

Quarks

Chris Newey
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Outline of Presentation

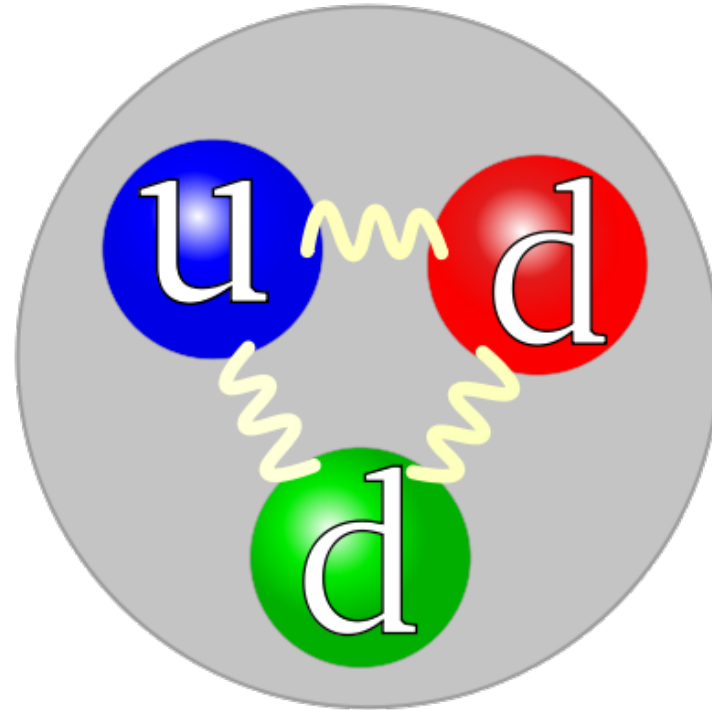
- What is a Quark?
- History of the quark
 - Major discoveries and discoverers
- Standard Model
 - General description
 - Where do Quarks fit in?



<https://upload.wikimedia.org/wikipedia/commons/5/55/MurrayGellMannJI1.jpg>

Why Do We Care About Quarks?

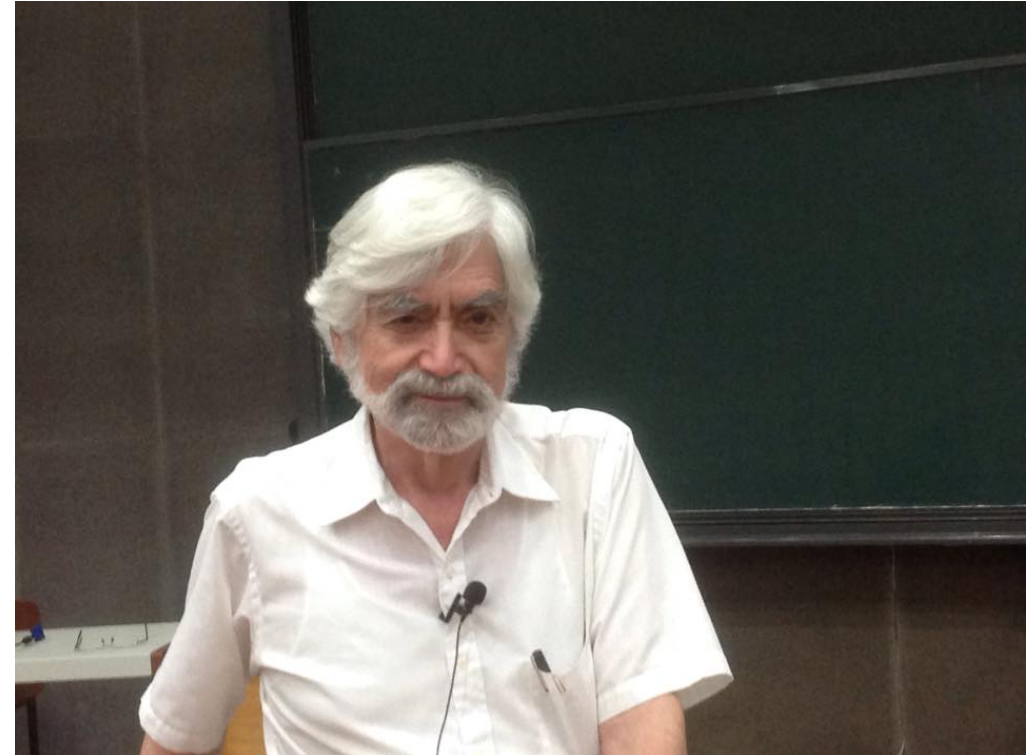
- A fundamental particle
- Building block of matter?
- Participant in
 1. Gravity
 2. Electroweak
 3. Strong



https://en.wikipedia.org/wiki/Neutron#/media/File:Quark_structure_neutron.svg

History of the Quark

- Who first theorized the quark?
- When were they theorized?
- Why are they called Quarks?



