U.S. DEPARTMENT OF ENERGY | Office of Science

Perspectives on the Future of Nuclear Physics in the United States

BNL Distinguished Lecture Series

June 13, 2012

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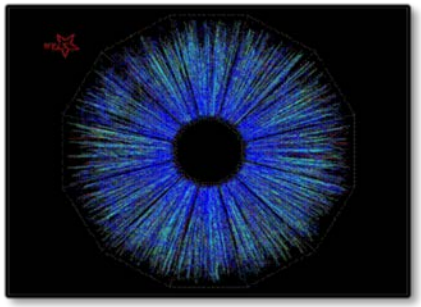
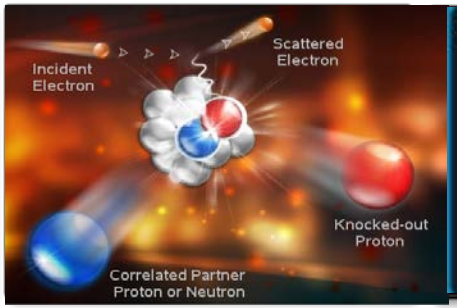
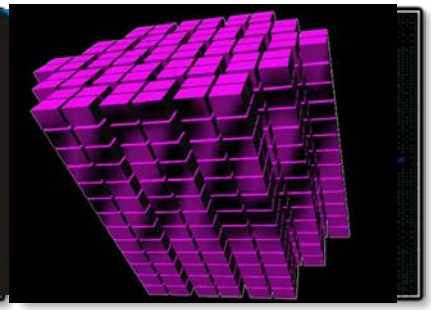
Associate Director for Nuclear Physics
DOE Office of Science







Disclaimer:

The views expressed are the opinion of the speaker (only)

The speaker continues to be an avid student of all the marvelous nuclear science research ongoing with the United States

The speaker has more questions than answers (input welcome)

Some comments are intended to provoke discussion and feedback

The talk is largely organized around four discovery science portfolios within NP (Heavy Ion, Medium Energy, Low Energy, Nuclear Theory)

This talk will attempt to focus on science (not budgets or politics)

The Breadth of the U.S. NP Discovery Horizon: "This is not your father's nuclear science"

Neutron-rich Nuclei;
Structure Of Nuclei;

Reactions in Core Collapse Super Novae;

Super Heavy Element 117
Heavy Nuclei Formation;
Density Effects in Nuclei;
Neutron Skins;

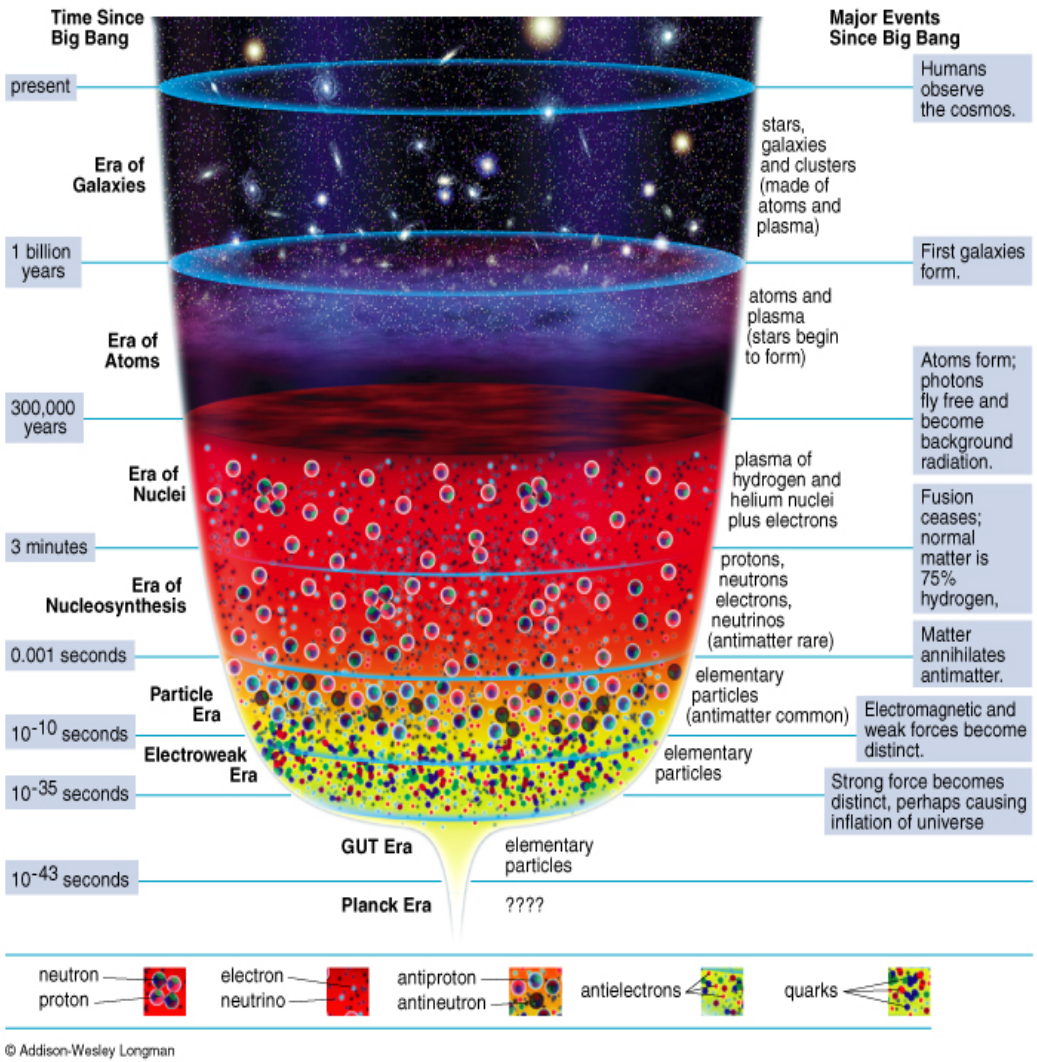
Nuclear-Reactions;

NP Discovery Horizon

Anti-Helium 4;
Proton Spin
Majorana/DIRAC Neutrino;
Perfect QGP Liquid

Neutron Beta Decay;
Neutron EDM;
Parity Violation Searches;

Evolution of the Universe



From The Frontiers of Nuclear Science from the 2007 Long Range Plan

(1) QCD and its implications and predictions for the state of matter in the early universe, quark confinement, the role of gluons, and the structure of the proton and neutron;

(2) The structure of atomic nuclei and nuclear astrophysics, which addresses the origin of the elements, the structure and limits of nuclei, and the evolution of the cosmos; and

(3) Developing a New Standard Model of nature's fundamental interactions, and understanding its implications for the origin of matter and the properties of neutrinos and nuclei.

Quantum Chromodynamics

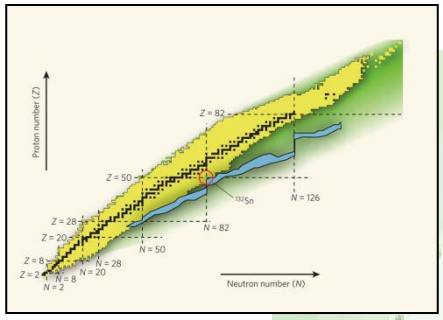
- What are the phases of strongly interacting matter, and what roles do they play in the cosmos?
- What is the internal landscape of the nucleons?
- What does QCD predict for the properties of strongly interacting matter?
- What governs the transition of quarks and gluons into pions and nucleons?
- What is the role of gluons and gluon self-interactions in nucleons and nuclei?
- What determines the key features of QCD, and what is their relation to the nature of gravity and spacetime?

Fundamental Symmetries and Neutrinos

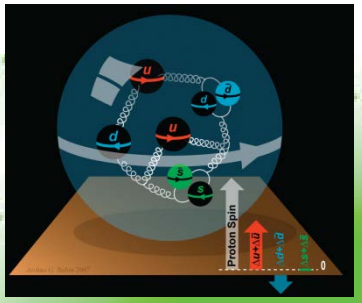
- What is the nature of the neutrinos, what are their masses, and how have they shaped the evolution of the universe?
- Why is there now more visible matter than antimatter in the universe? ?
- What are the unseen forces that were present at the dawn of the universe but disappeared from view as the universe evolved? ?

