"Welcome"

"Dark Interactions:
Perspectives from Theory and Experiment"

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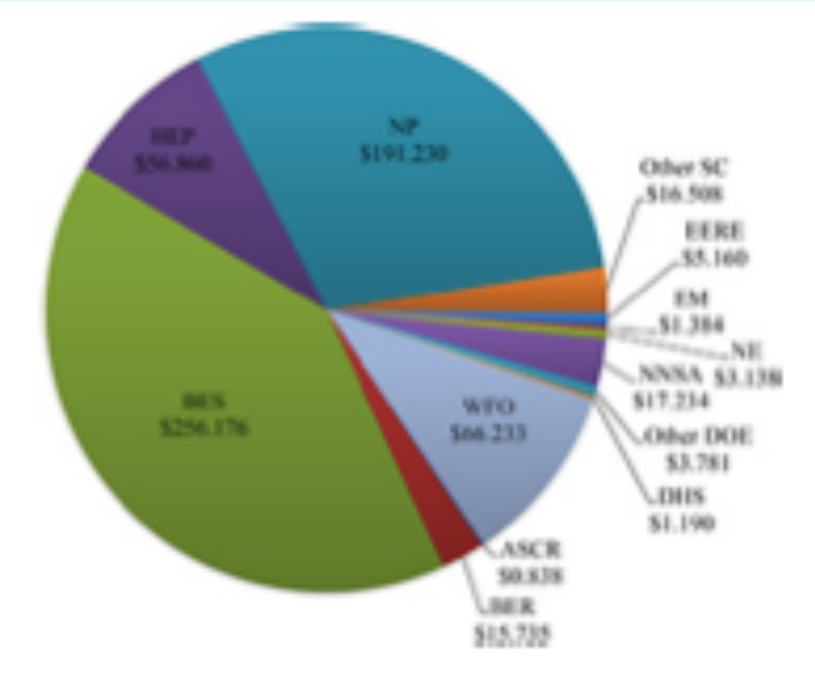
(October 4, 2016)

BROOKHAVEN
NATIONAL LABORATORY

BNL is a Multi-Purpose National Lab

- Physics (Nuclear, BES, HEP) Chemistry, Biology, Energy… etc
- Nuclear (RHIC), BES (NSLS II) Major Facilities
- **HEP (ATLAS, Neutrinos [Daya Bay, DUNE…], g_μ-2, Theory…)**



BNL Campus: (RHIC & NSLS Rings)

- 5,320 Acres, ~300 Buildings, ≤ 3000 Employees
- Relativistic Heavy Ion Collider – Last USA Collider!

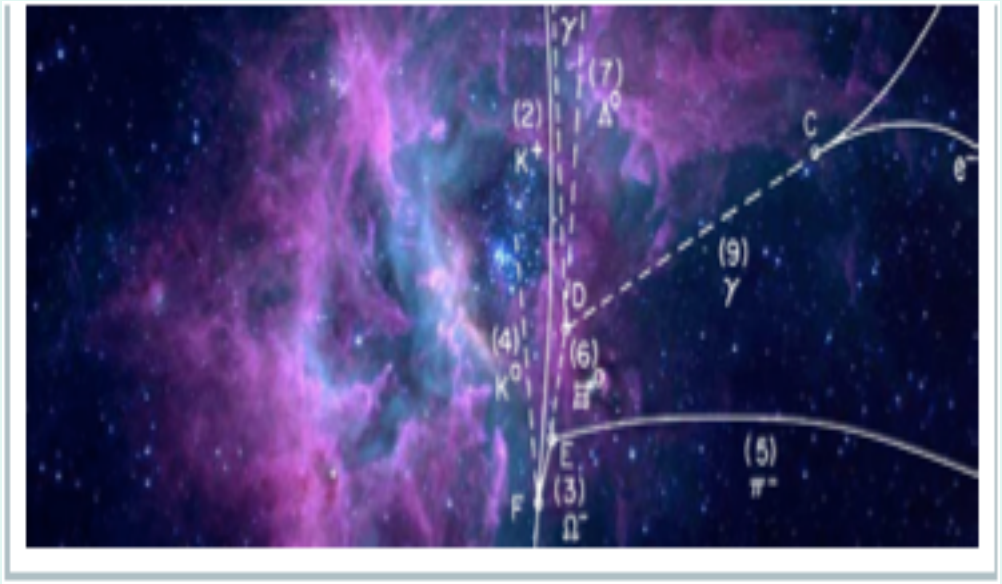
NSLS II (Newest Light Source) ~$1 Billion