https://commons.wikimedia.org/wiki/File:George_Zweig.jpg

<https://upload.wikimedia.org/wikipedia/commons/8/8a/Stanford-linear-accelerator-usgs-ortho-kaminski-5900.jpg>

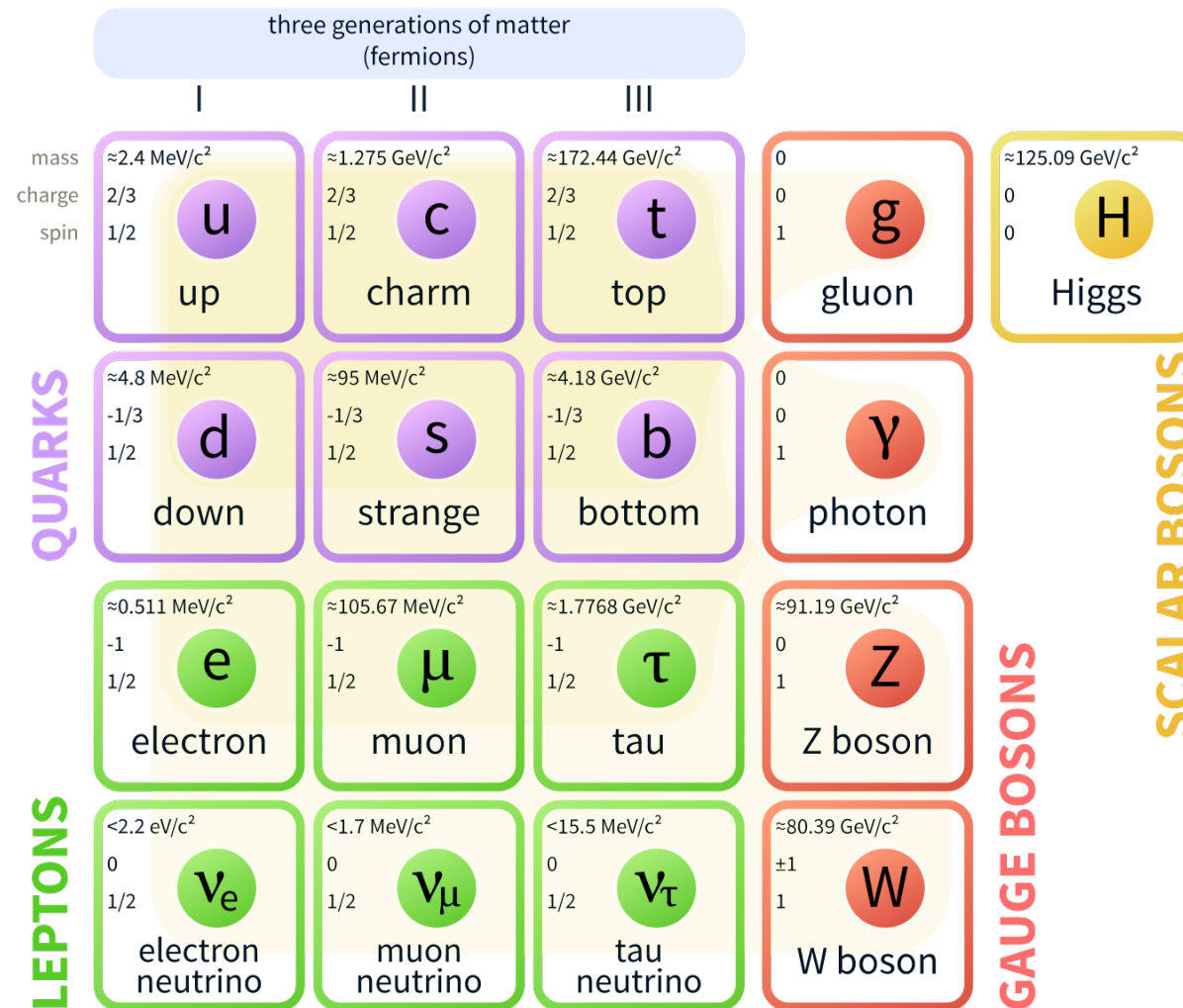


What Were The First Experiments

United States Geological Survey

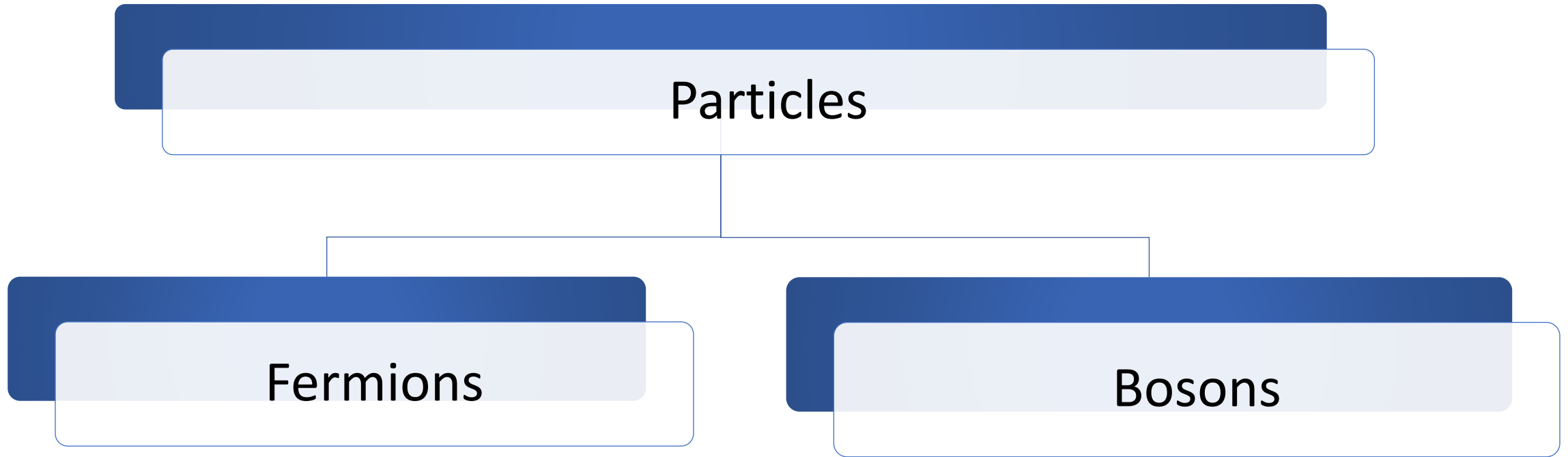