● = what the NP medium energy subprogram is expected to and will address

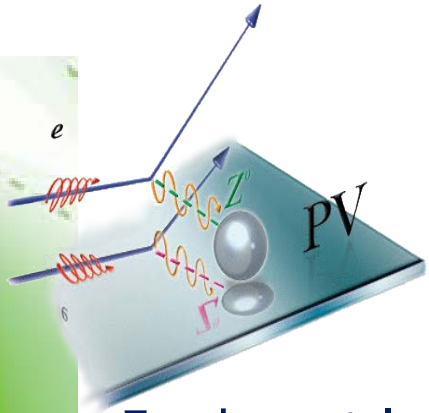
JLAB: A Laboratory for Nuclear Science



Nuclear Structure

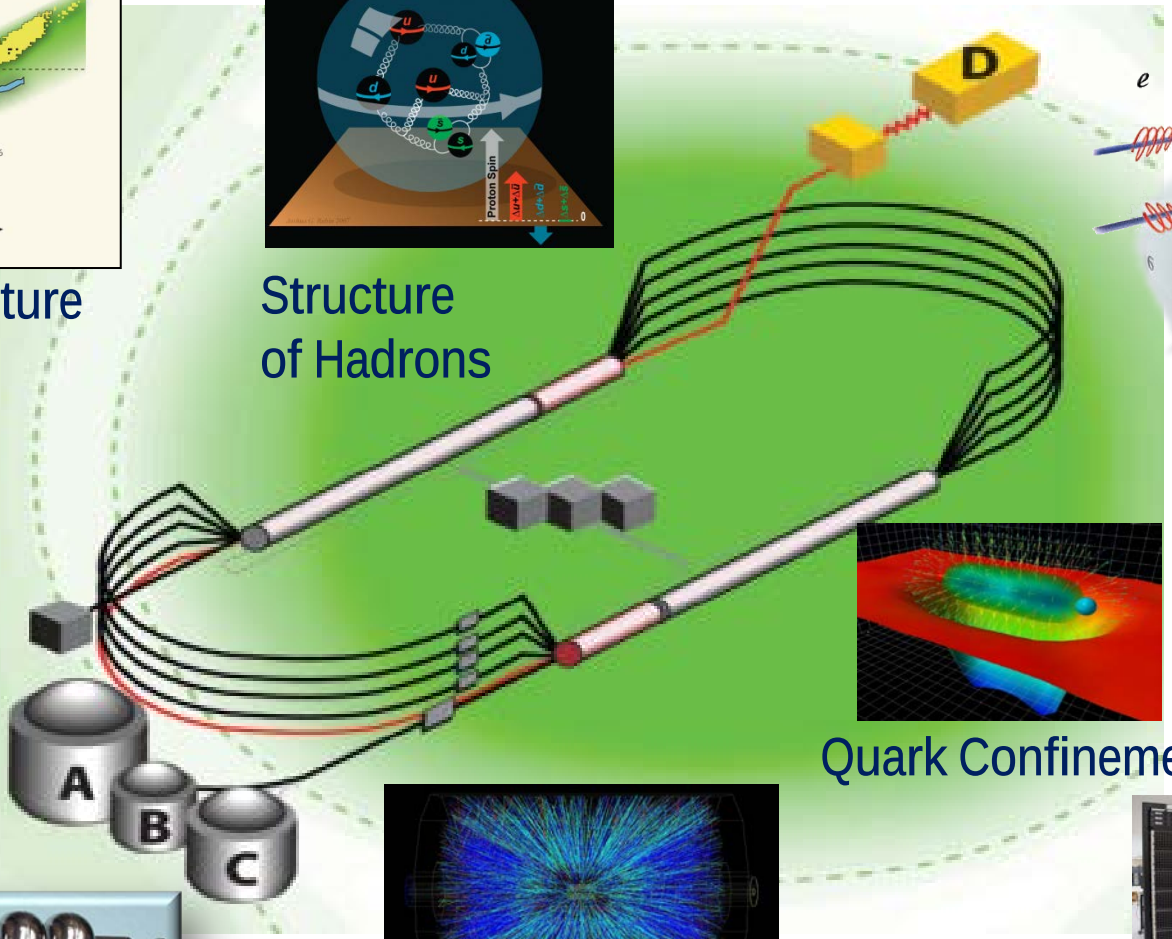


Structure of Hadrons

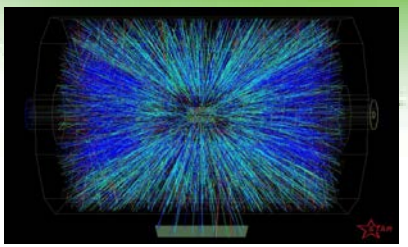


Fundamental Forces & Symmetries

Medical Imaging



Quark Confinement

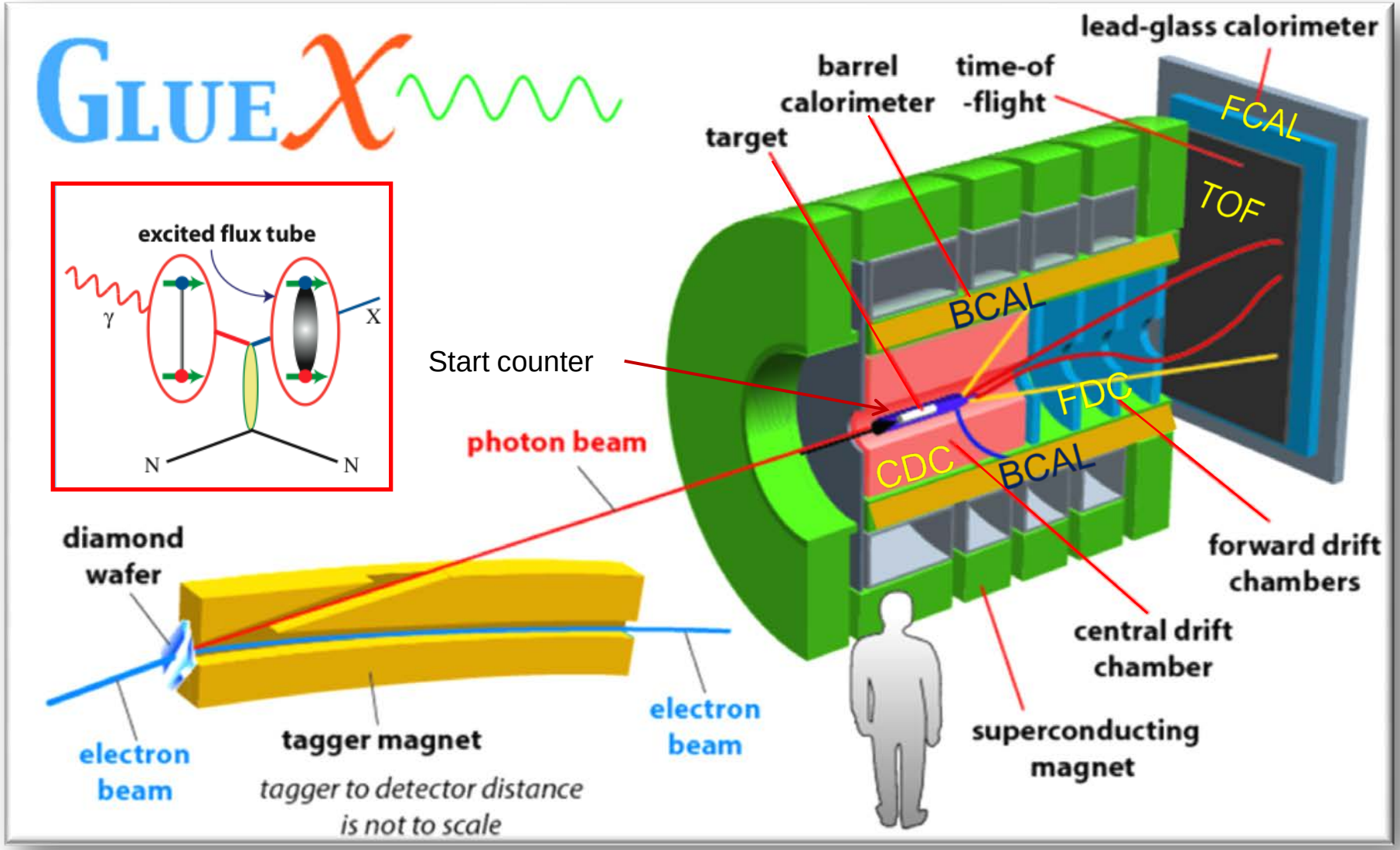


Hadrons from QGP

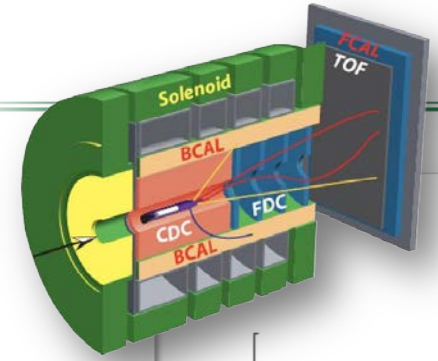
Theory and Computation

Accelerator S&T

Hall D

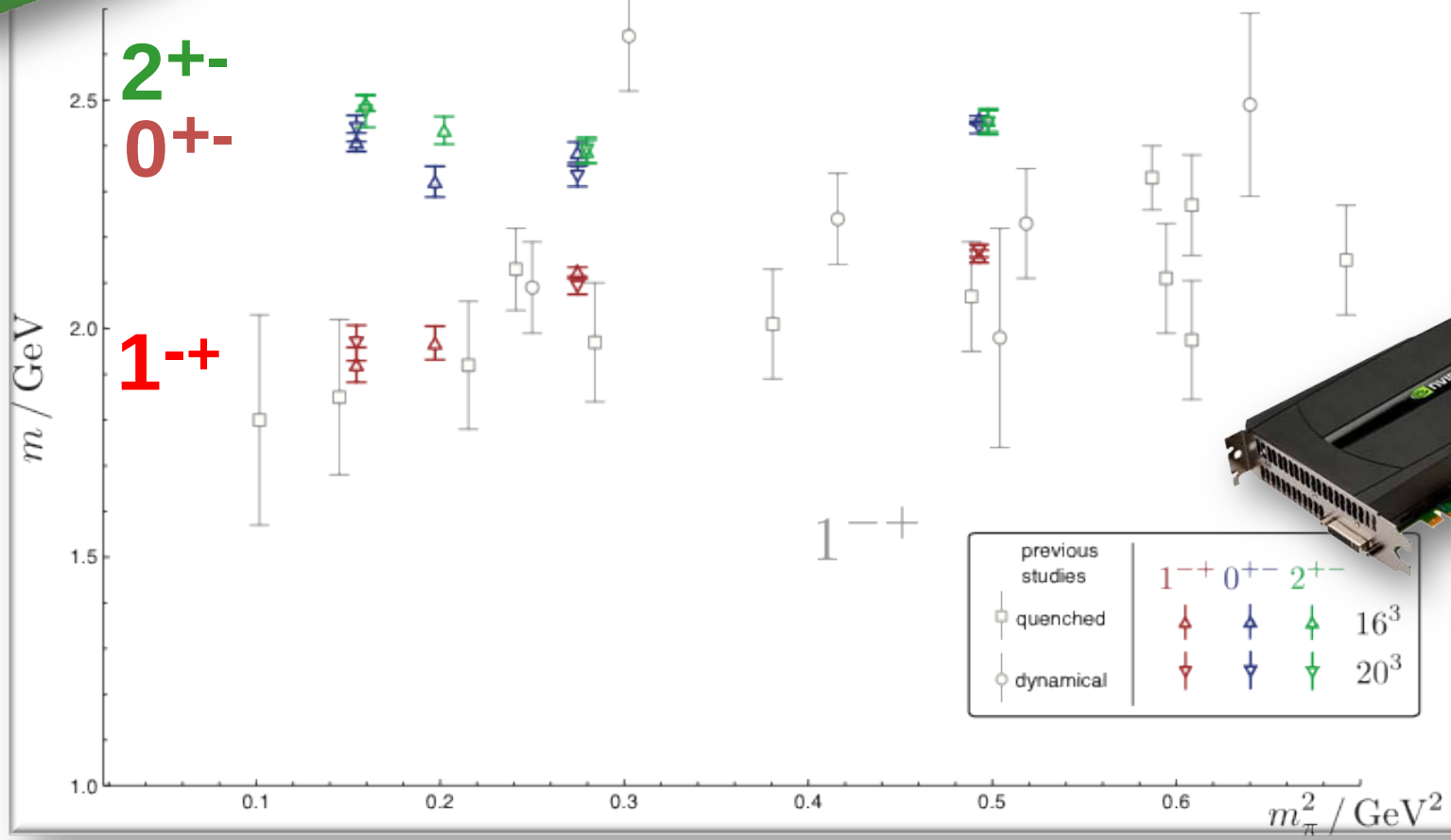

GlueX
excited flux tube
γ
X
N
N
lead-glass calorimeter
barrel calorimeter
time-of -flight
target
FCAL
TOF
BCAL
Start counter
FDC
photon beam
CDC
BCAL
diamond wafer
forward drift chambers
central drift chamber
electron beam
tagger magnet
electron beam
superconducting magnet
tagger to detector distance is not to scale

Isovector Meson Spectrum



GlueX CITATIONS PERIMENT
Hall D@JLab

States with Exotic Quantum Numbers



Dudek et al.

Speaker's Remarks

What is particularly powerful is the promised of significant advances in LQCD (more sophisticated, more precise, larger calculations) combined with experimental data from Hall D,

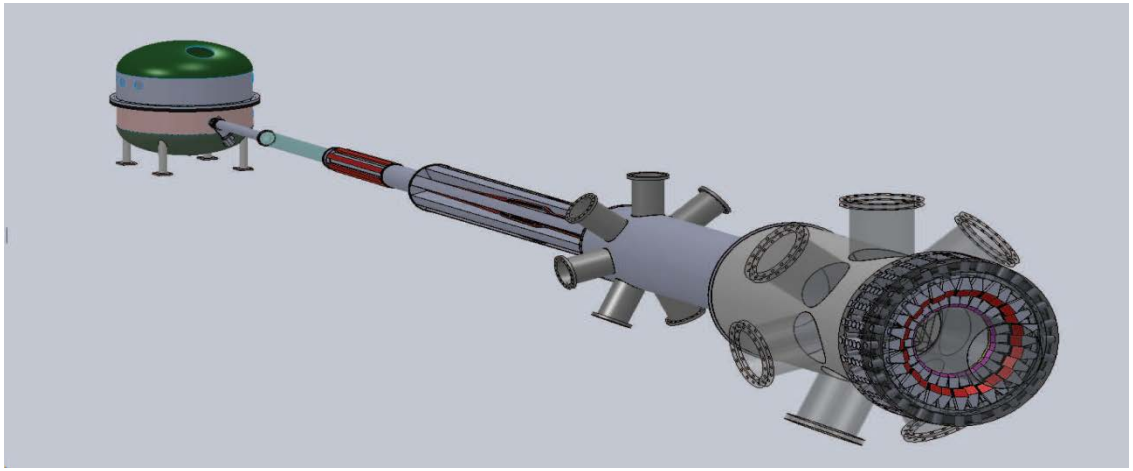
Initially from LQCD one expects to get the spectrum of states (masses and quantum numbers), e.g. for glueballs, exotic mesons (hybrid w/ gluonic excitations), conventional mesons and baryons… significant strides have already been made although the u,d masses (hence m_π) is till too high too high.

Nonetheless, as an example of the promsie of this research the flux tube and constituent gluon models predict different spectra for hybrids, which the lattice can distinguish.

Important upcoming steps to realize this goal will be predicting the photo-couplings of these states and predicting their strong decays – what final states can they be seen in, and how broad are they?

These production and strong decay questions are crucial and largely untouched questions for glueballs and hybrids (gluonic excitations). A whole new field!

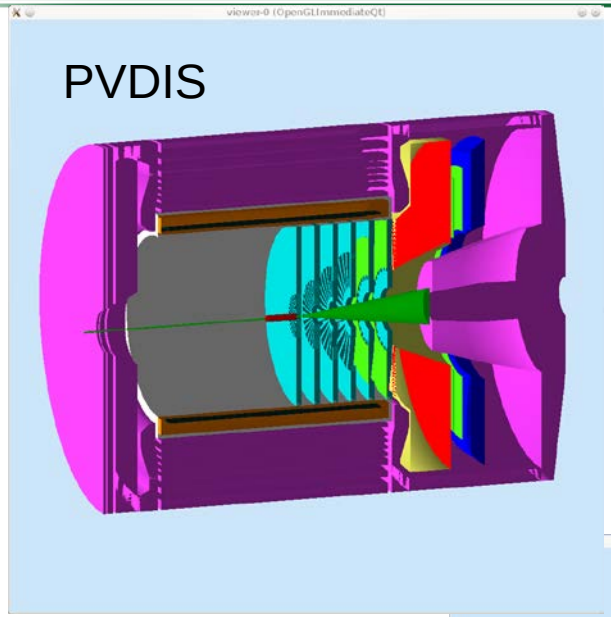
Longer term possibilities at JLab



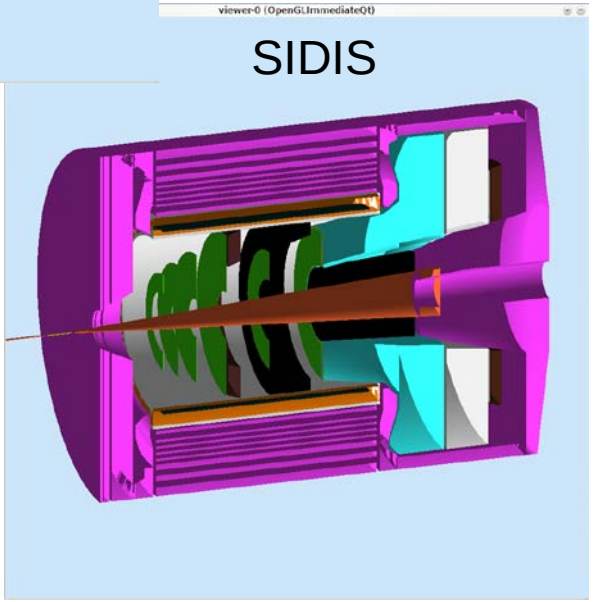
The MOLLER experiment at JLab proposes to measure the parity-violating asymmetry in electron-electron (Moeller) scattering. The measurement will be carried out with a longitudinally polarized electron beam that has been accelerated to 11 GeV at CEBAF, and observing the resulting fractional difference in the probability of electrons scattering off atomic electrons in a liquid hydrogen target.

The asymmetry is proportional to the weak charge of the electron, which in turn is a function of the electroweak mixing angle, a fundamental parameter of the electroweak theory. The accuracy of the proposed measurement will provide a value of the mixing angle with a precision on par with the two single best measurements of the same parameter at electron-positron colliders.

Longer term possibilities at JLab



The Solenoidal Large Intensity Device (SoLID)



PVDIS:

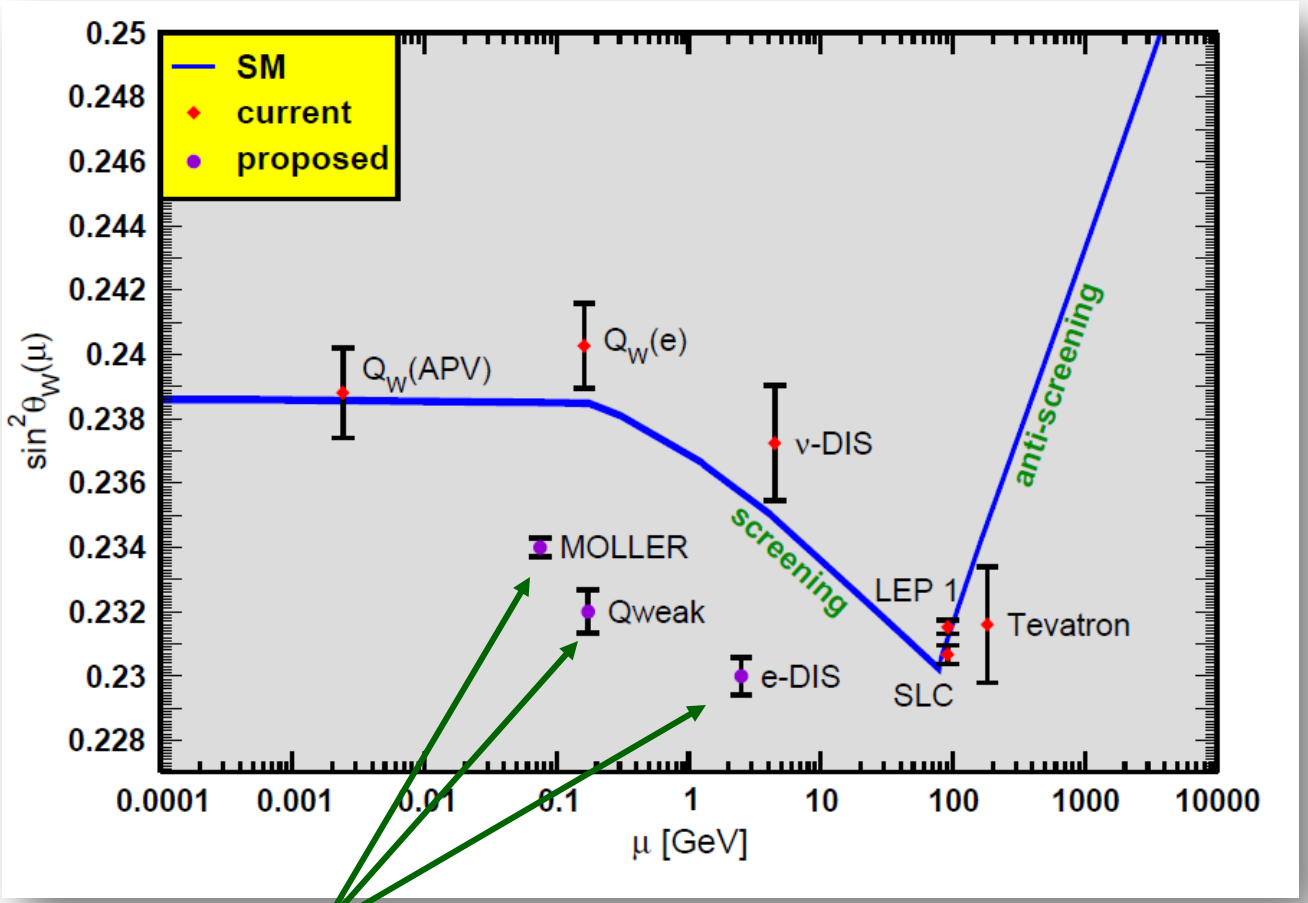
Can extract $C_{1,2q}$ and $\sin^2\theta_W$ which are sensitive to physics beyond the SM

Senstive to searches for Z', compositeness, leptoquarks, etc.

