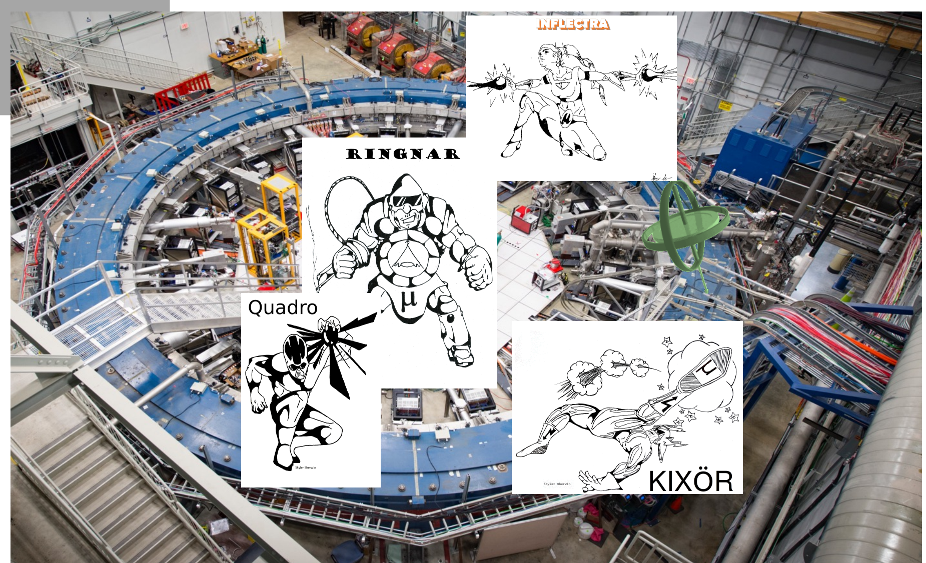
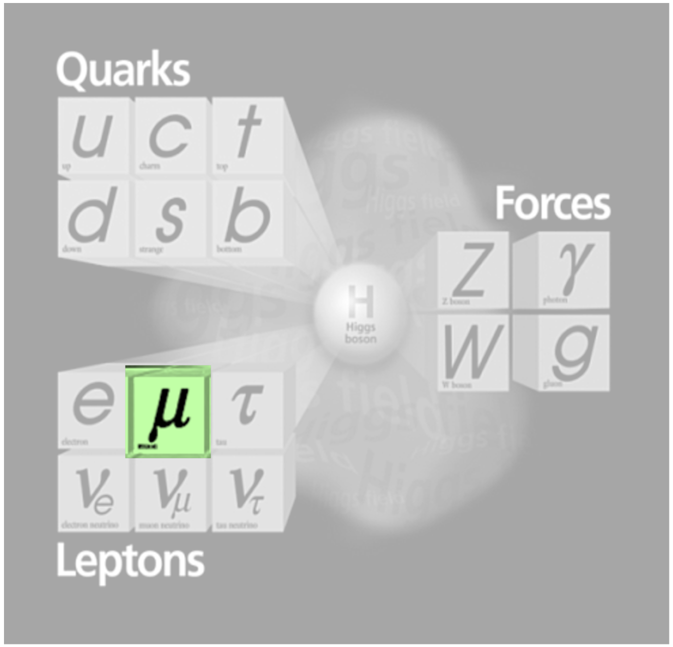


Image credits: Abigail Malate, Staff Illustrator at American Institute of Physics



Art is courtesy of g-2 collaborator

What is Muon g-2?



