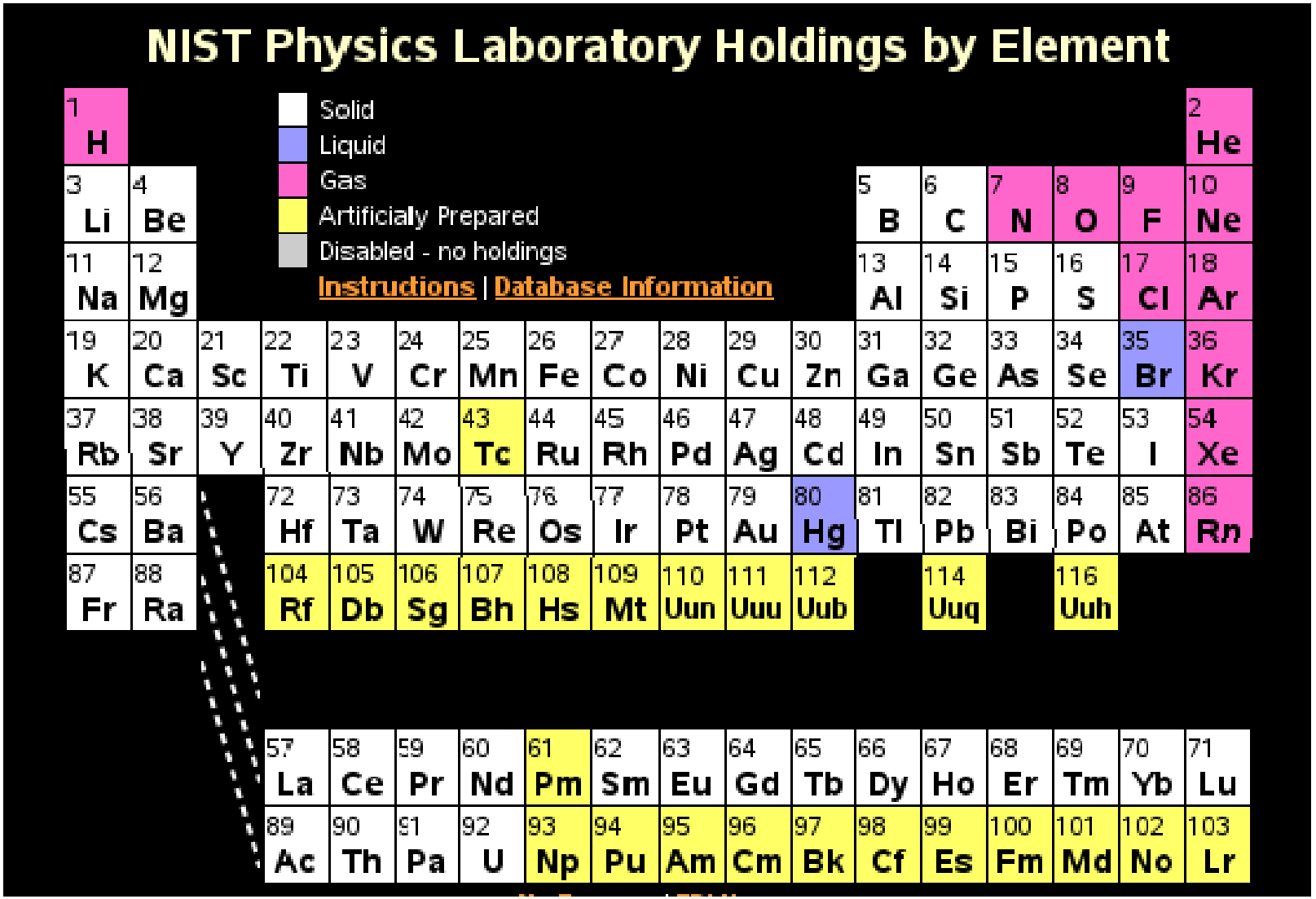
# What's Inside the Neutron?

*Jerry Gilfoyle, University of Richmond*


"The Periodic Table"

# The Periodic Chart



# What Do We Know?

- The Universe is made of quarks and leptons and the force carriers.