Photo: Brookhaven National Laboratory

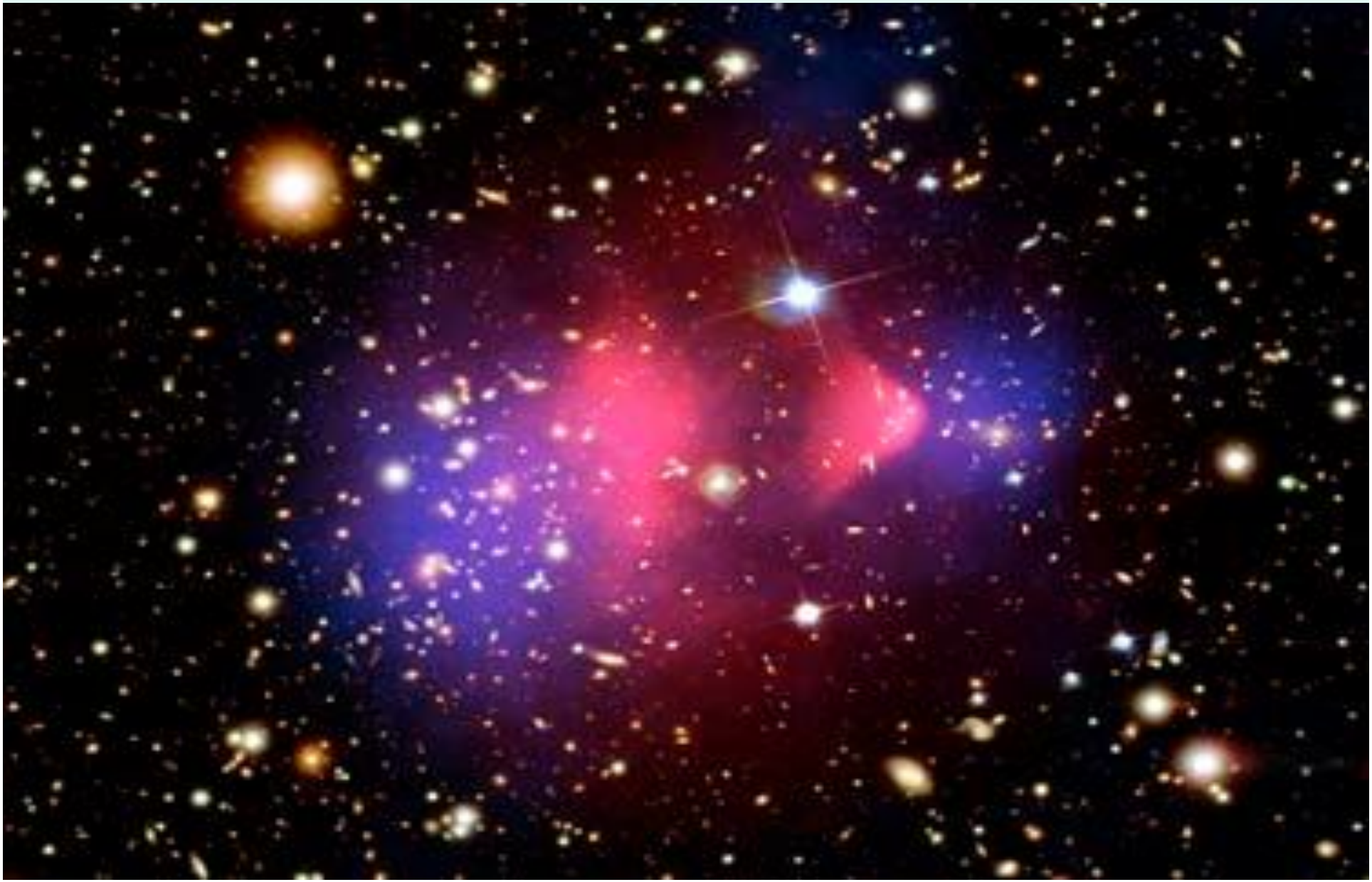
BNL HEP "Physics of the Universe"

Exploring the Frontiers of Energy, Intensity and the Cosmos

- Featured Projects:ATLAS, Daya Bay, DUNE, LSST, BOSS



Bullet Galaxy Cluster Dark Matter Poster



The Dark Boson – A Portal to Dark Matter

What if some dark **sector** particles interact with one another via a new massive but relatively "light" γ_d (Dark Boson)?

$U(1)_d$ local gauge symmetry of the Dark Sector

Introduced for 1) Sommerfeld Enhancement

2) $\gamma_d \rightarrow e^+e^-$ (source of positrons, ***γ-rays)***

3) Cosmic Stability of dark matter $U(1)_d$

eg Wimp Number (S. Weinberg)

4) Light (< GeV) Dark Matter Abundance

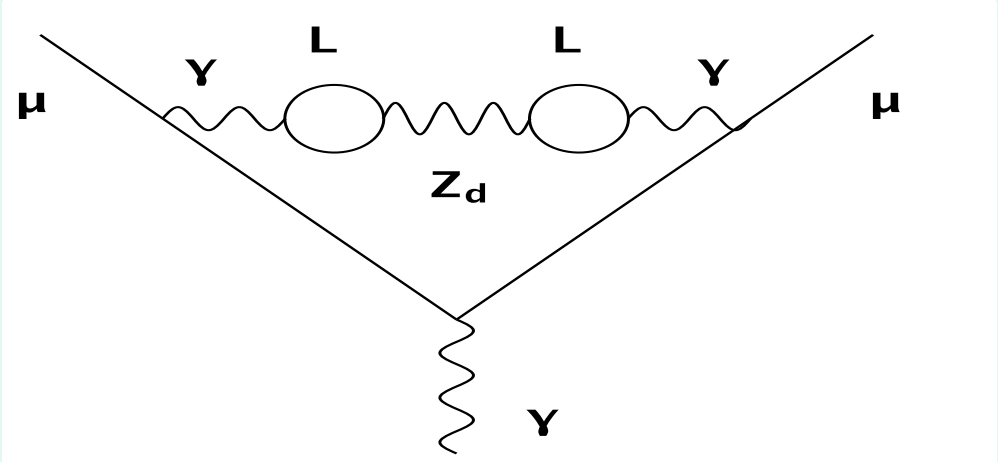
****5) Muon Anomalous Magnetic Moment***

etc.