The SIDIS Physics Menu

- Unprecedented precision 3-d mapping of SSA
  - Collins and Sivers
  - p+, p- and K+, K-
- Study factorization with x and z-dependences
- Study PT dependence
- Combining with CLAS12 proton and world data
  - extract transversity and fragmentation functions for both u and d quarks
  - determine tensor charge
  - study TMDs for both valence and sea quarks
  - study quark orbital angular momentum
- Combining with world data, especially data from high energy facilities
  - study Q^2 evolution
  - much better understanding of 3-d nucleon structure and QCD

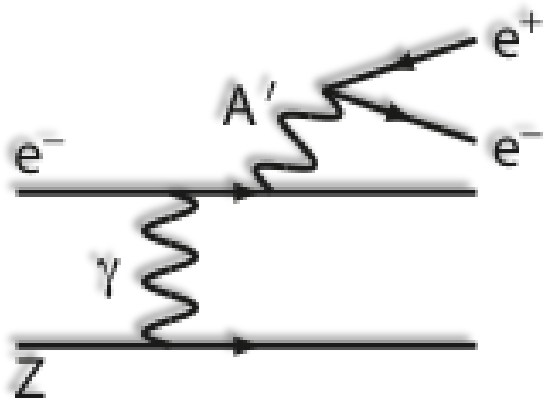
Projected Results

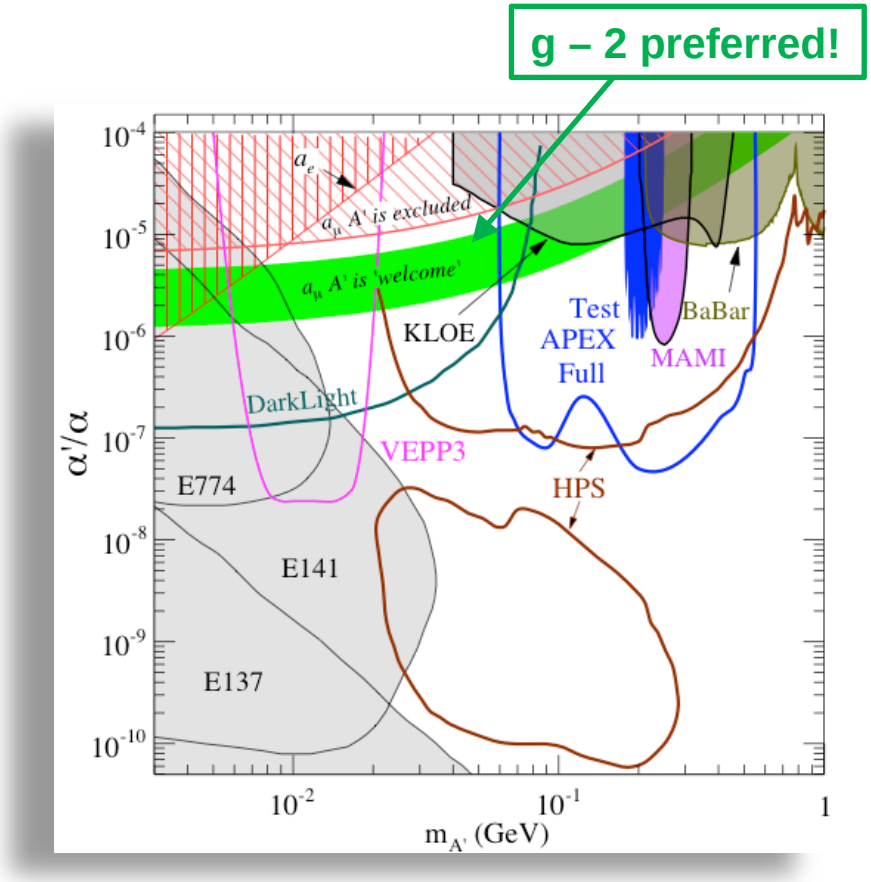


JLab program

New Opportunity: Search for A' at JLab

Search for new forces mediated by ~100 MeV vector boson A' with weak coupling to electrons:





- New ~GeV–scale force carriers are important category of physics beyond the SM
- Fixed-target experiments @JLab (FEL + CEBAF) have capability to explore this

JLab: 21st Century Science Questions

- What is the role of gluonic excitations in the spectroscopy of light mesons? Can these excitations elucidate the origin of quark confinement?
- Where is the missing spin in the nucleon? Is there a significant contribution from valence quark orbital angular momentum?
- Can we reveal a novel landscape of nucleon substructure through measurements of new multidimensional distribution functions?
- What is the relation between short-range N-N correlations and the partonic structure of nuclei?
- Can we discover evidence for physics beyond the standard model of particle physics?

Speakers Remarks

Based on Science:

There is clear a decade-plus of compelling science opportunities which could be addressed in the medium energy portfolio

One might expect that realizing the potential of the 12 GeV investment would be an important priority for the community

The more substantive experiments, as for all such experiments in NP, will have to compete with other opportunities across the portfolio, and all such experiments will need to be in the “re-write the textbooks” category of impact

One could imagine a program of detector upgrades/ new detectors similar to the evolution at RHIC

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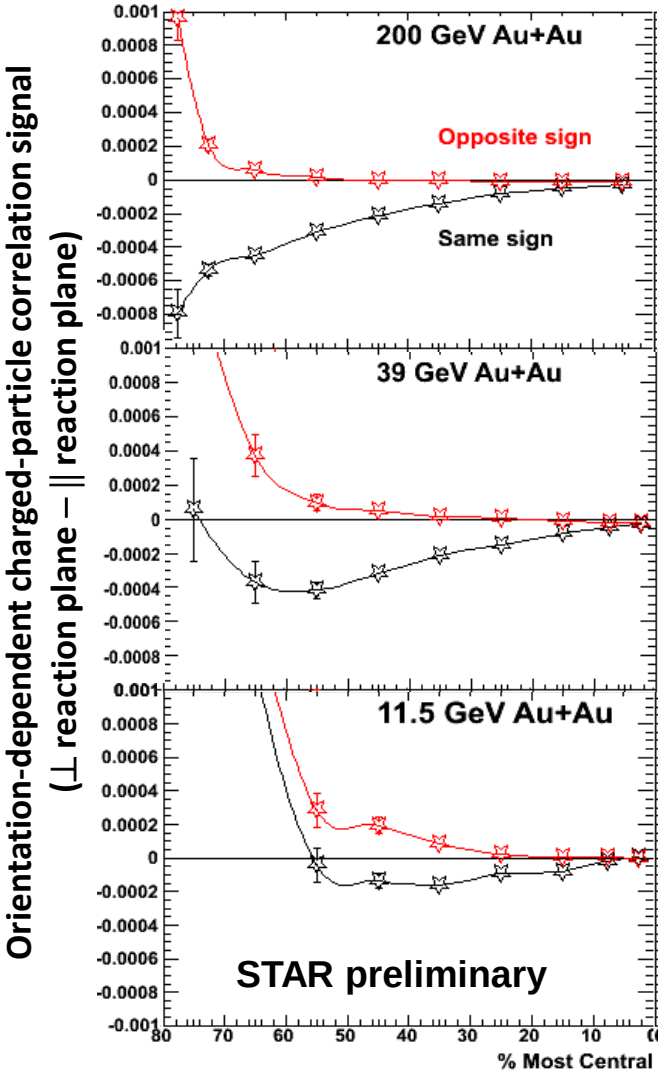
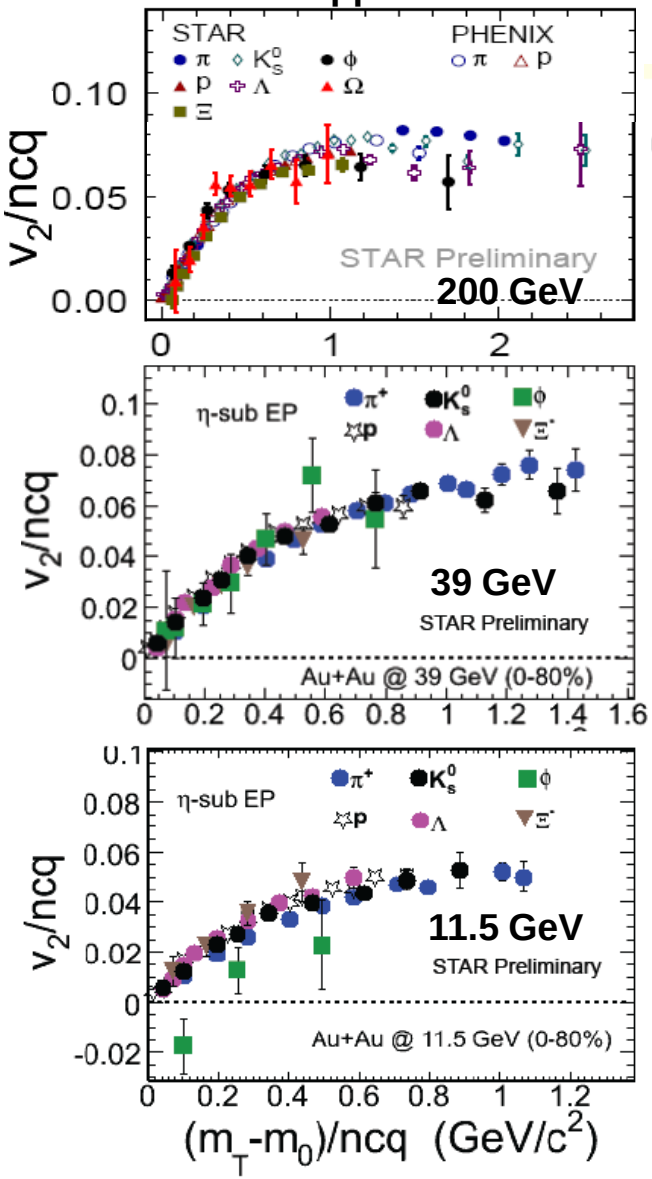
The science productivity at RHIC over the last decade has quite simply been stunning

New RHIC Data ⇒ Behavior Changes Below $\sqrt{s_{NN}}$ = 39 GeV ⇒ Signal of Onset of Deconfinement?

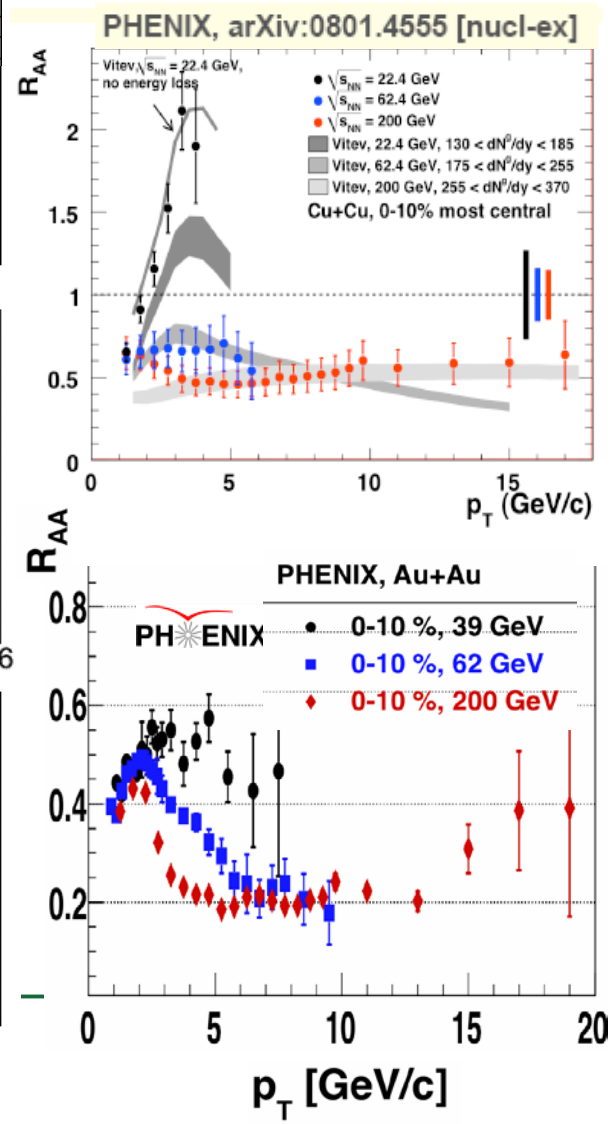
Charge-dependent correl'n consistent with Local Parity Violation tends to vanish below 39 GeV