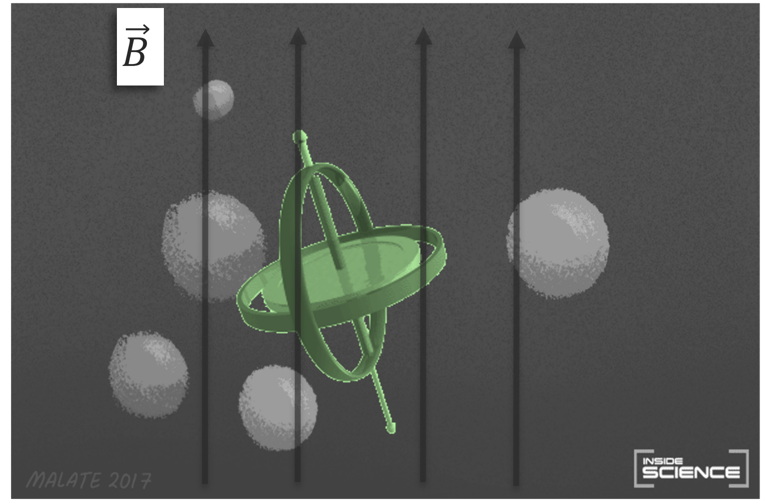
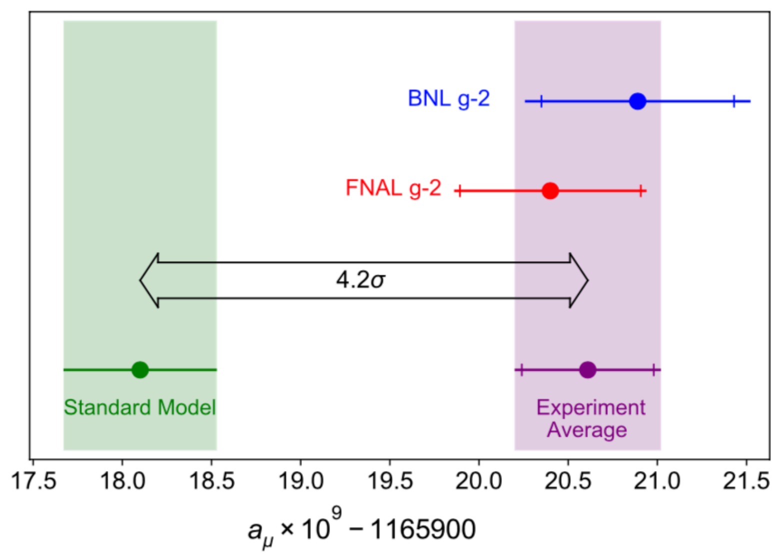


Image credits: Abigail Malate, Staff Illustrator at American Institute of Physics