Standard Model of Elementary Particles

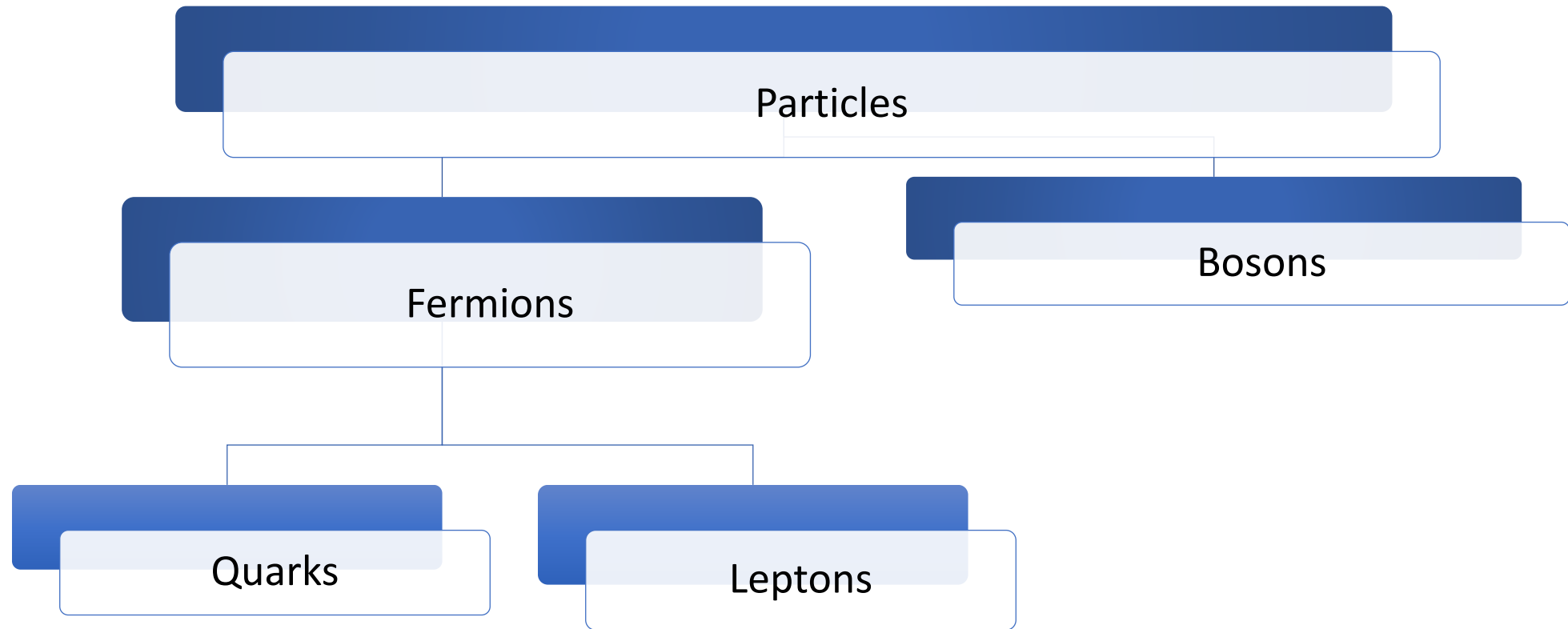


https://upload.wikimedia.org/wikipedia/commons/0/00/Standard_Model_of_Elementary_Particles.svg

Breaking the Model Apart



From Fermions to Quarks



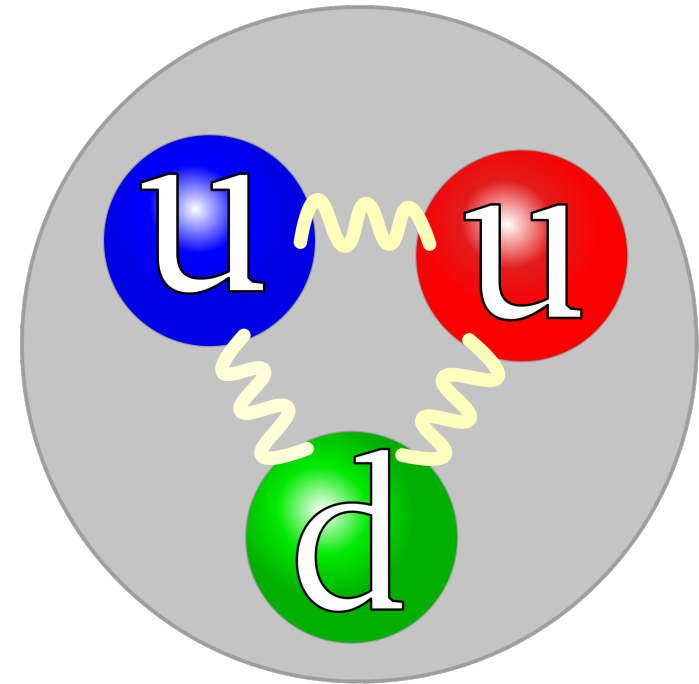
How Many Quarks Exist?

Quark Name	Charge (e)	Mass (MeV/C ²)	Spin	Color Charge
Up	+2/3	1.7-3.3	1/2	r,g,b
Down	-1/3	4.1-5.8	1/2	r,g,b
Charm	+2/3	1180-1340	1/2	r,g,b
Strange	-1/3	80-130	1/2	r,g,b
Top	+2/3	≈172000	1/2	r,g,b
Bottom	-1/3	4130-4370	1/2	r,g,b

(Robinson, Mathew. *Symmetry and the Standard Model* pg. 35 and Harris, Randy. *Modern Physics* pg 529)