Constituent-quark scaling of elliptic flow less apparent < 39 GeV

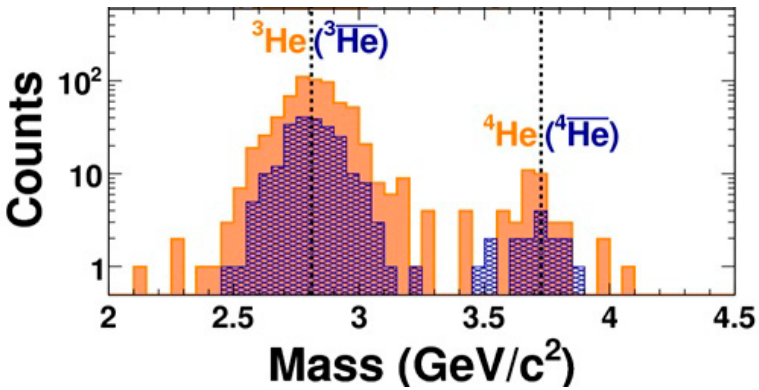


High-p_T hadron suppression → enhancement < 39 GeV

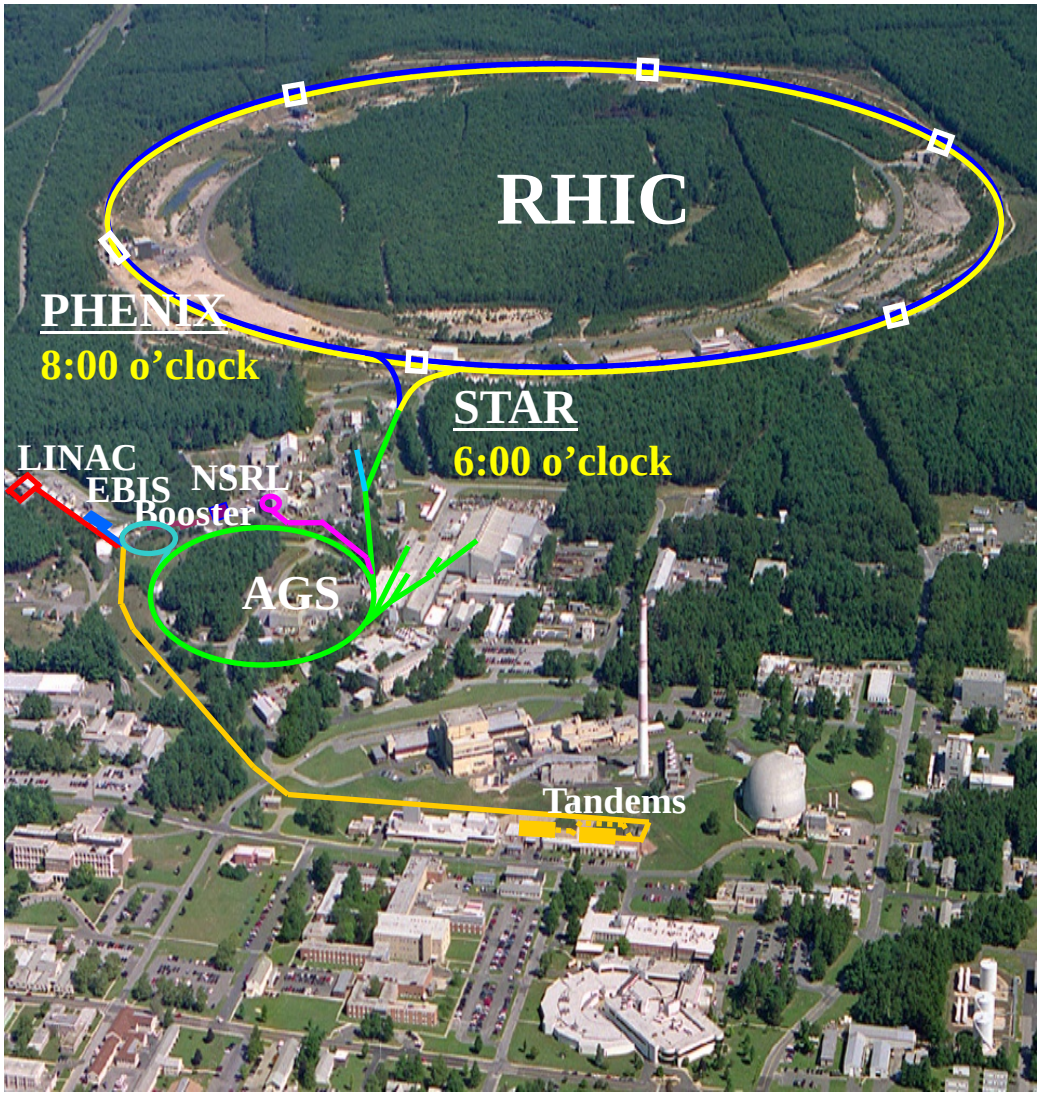


Research Focus of the Relativistic Heavy Ion Collider

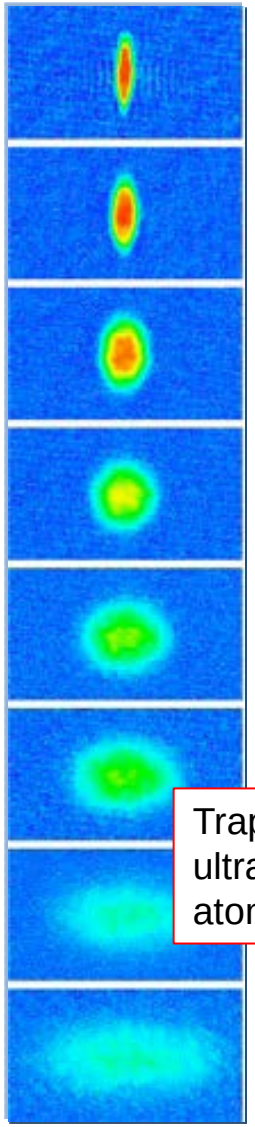
- To elucidate the fundamenal properties of the Perfect Liquid discovered in Au+Au collisions
- To determine the contribution to the proton spin from gluons, sea quarks/anti-quarks; to study transversity and advance understanding of contributions from orbital motion within the proton
- To address other scientific "targets of discovery opportunity" afforded by RHIC's capabilities



RHIC also stewards strong core competencies in accelerator physics



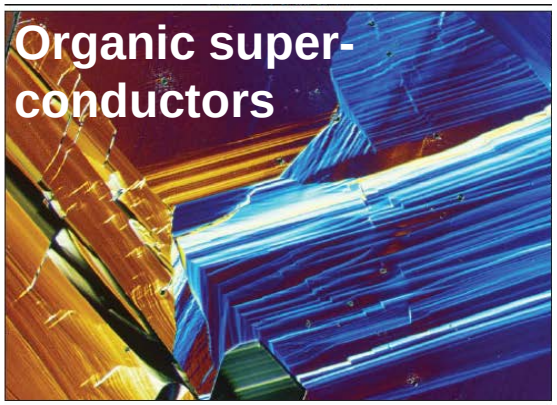
Unanticipated Intellectual Connections to Hot QCD Research at RHIC

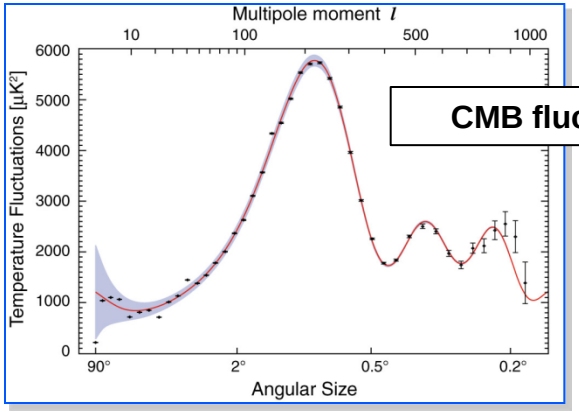


Trapped ultra-cold atom clouds

RHIC results have established ties to other forefront science:

- String Theory studies of black hole behavior led to prediction of a conjectured quantum lower bound on η/s — a "perfect fluid"
- Ultra-cold atomic gases, at temperatures 19 orders of magnitude below QGP, can also be "nearly perfect liquids"
- Similar liquid behavior seen and studied in a number of strongly correlated condensed matter systems
- Symmetry-violating bubbles in QGP analogous to speculated cosmological origin of baryon-antibaryon imbalance in universe
- Power spectrum of flow analogous to power spectrum of cosmic microwave background, used to constrain baryon acoustic oscillations & dark energy





CMB fluctuations

Speaker's Remarks

All wonderful, but there is some very important homework still left on the table despite a lot of experimental and theoretical work:

It was shown at QM 2005 that charm hadrons are as suppressed as light quark hadrons

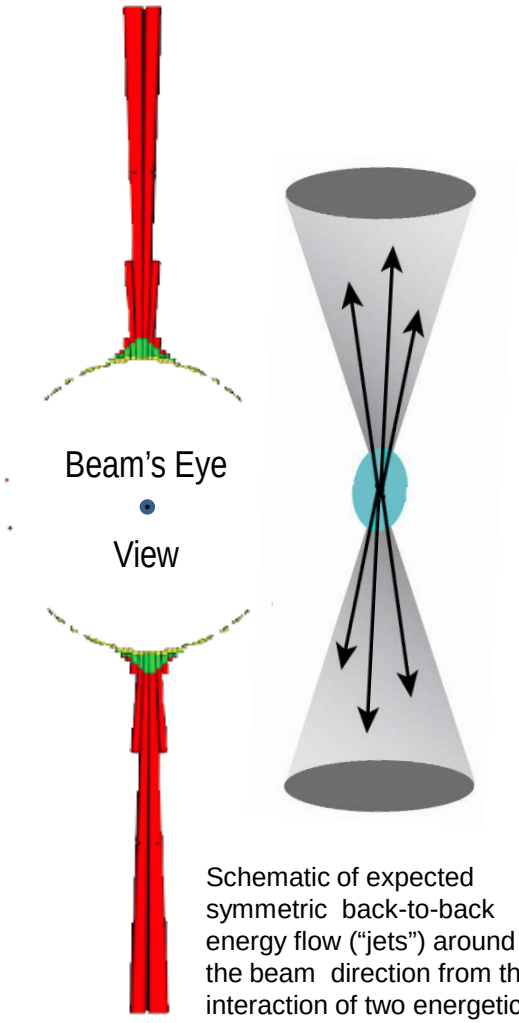
It is 2012 and we still don't fully understand why that is the case

New complementary capability at the LHC may help

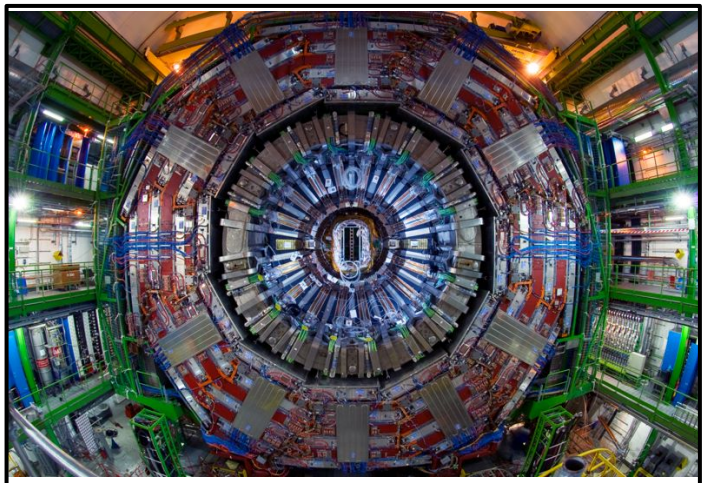
New ideas and instrumentation at RHIC may also help

It is rather imperative this get resolved

Initial HI Research at the LHC confirms the 2005 Discovery at RHIC



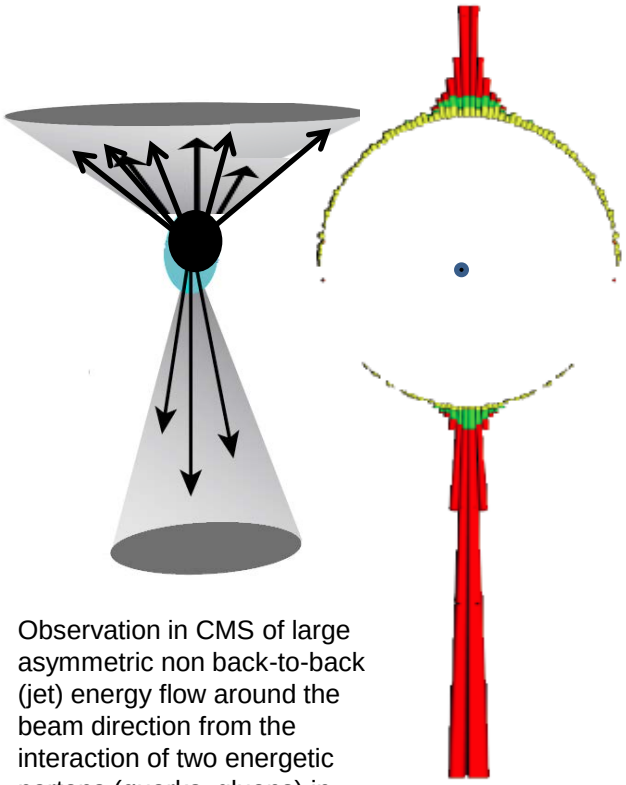
Schematic of expected symmetric back-to-back energy flow ("jets") around the beam direction from the interaction of two energetic partons (quarks, gluons) in proton – proton collisions



Heavy ion data at the LHC indicate a new state of opaque, strongly interacting matter similar to that first discovered at RHIC is produced in heavy ion collisions. "Jets" of energetic particles that traverse the new form of matter are disrupted (right) unlike in proton-proton collisions (left).

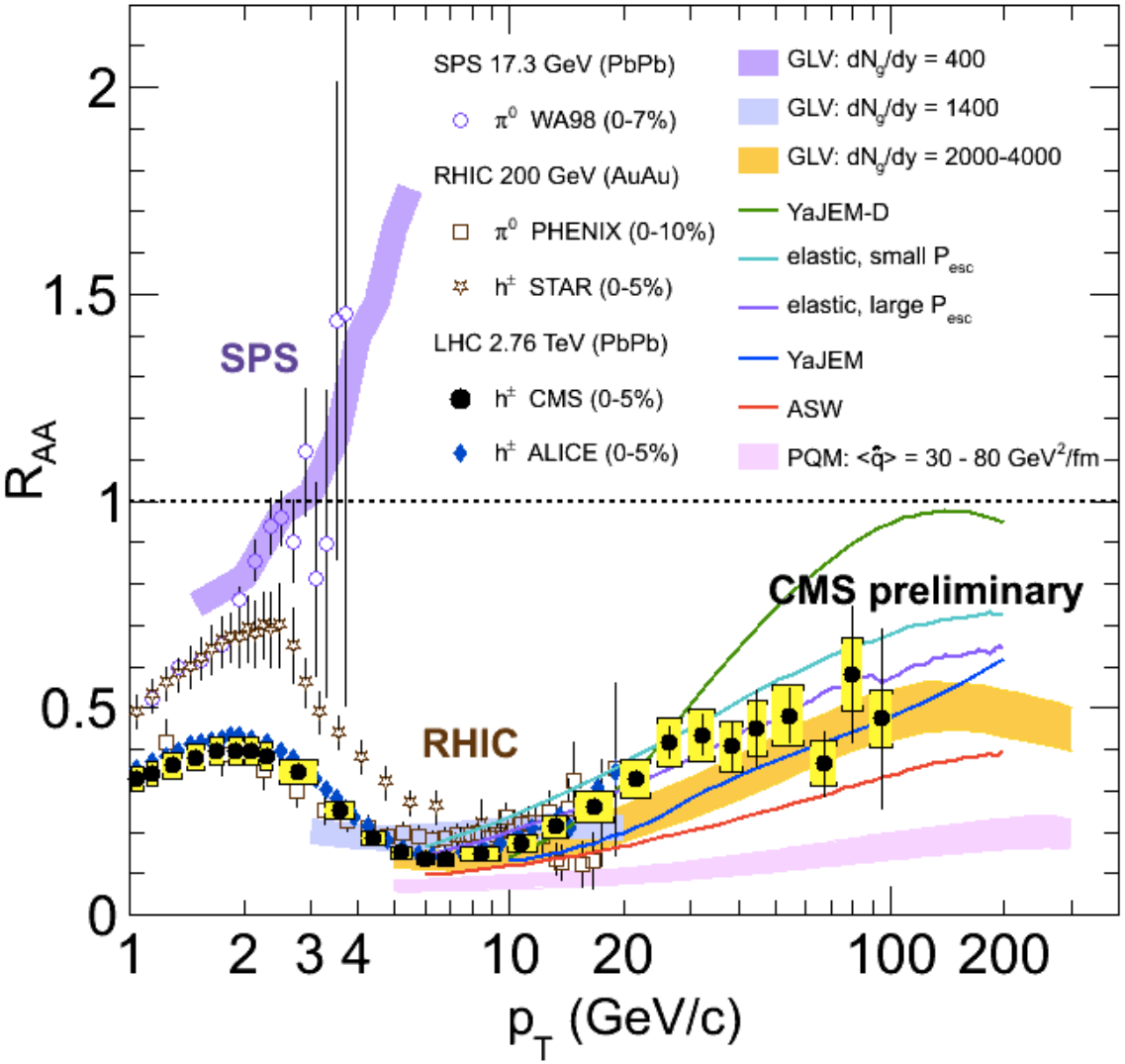
The results show that this new form of matter, believed to have influenced the evolution of the early universe, has unique properties and interacts more strongly than any matter previously produced in the laboratory.