**BOSONS** — force carriers spin = 0, 1, 2, ...

| Unified Electroweak spin = 1 | | |
|---|---|---|
| Name | Mass GeV/$c^2$ | Electric charge |
| $\gamma$ photon | 0 | 0 |
| $W^-$ | 80.4 | −1 |
| $W^+$ | 80.4 | +1 |
| $Z^0$ | 91.187 | 0 |

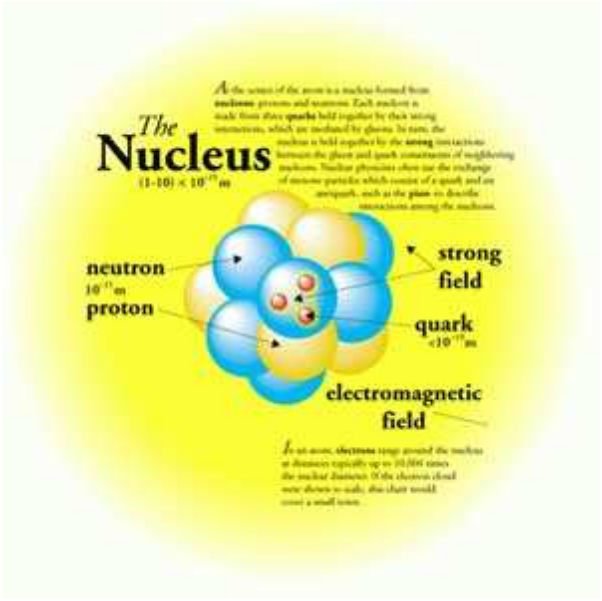
| Strong (color) spin = 1 | | |
|---|---|---|
| Name | Mass GeV/$c^2$ | Electric charge |
| g gluon | 0 | 0 |

**FERMIONS** — matter constituents spin = 1/2, 3/2, 5/2, ...

| Leptons spin = 1/2 | | |
|---|---|---|
| Flavor | Mass GeV/$c^2$ | Electric charge |
| $\nu_e$ electron neutrino | $<1\times10^{-8}$ | 0 |
| e electron | 0.000511 | −1 |
| $\nu_\mu$ muon neutrino | <0.0002 | 0 |
| $\mu$ muon | 0.106 | −1 |
| $\nu_\tau$ tau neutrino | <0.02 | 0 |
| $\tau$ tau | 1.7771 | −1 |

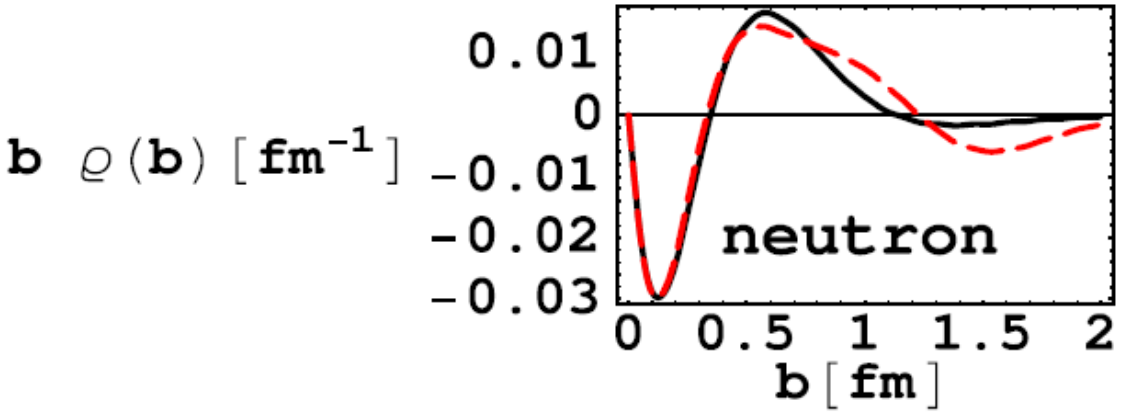
| Quarks spin = 1/2 | | |
|---|---|---|
| Flavor | Approx. Mass GeV/$c^2$ | Electric charge |
| u up | 0.003 | 2/3 |
| d down | 0.006 | −1/3 |
| c charm | 1.3 | 2/3 |
| s strange | 0.1 | −1/3 |
| t top | 175 | 2/3 |
| b bottom | 4.3 | −1/3 |

- The atomic nucleus is made of protons and neutrons bound by the strong force.