$$a_\mu^{SM} = 116\,591\,810(43) \times 10^{-11}$$

$$a_\mu^{EX} = 116\,592\,061(41) \times 10^{-11}$$

$$a_\mu^{EX} - a_\mu^{SM} = (251 \pm 59) \times 10^{-11}$$



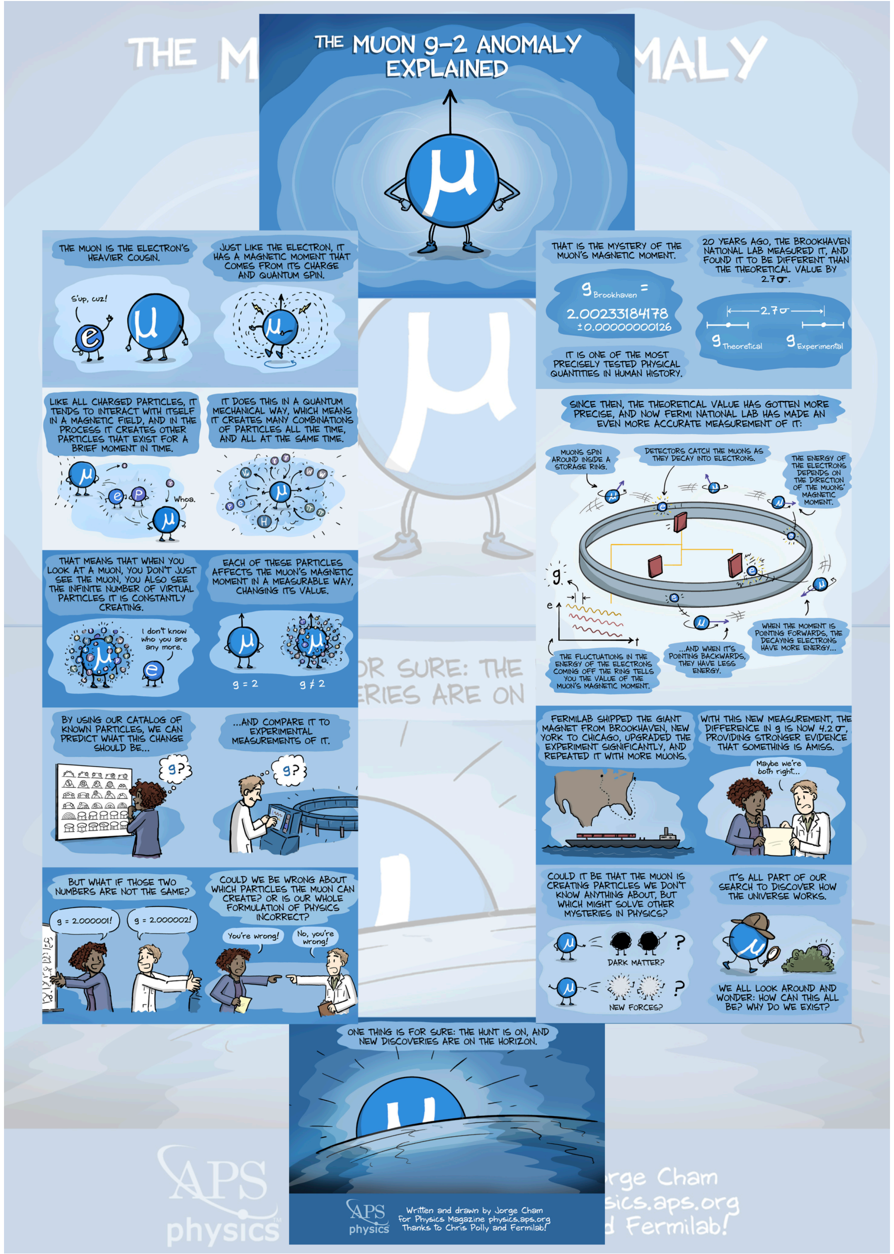
Fermilab

Science news

- APS viewpoint: Muon's Escalating Challenge to the Standard Model
- APS special feature: muon g-2 explained The Muon g–2 Anomaly Explained (nice cartoon)
- APS research news: Measuring the Magnet that Measures the Muon
- Cern courier: Fermilab strengthens muon g-2 anomaly
- Scientific American podcast: Big Physics News: The Muon g-2 Experiment Explained with D. Hertzog
- Nature: Is the standard model broken? Physicists cheer major muon result
- Science: Particle mystery deepens, as physicists confirm that the muon is more magnetic than predicted
- UW News: First results from Muon g-2 experiment strengthen evidence of new physics
- CNN opinion Lincoln: It took a sea and land journey to prove to scientists they were wrong about physics
- Argonne National Lab: Testing Our Fundamental Understanding of the Universe: Muon G-2 Experiment Hints at Mysterious New Physics
- National Science Foundation: First results from Fermilab's Muon g-2 experiment strengthen evidence of new physics
- Physics World: The muon's theory-defying magnetism is confirmed by new experiment

Newspaper articles

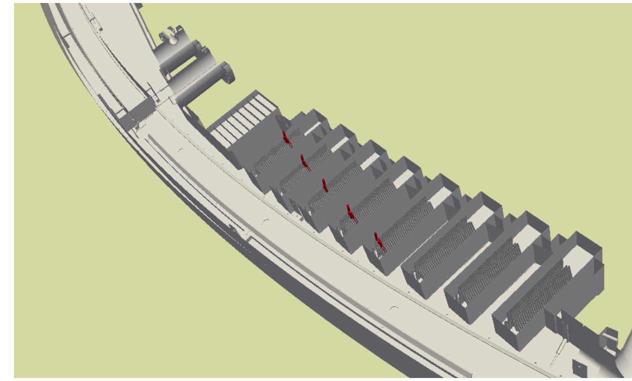
- New York Times: A Tiny Particle's Wobble Could Upend the Known Laws of Physics
- BBC: Muons: 'Strong' evidence found for a new force of nature
- Ars Technica : Fermilab's latest muon measurements hint at cracks in the Standard Model
- Forbes: Why you should doubt new physics from the latest muon g-2 results
- The Indian Express: Muon g–2: landmark study challenges rulebook of particle physics
- The Wire Science: Muon g-2 Anomaly: US Experiments Find Hint of a Crack in the Laws of Physics
- National Geographic : New experiment hints that a particle breaks the known laws of physics
- ABC News: Fermilab experiment results strengthen evidence of new physics
- SCI News : New Measurements of Muon's Magnetic Moment Strengthen Evidence of New Physics
- Los Angeles Times: "Tantalizing" results of two experiments defy physics rulebook
- Luke Skywalker: Evidence is mounting that The Force has been with us… ALWAYS.