Energy deposition in the CMS detector at the Large Hadron Collider (LHC) as a function of angle around the beam direction



Observation in CMS of large asymmetric non back-to-back (jet) energy flow around the beam direction from the interaction of two energetic partons (quarks, gluons) in relativistic nucleus-nucleus collisions

Initial HI Research at the LHC confirms the 2005 Discovery at RHIC

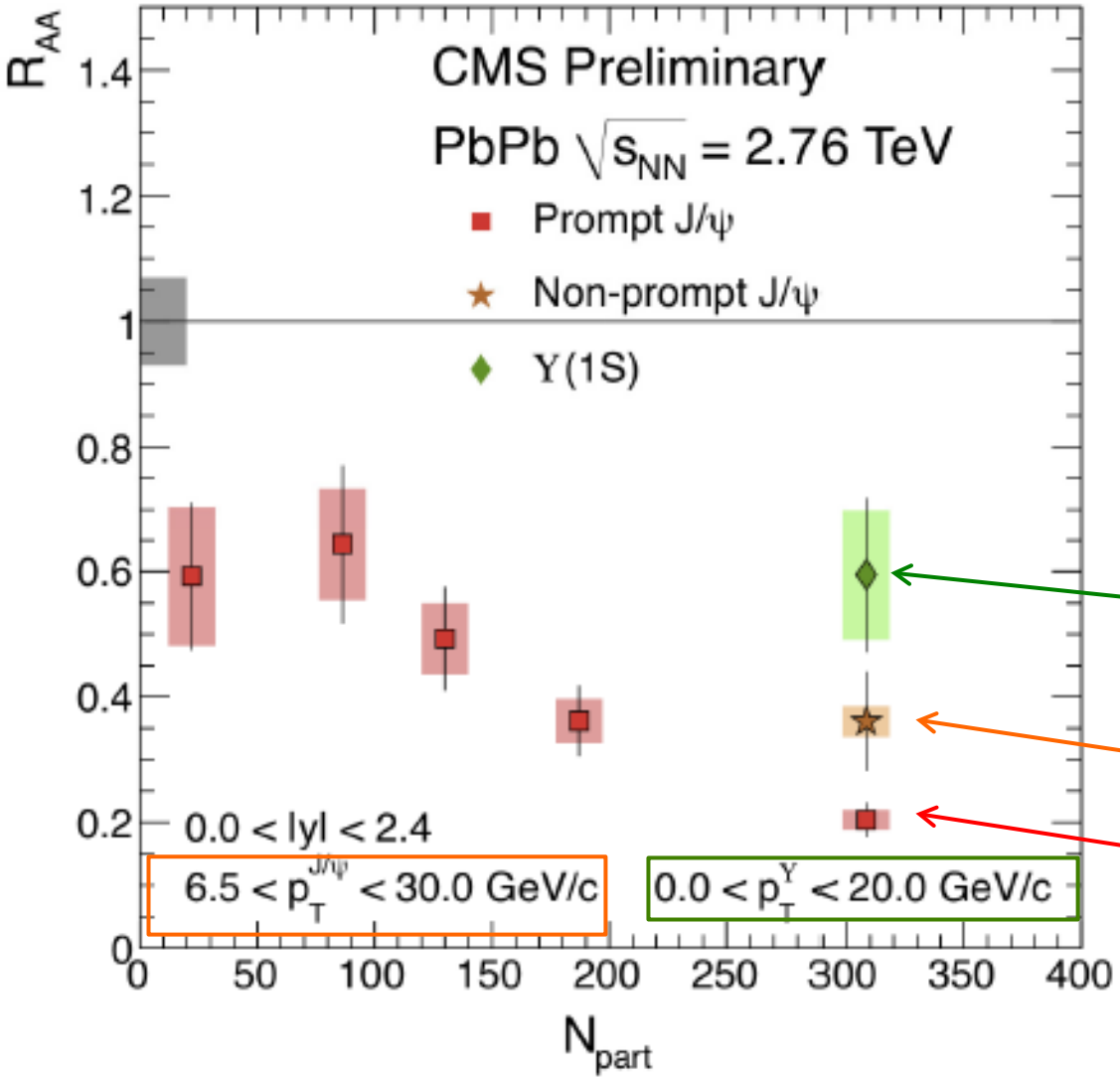


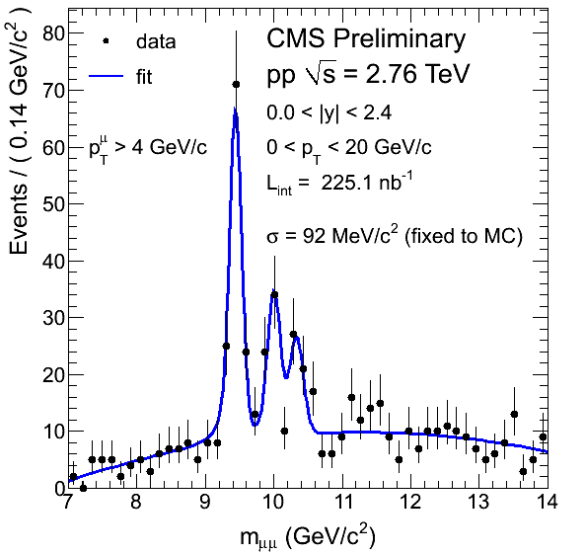
R_{AA} to 100 GeV/c!

Large quenching!

For colorless probes (direct photons) initial results consistent with no suppression

Initial HI Research at the LHC confirms the 2005 Discovery at RHIC



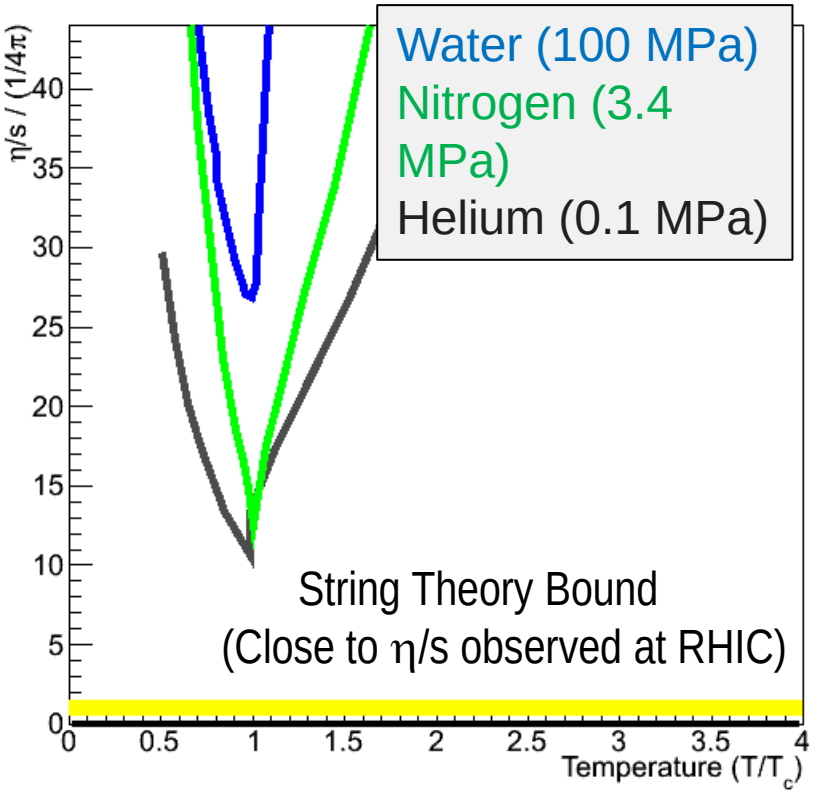


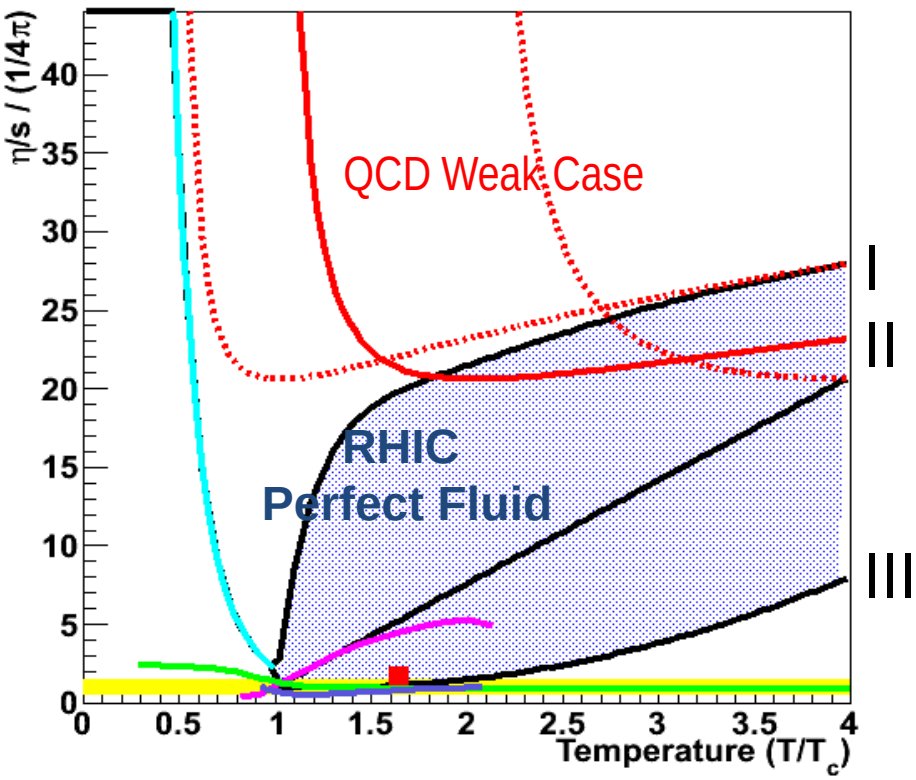
Inclusive Υ (1s) suppressed

Non-Prompt J/ψ from B-decays

Prompt J/ψ suppressed

Strong versus Weak Coupling





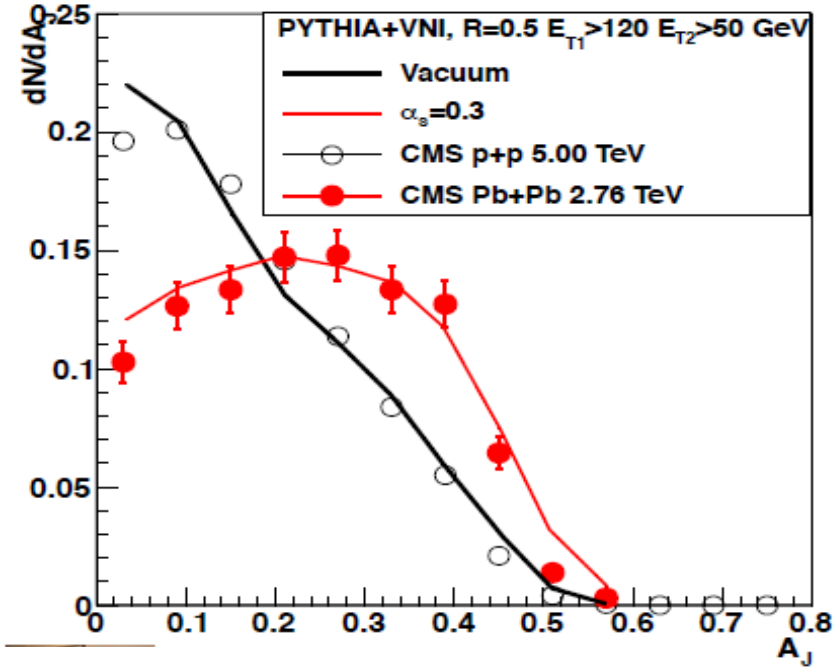
Small η/s implies strong coupling in the plasma

How does the Quark-Gluon Plasma transition from strong to weak?

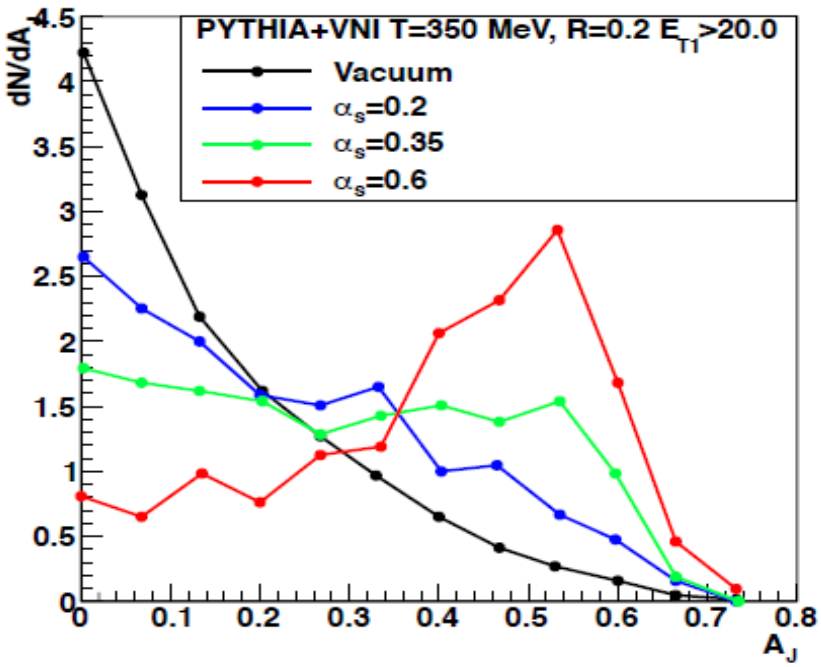
Is this transition associated with changes in quasi-particles, excitations, strong fields?