Can we find direct evidence for such a particle (boson)?

* *Dark Boson g_μ-2 Solution*
(Fayet, Pospelov…)

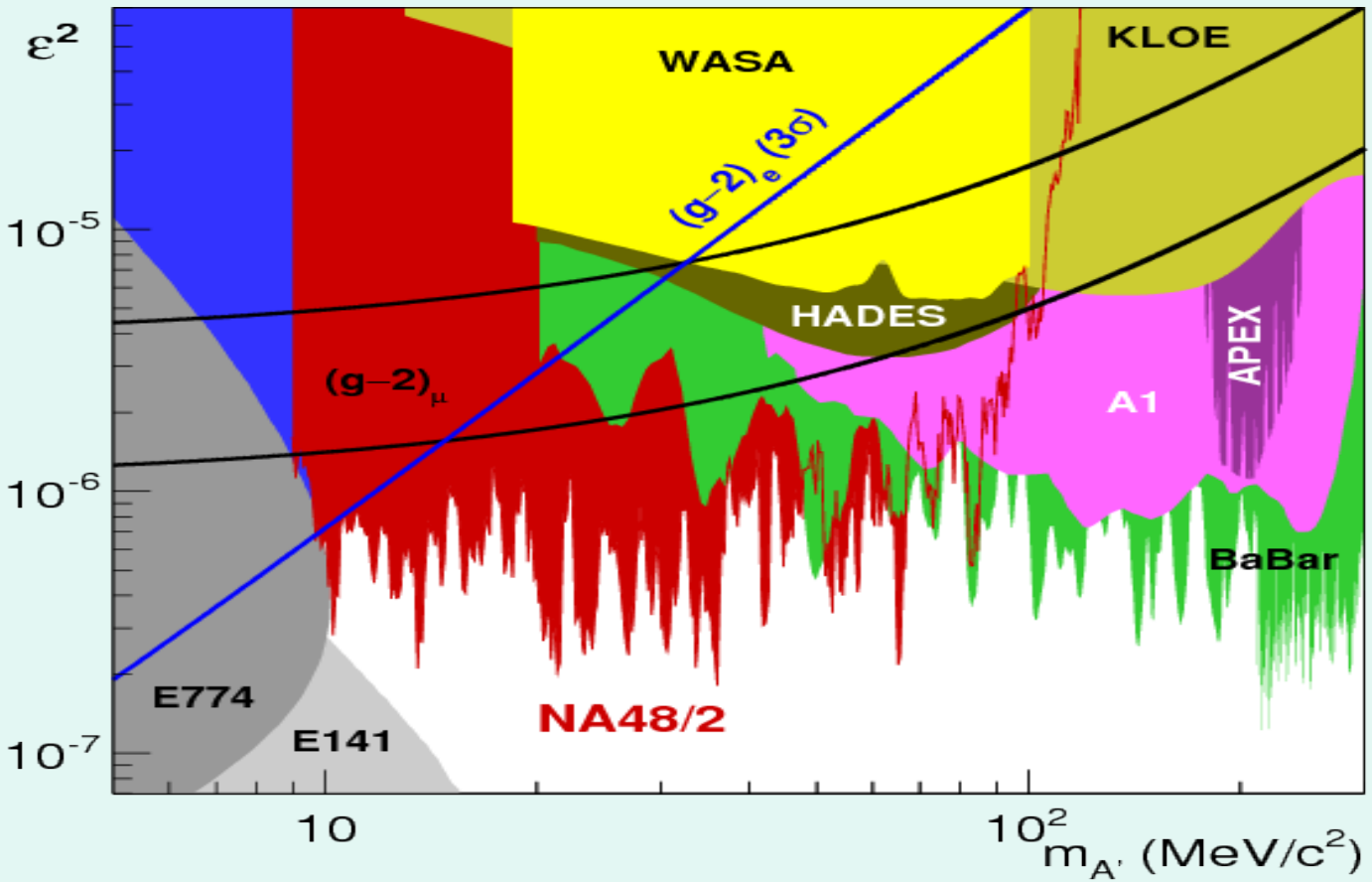
- **3 Loop Diagram Example**



NA48/2 Updated Bounds on Dark Photon

Simple **g_μ-2 discrepancy solution ruled out**

Assumes BR(Z_d ➔ e+e-) ~1



BNL to FNAL: The Last Mile