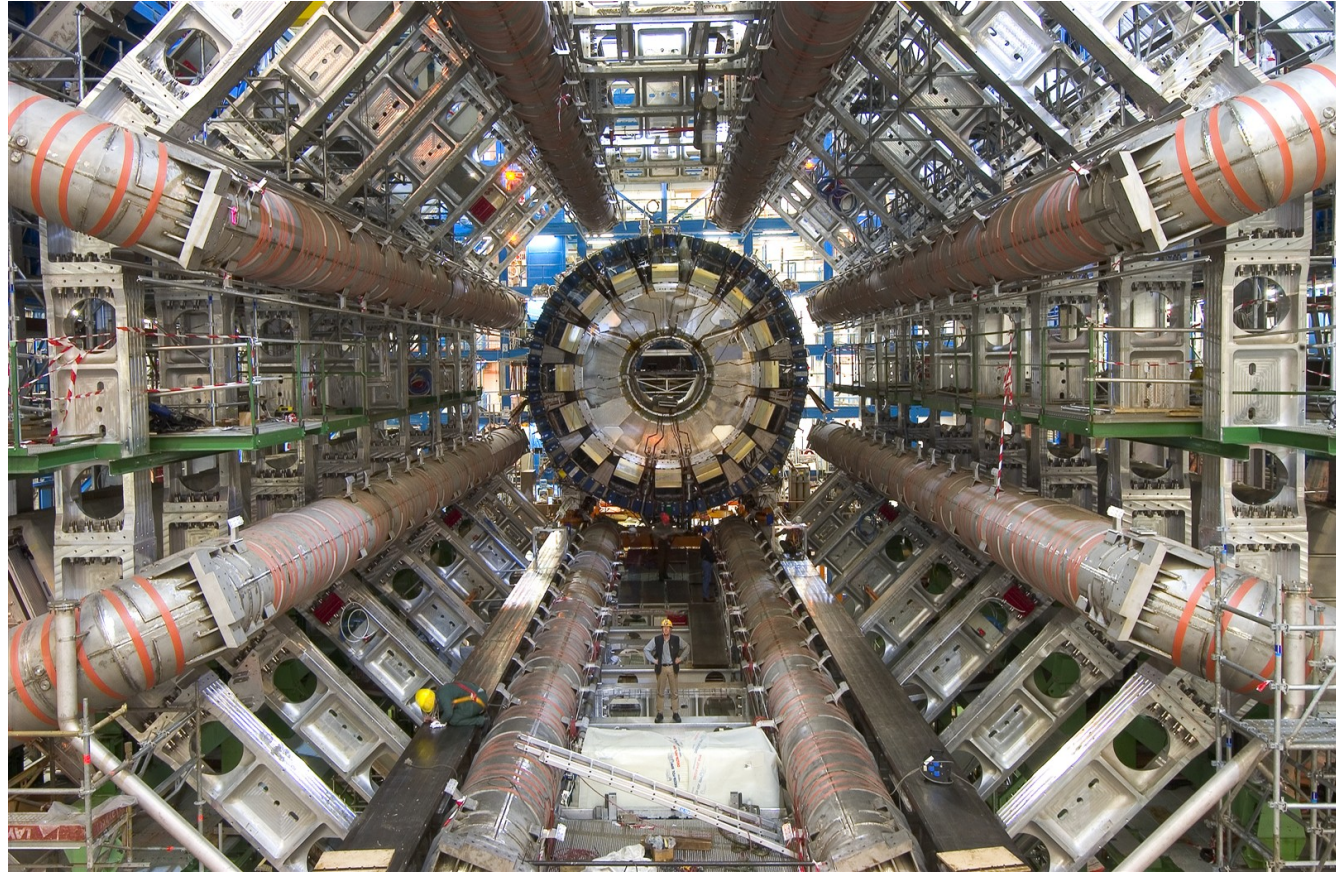
What Fundamental Forces Do Quarks Interact With?

- What properties are associated with each force?
 - Gravitation: Mass/Energy
 - Electroweak: Charge/Weak Charge
 - Strong (QCD): Color Charge



https://upload.wikimedia.org/wikipedia/commons/9/92/Quark_structure_proton.svg

Conclusion



https://upload.wikimedia.org/wikipedia/commons/f/fa/Installing_the_ATLAS_Calorimeter.jpg

Works Cited

Harris, Randy. *Modern Physics*. 2nd ed., Pearson, 2014.

Robinson, Matthew *Symmetry and the Standard Model: Mathematics and Particle Physics*. Springer, 2011.

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