Di-jet asymmetry: a new window on strong coupling and the evolution to weak coupling in the plasma

Comparison to LHC data



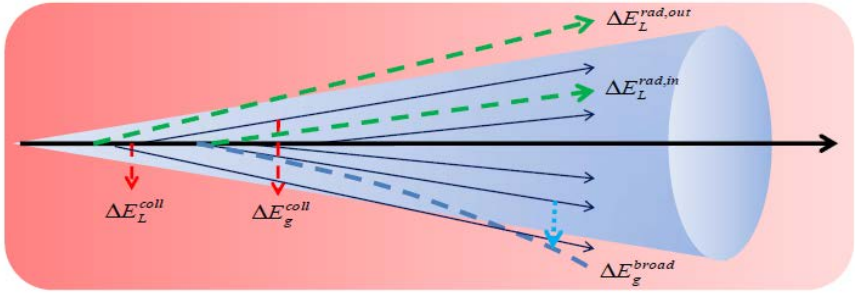
Sensitivity to α_s at RHIC energies



Dijets at RHIC scales are likely to be strongly modified by the presence of the deconfined QGP medium. The observables we have discussed are sensitive to many aspects of this modification and suggest that further jet measurements at RHIC will provide valuable insights into the nature of the QGP and into the applicability of pQCD jet suppression models .

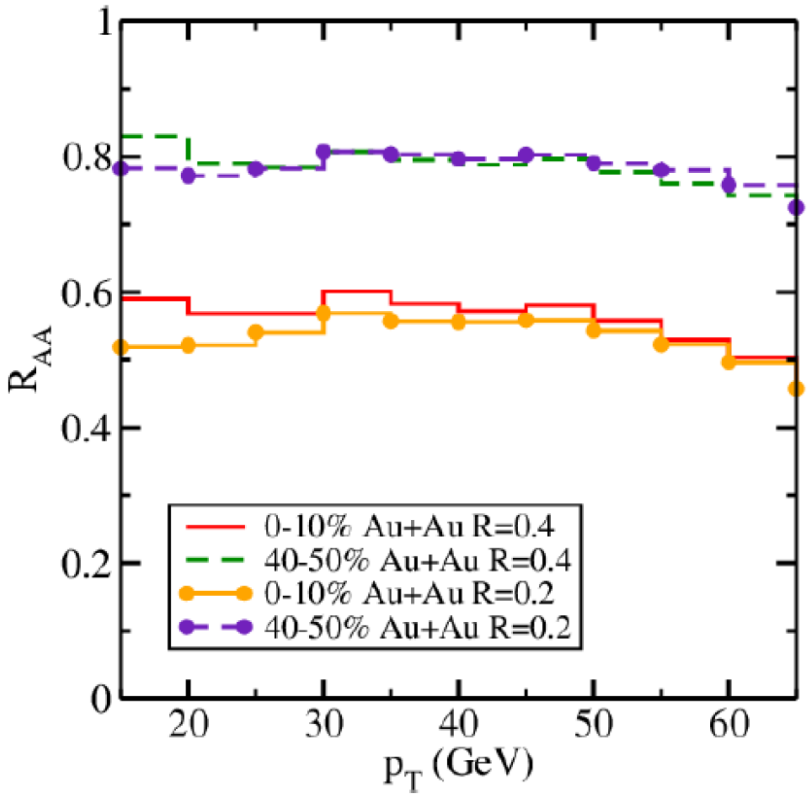
C. Coleman-Smith

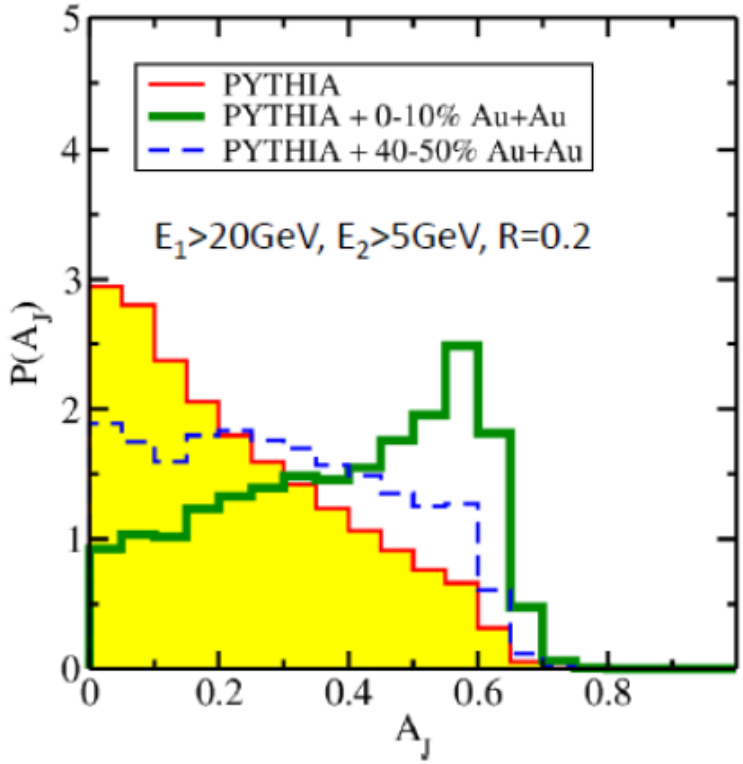
Di-jet asymmetry: a new window on strong coupling and the evolution to weak coupling in the plasma



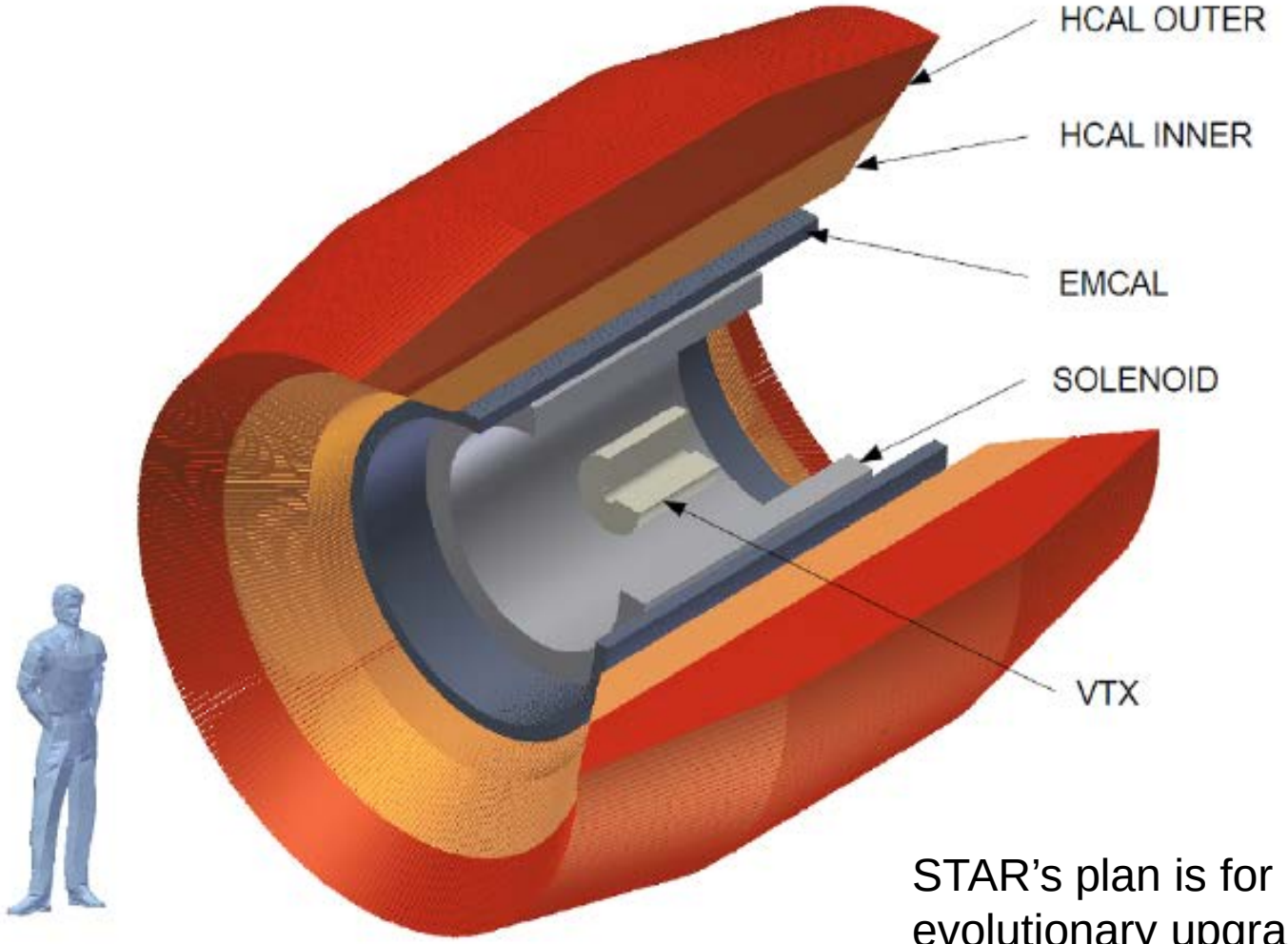
Large modification at RHIC
More of parton shower equilibrated into medium.

PRL 2011 G.Qin, B. Muller





One Possibility: sPHENIX First Stage in MIE Proposal



STAR's plan is for evolutionary upgrades

Speaker's Remarks

Based on Science:

There appears to be a decade-plus of compelling science opportunities which could be addressed in the RHIC heavy ion portfolio

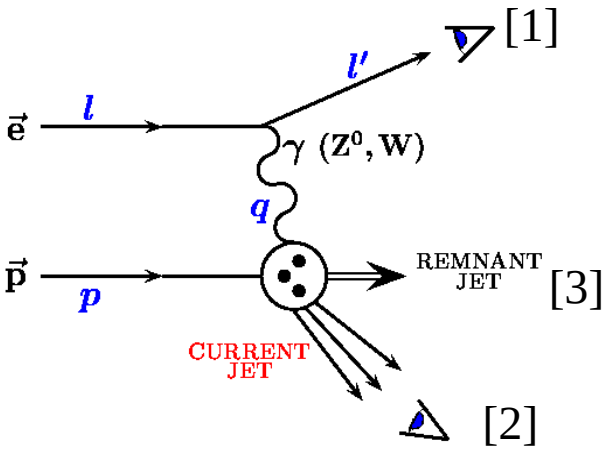
Efforts in QCD thermodynamics (e.g. those led by Karsch) and more generally in nuclear theory remain essential for the interpretation of relativistic heavy ion collisions.

The more substantive proposed experiments, as for all such experiments in NP, will have to compete with other opportunities across the portfolio, and all such experiments will need to be in the "re-write the textbooks" category of impact

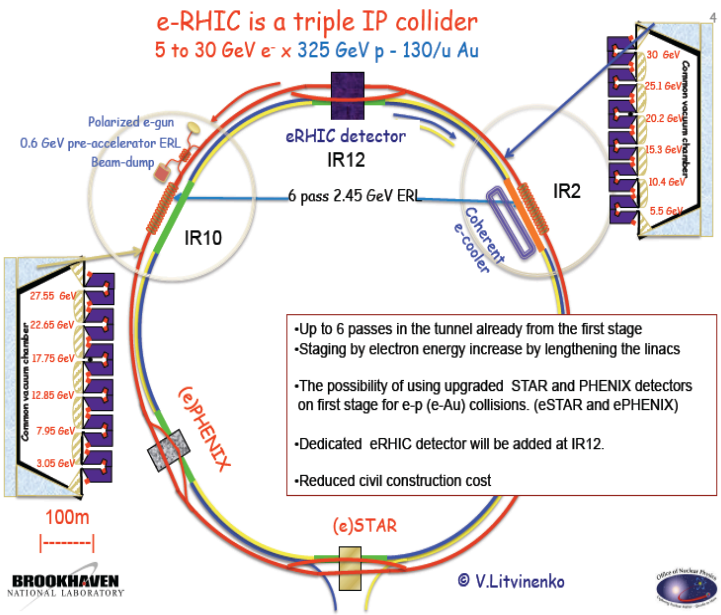
In the logical extreme, the HI campaign will complete its mission (a higher energy collider seems unlikely, and at some point TBD, the experimental opportunities will become exhausted.

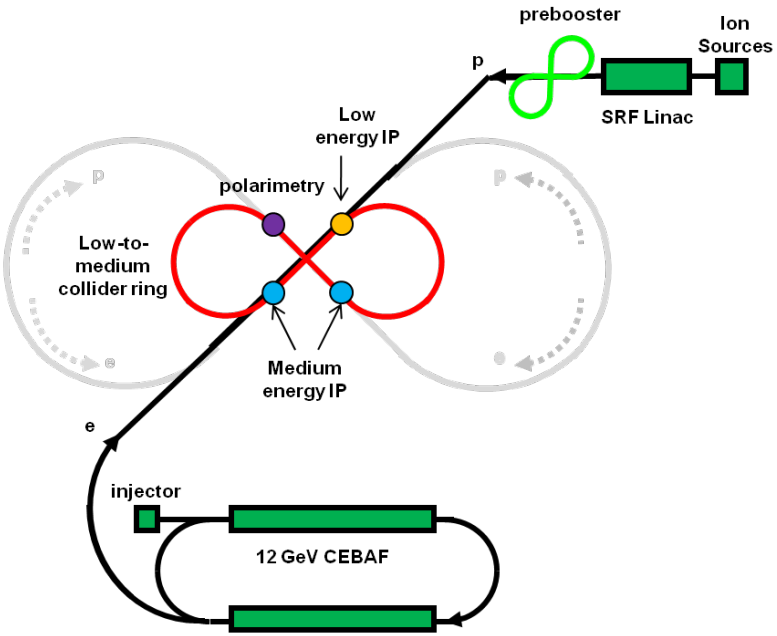
One question the speaker wrestles with is what will the relativistic nuclear community pursue after that?

One possibility: An Electron-Ion Collider



A high energy, high luminosity (polarized) *ep* and eA collider and a suitably designed detector





Fundamental Questions in QCD to be Adressed

- How do gluons contribute to the structure of the nucleon?
- What role do the gluons play in determining the spin structure of the nucleon?
- What is the spatial distribution of the gluons and sea quarks in the nucleon?

- **How do the gluons contribute to the structure of the nuclei?**
- **What are the properties of *high density* gluon matter?**
- **How do fast quarks and gluons interact when they traverse through nuclear matter?**

To get to the answers?