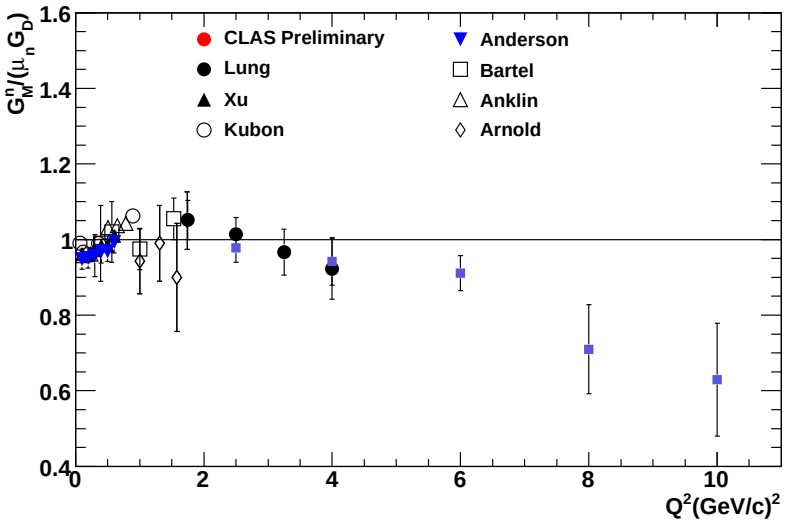



- The quarks are confined inside the protons and neutrons.
- Protons and neutrons are NOT confined.

# What We Know About the Neutron.




Which comes from ...



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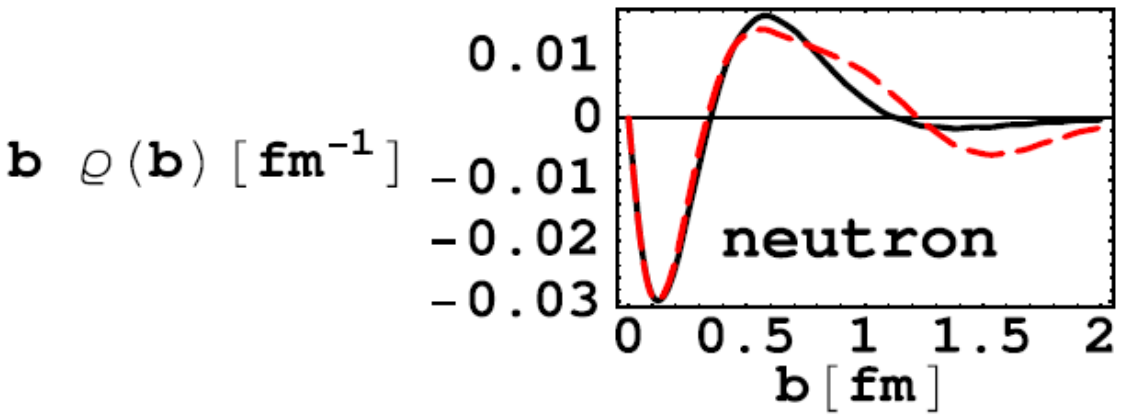
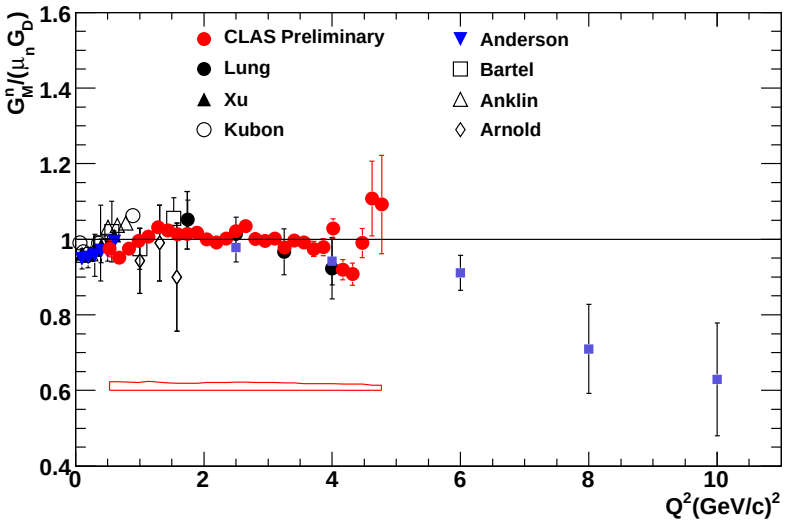
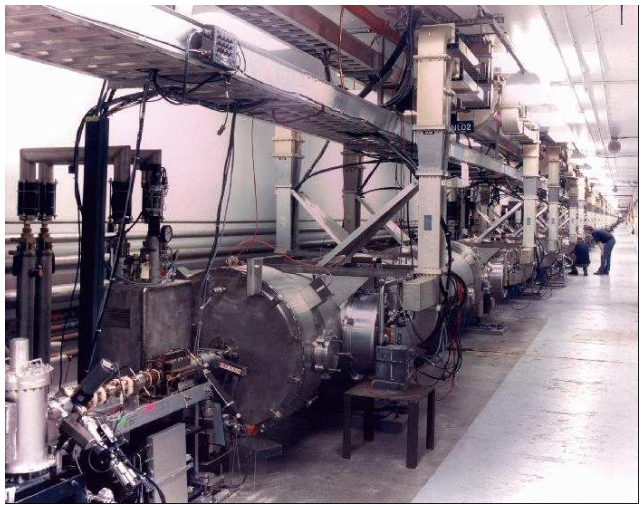