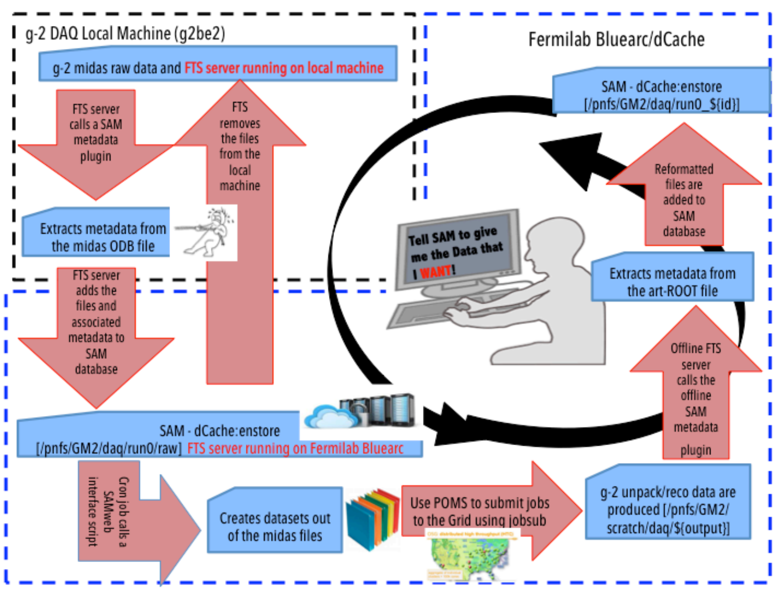


Fermilab

Me on Muon g-2

- Software manager
- Developer of the g-2 software and infrastructure
- Designed the tracking software infrastructure
- Work on tracking algorithms and reconstruction
- Manage, design, and write useful tools for organizing and processing the data





Fermilab scientist Tammy Walton receives Brookhaven's Leona Woods Lectureship Award