Precise imaging of the sea-quarks and gluons in the nucleon

Need to explore a new QCD frontier: of strong color fields in nuclei

The Science of EIC:

- Nucleon (spin) structure

  Precision measurements of DQ and DG via inclusive and semi-inclusive DIS → Spin puzzle

  Measurement of (gluon) GPDs & TMDs: via semi-inclusive and exclusive DIS → 3D momentum and position (correlations) of the nucleon

  - Explore and understand the richness of QCD & detailed nucleon structure
  - possibly leading to orbital angular momentum → Spin puzzle

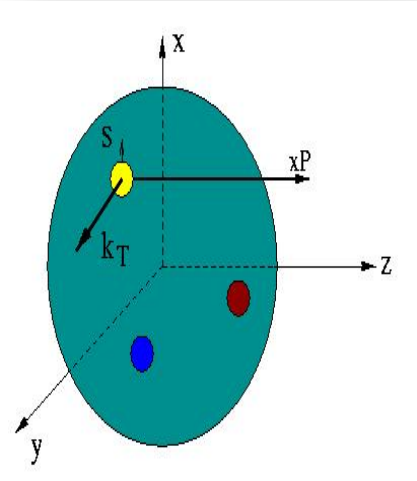
- Study of extreme high gluon densities via inclusive and sem-inclusive DIS off a wide range of nuclei

- High energy, beam polarization, and a full acceptance detector: capability to explore precision electroweak physics and EW (spin) structure functions

One Science Goal: A Unified View of Nucleon Structure

$W_p^u(x,k_T,\boldsymbol{r})$ Wigner distributions

6D Dist.

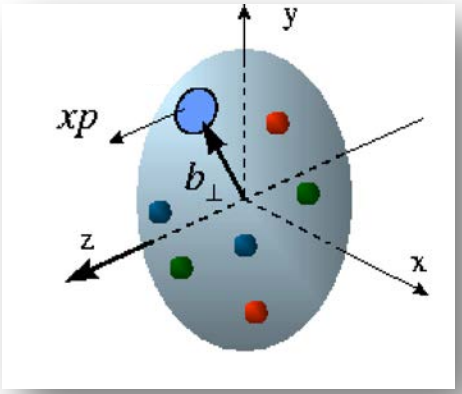


$d^3\boldsymbol{r}$

$d^2k_T\, dr_z$

TMD PDFs
$f_1^u(x,k_T)$, .. $h_1^u(x,k_T)$

GPDs/IPDs

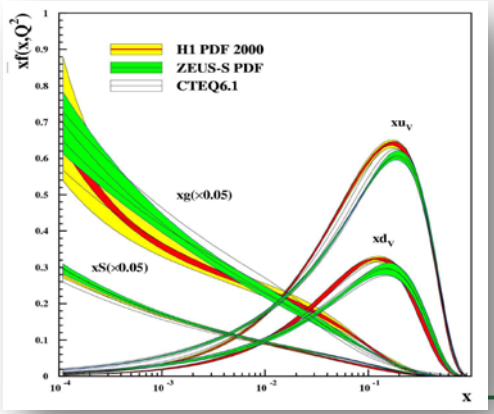


3D imaging

d^2k_T

d^2r_T

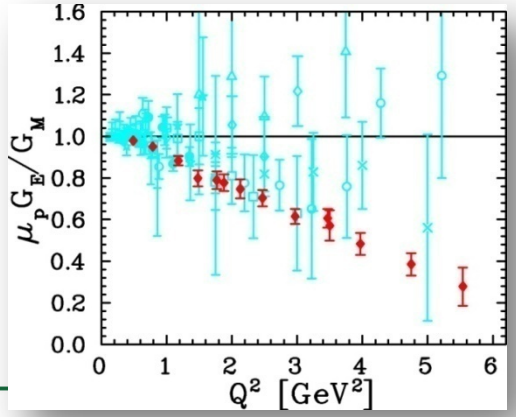
dx &
Fourier Transformation



PDFs
$f_1^u(x)$, .. $h_1^u(x)$

1D

Form
Factors
$G_E(Q^2)$,
$G_M(Q^2)$



Speaker's Remarks

Question:

But — if you build it, will they in fact come? (Strong investment by both the present RHIC and JLAB communities is likely essential; wherever it is built both communities and labs must have a viable future path)

Comments:

The science case still has not been presented to or embraced by the wider nuclear science community or the funding agencies

Spin physics will be an essential component of the physics case but would be challenging to propose as the primary science motivation

In discussing the spin physics case, it will be essential to articulate what is new and could fundamentally advance our understanding

It is not hard to envision that in the future there could be one QCD user facility

From The Frontiers of Nuclear Science from the 2007 Long Range Plan

(1) QCD and its implications and predictions for the state of matter in the early universe, quark confinement, the role of gluons, and the structure of the proton and neutron;

(2) The structure of atomic nuclei and nuclear astrophysics, which addresses the origin of the elements, the structure and limits of nuclei, and the evolution of the cosmos; and

(3) Developing a New Standard Model of nature's fundamental interactions, and understanding its implications for the origin of matter and the properties of neutrinos and nuclei.

Nuclei and Nuclear Astrophysics

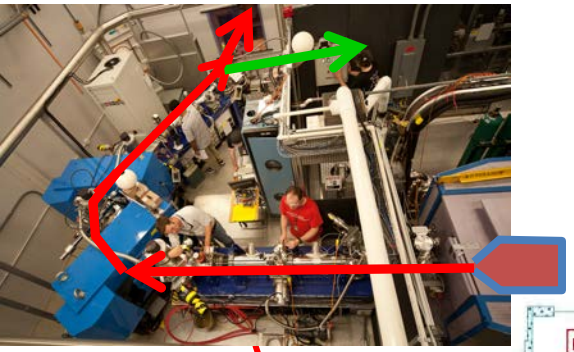
- What is the nature of the nuclear force that binds protons and neutrons into stable nuclei and rare isotopes?
- What is the origin of simple patterns in complex nuclei?
- What is the nature of neutron stars and dense nuclear matter?
- What is the origin of the elements in the cosmos?
- What are the nuclear reactions that drive stars and stellar explosions?

Fundamental Symmetries and Neutrinos

- What is the nature of the neutrinos, what are their masses, and how have they shaped the evolution of the universe?
- Why is there now more visible matter than antimatter in the universe?
- What are the unseen forces that were present at the dawn of the universe but disappeared from view as the universe evolved?

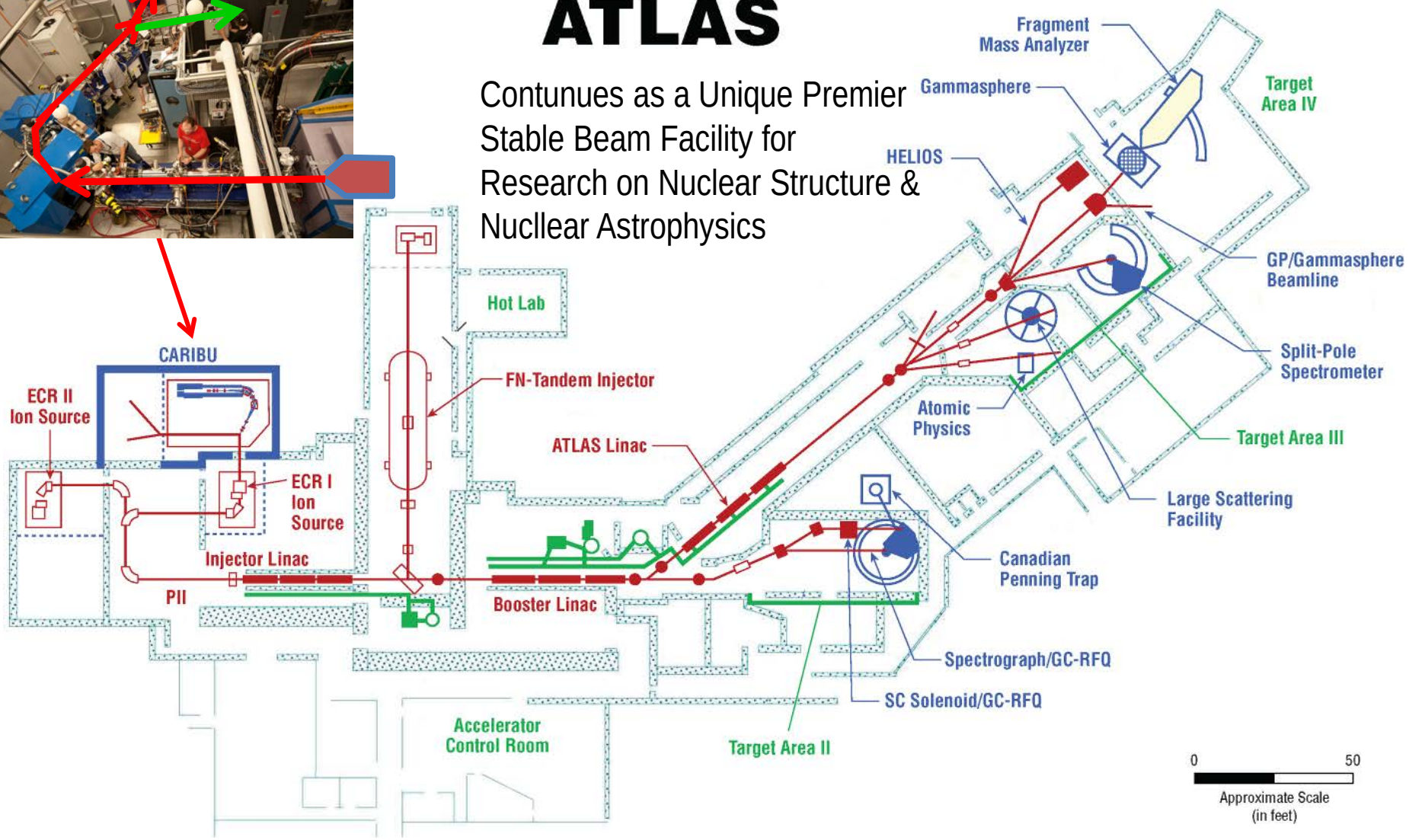
● = what the NP Low Energy subprogram is expected to and will address

Argonne Tandem Linac Accelerator System Layout



ATLAS

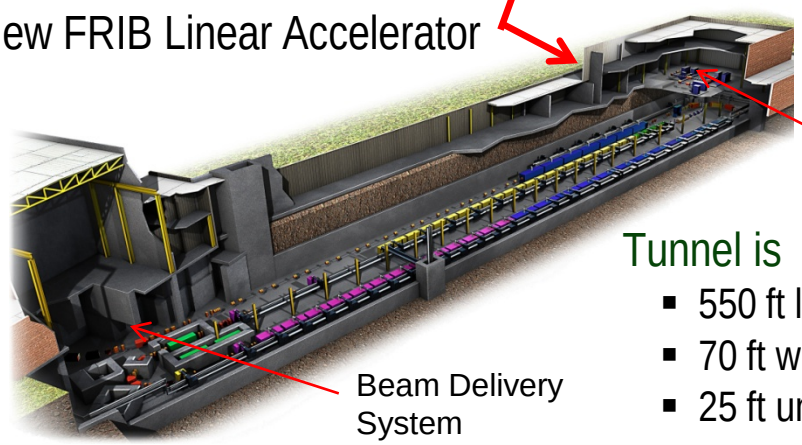
Contunues as a Unique Premier Stable Beam Facility for Research on Nuclear Structure & Nucllear Astrophysics



Research Focus of the Facility for Rare Isotope Beams

Existing National Superconducting Cyclotron Laboratory

New FRIB Linear Accelerator



Tunnel is

- 550 ft long
- 70 ft wide
- 25 ft underground

FRIB will increase the number of isotopes with known properties from ~2,000 observed over the last century to ~5,000 and will provide world-leading capabilities for research on:

Nuclear Structure

- The ultimate limits of existence for nuclei
- Nuclei which have neutron skins
- The synthesis of super heavy elements

Nuclear Astrophysics

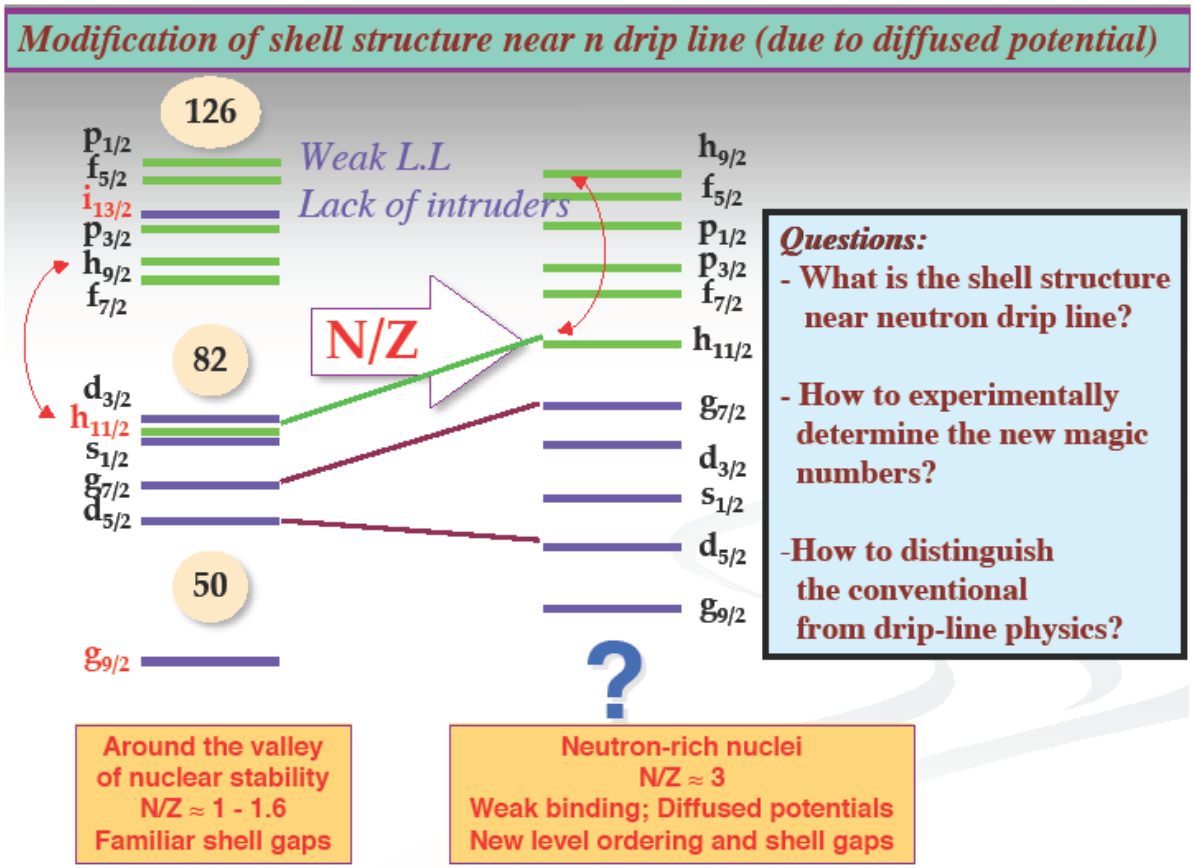
- The origin of the heavy elements and explosive nucleo-synthesis
- Composition of neutron star crusts

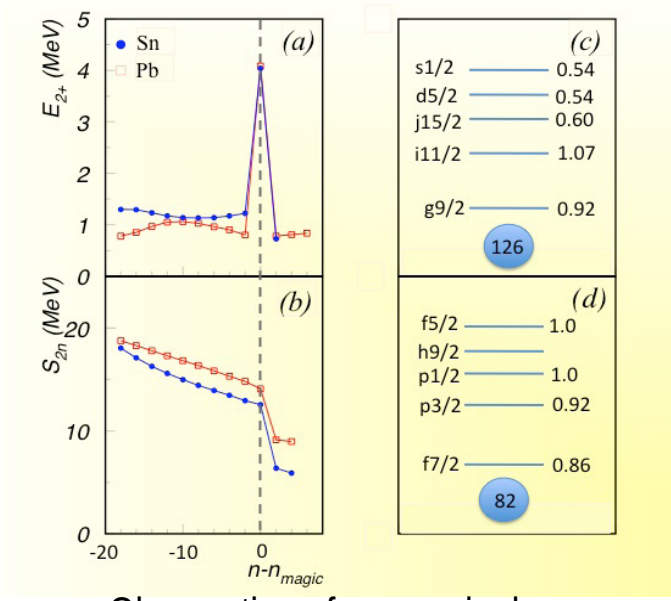
Fundamental Symmetries

- Tests of fundamental symmetries, Atomic EDMs, Weak Charge

This research will provide the basis for a model of nuclei and how they interact.