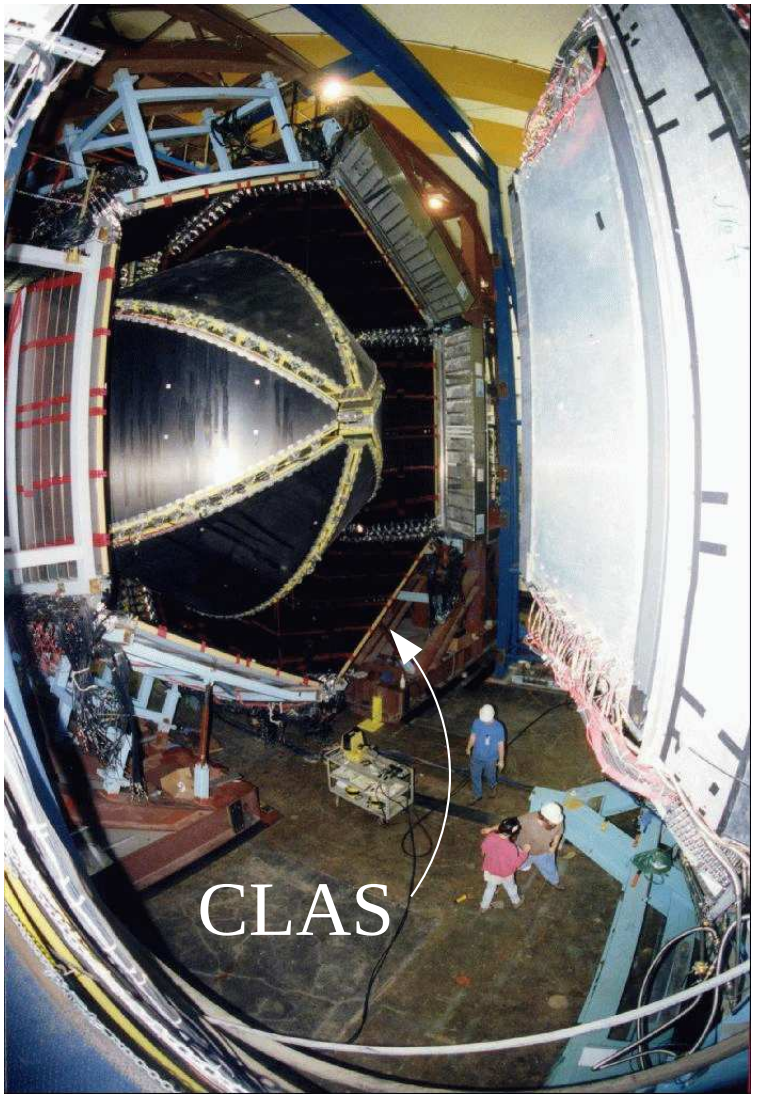

Which comes from ...



# Experiments at Jefferson Lab



# The CEBAF Large Acceptance Spectrometer (CLAS)



# Life on the Frontiers of Knowledge

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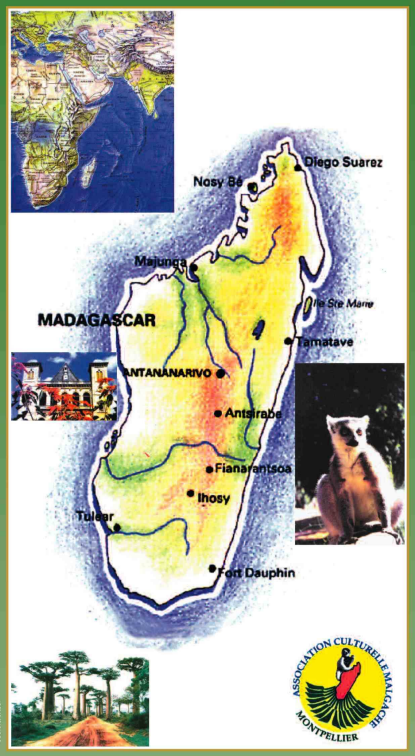
## 3rd High-Energy Physics Conference in Madagascar

10-15th September 2007 (Antananarivo)

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Weak, rare decays and CP-violation,
Physics beyond the standard model,
Neutrino Oscillations.

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### Url Address

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