April 25, 2018

Share Tweet Email

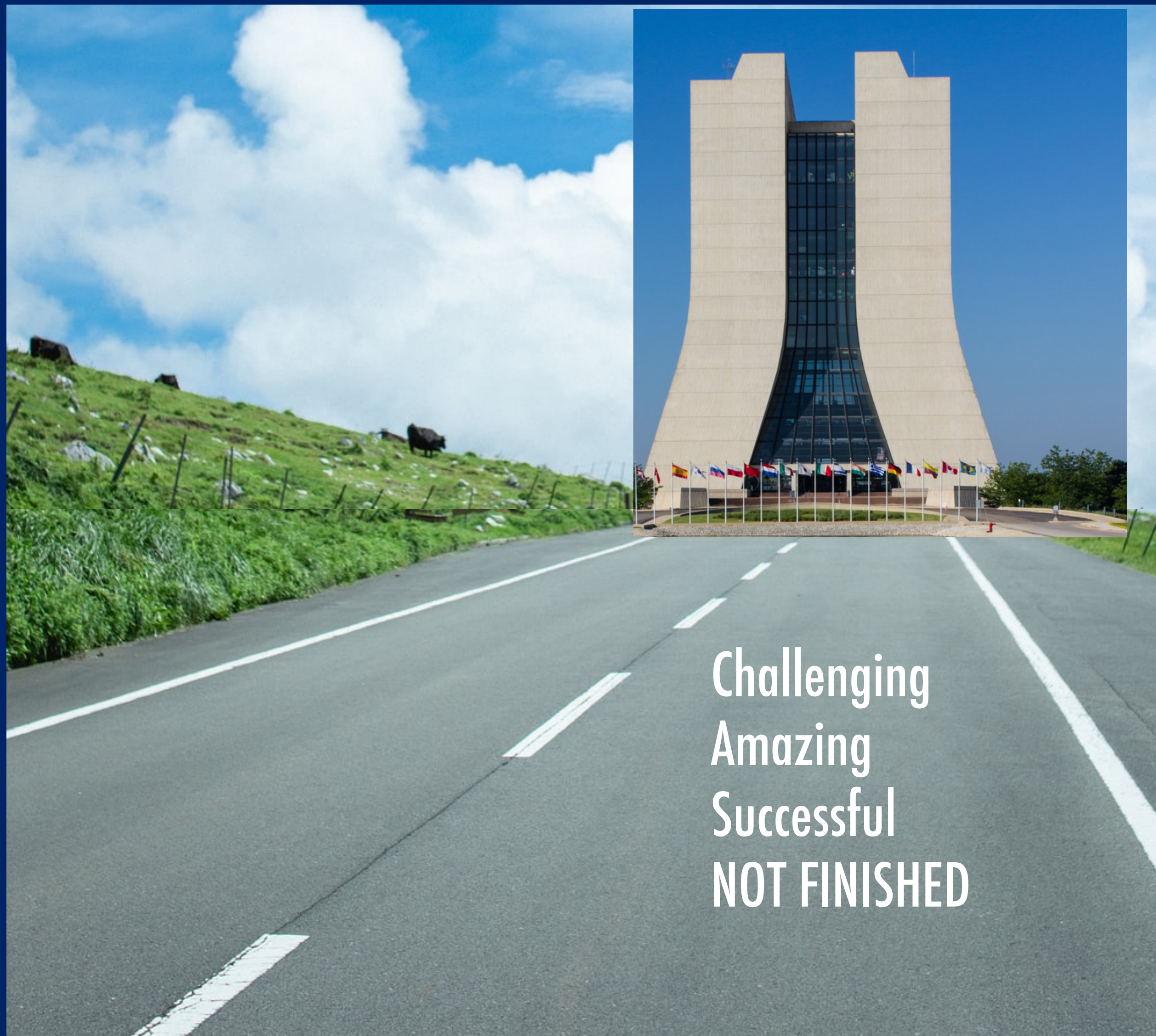
Tammy Walton

Fermilab scientist Tammy Walton, a research associate on the Muon g-2 experiment, has been named the second recipient of the Leona Woods Distinguished Postdoctoral Lectureship Award, which is given by the Physics Department at Brookhaven National Laboratory. The new experiment is conducting precision measurements to follow up on results reported in the early 2000s by Brookhaven's version of the experiment. Those measurements indicated that muons, heavy cousins of electrons, were interacting with a powerful magnetic field in a subtly different way than expected, potentially pointing to new physics inexplicable by today's reigning theory of particle physics.

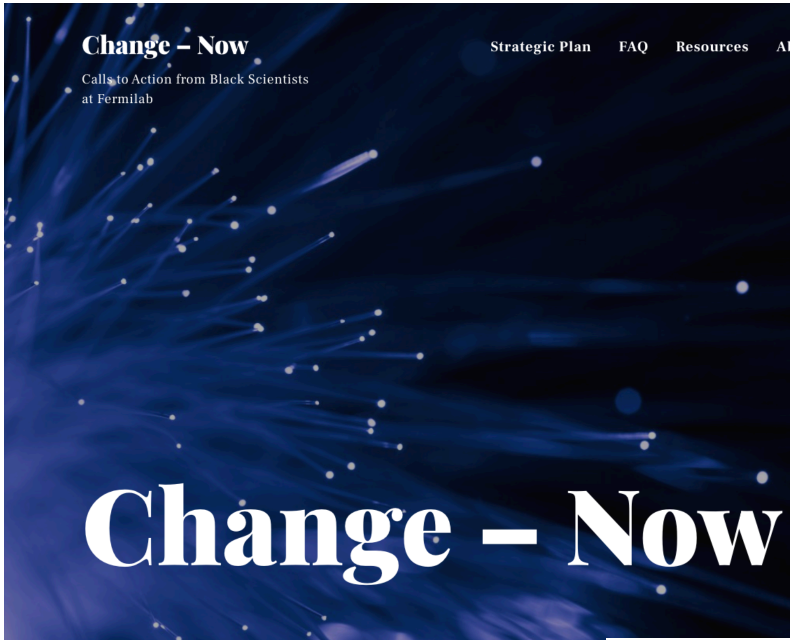
As recipient of the Leona Woods Lectureship Award, Walton will receive a prize of $1,000 and the opportunity to give a general-interest colloquium and a technical talk about her work — both open to the public — during a weeklong stay at Brookhaven. She will also participate in informal discussions with Brookhaven physicists, including some who worked on the earlier version of the Muon g-2 experiment and theorists who are continually improving the precision of their predictions for the property under question: the muon's so-called anomalous magnetic moment, which could reveal physics beyond the Standard Model.

Brookhaven's Physics Department established the Leona Woods Distinguished Postdoctoral Lectureship Award to celebrate the

My Road to Fermilab



My Road to Fermilab

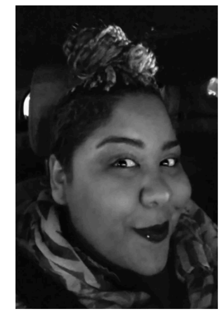



Dr. Michael Kirby, Scientist


Dr. Corrinne Mills, Associate Scientist Assistant Professor


Dr. Jennifer Raaf, Senior Scientist


Dr. Doug Berry, Associate Scientist


Dr. Jessica Esquivel, Research Associate


Dr. Brian Nord, Associate Scientist


Dr. Erica Snider, Senior Scientist


Dr. Jason St. John, Applications Physicist


Dr. Bryan Ramson, Research Associate


Dr. Tammy Walton, Associate Scientist


Dr. Daniel Bowring, Scientist


Dr. Alex Drlica-Wagner, Associate Scientist


Dr. Bo Jayatilaka Scientist

Enjoy the Superheroes STEM Conference!

WE NEED YOU FOR THE FUTURE!

Special Thank you to Jessica Esquivel and Bo Jayatilaka