Exploration of Neutron-rich Matter: Bridging Terrestrial & Celestial





Observation of a new single particle state ^{133}Sn created by from a single neutron transfer reaction on doubly magic ^{132}Sn ($T_{1/2}$ = 39.7 s) at an excitation energy of 1363 KeV provides a new "laboratory" to test nuclear models used to extrapolate to exotic nuclei out of the range of current experiments

Speaker's Remarks

What is particularly powerful is the promised of significant theory advances e.g. in LQCD (more sophisticated, more precise, larger calculations) and compute-intensive density functional theory calculations combined with extensive experimental data

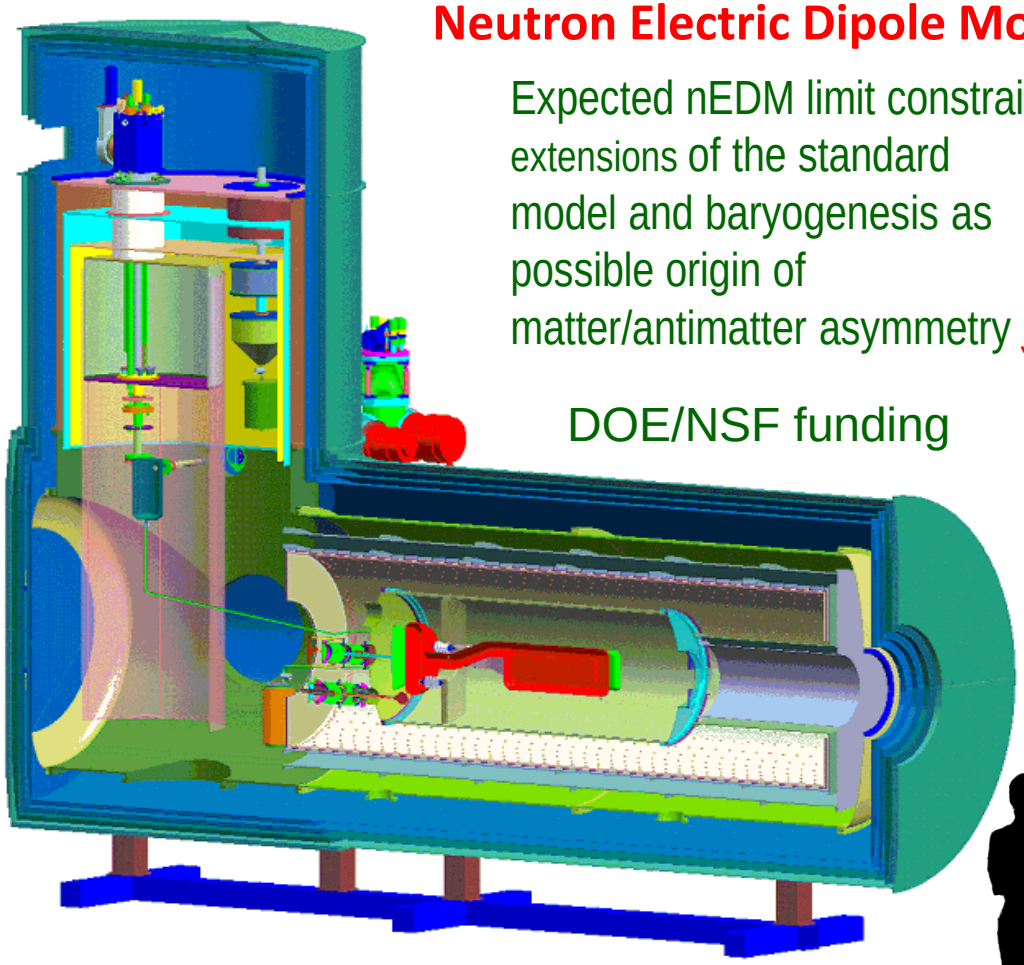
For low E NP, LQCD folks are planning to extract nuclear forces, which can be used as input to their usual shell model and related codes. This will be a breakthrough, since they currently get NN and NNN forces from experiment rather than from QCD.

The more substantive experiments at ATLAS & FRIB, as for all such experiments in NP, will have to compete with other opportunities across the portfolio, and all such experiments will need to be in the "re-write the textbooks" category of impact

One could imagine a program of detector upgrades/ new detectors at FRIB similar to the evolution at RHIC

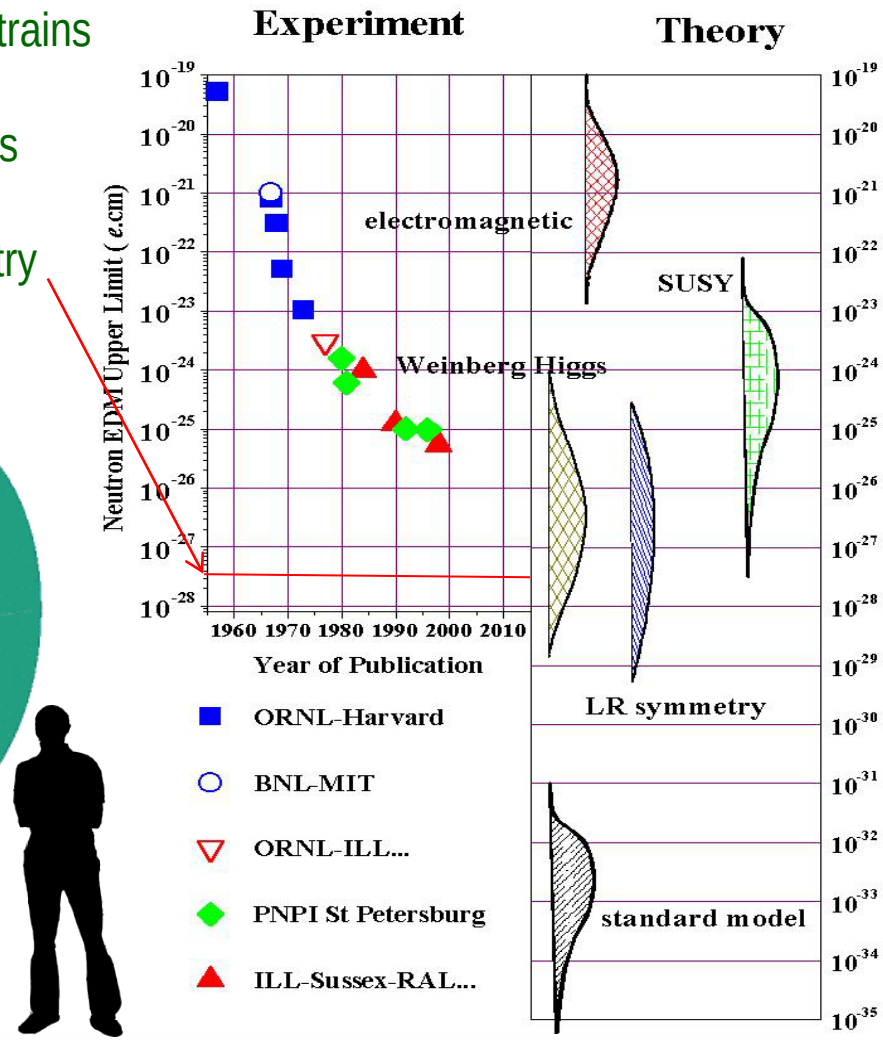
Fundamental Symmetries (cont'd)

Neutron Electric Dipole Moment (nEDM)



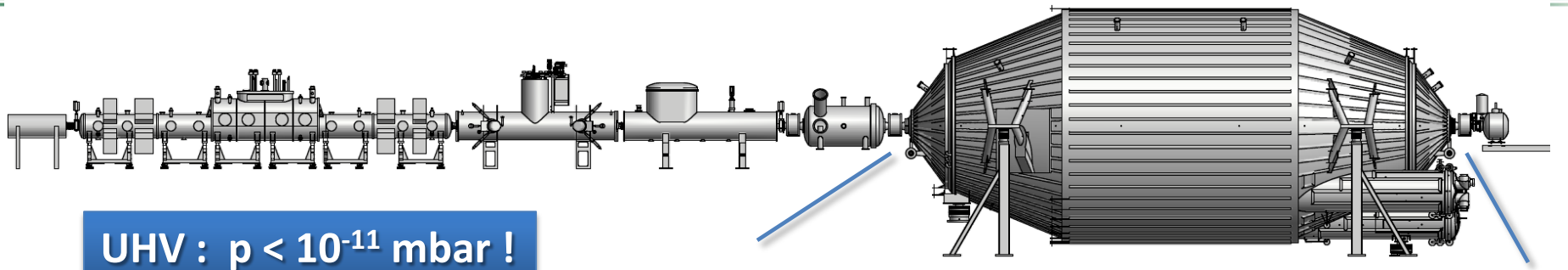
Expected nEDM limit constrains extensions of the standard model and baryogenesis as possible origin of matter/antimatter asymmetry

DOE/NSF funding

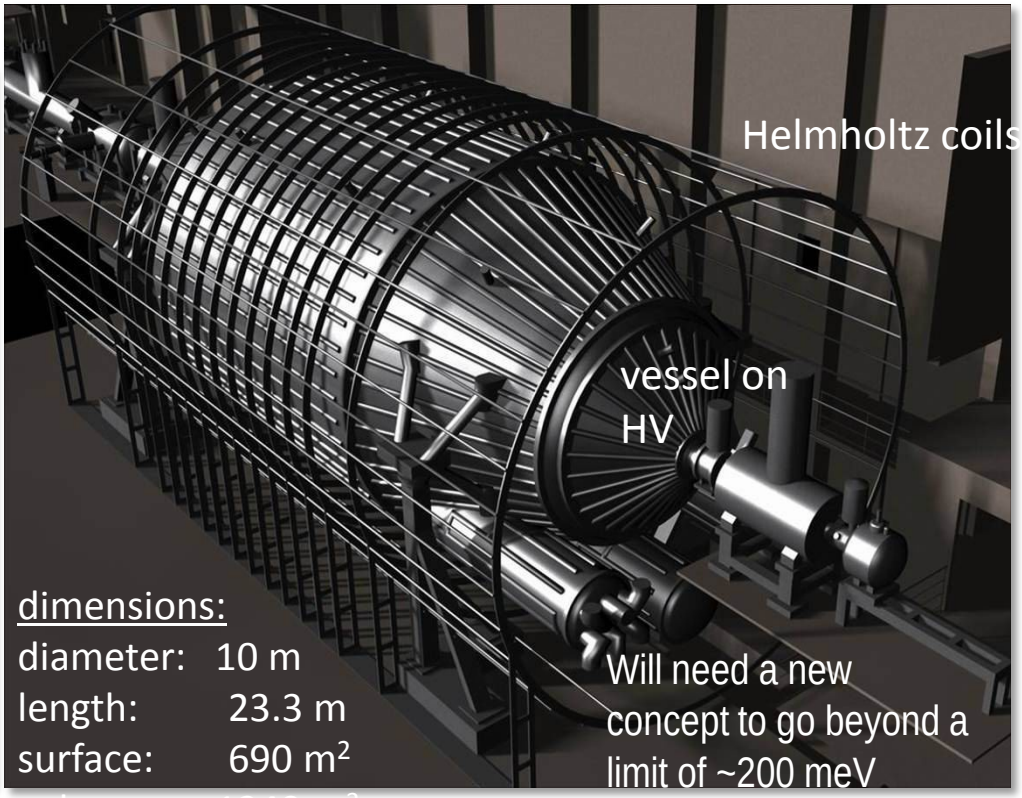


Collaboration of 17 universities and 2 National Laboratories

KATRIN spectrometer – Model-independent Limit on ν mass



UHV : p < 10^{-11} mbar !

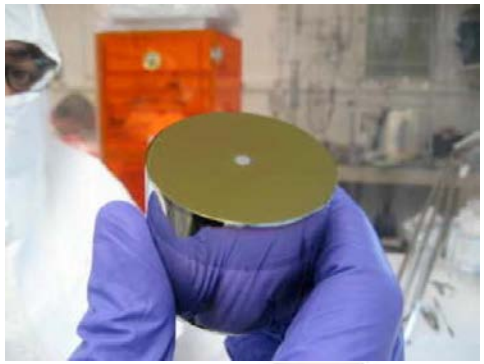


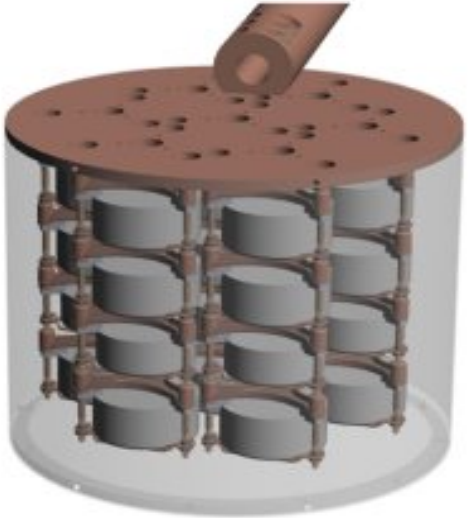
Neutrino-less Double Beta Decay

Grand challenge question: Is the neutrino its own anti-particle?

- An R&D effort on the Majorana Demonstrator (MJD) will help establish the feasibility of a tonne-scale ^{76}Ge neutrino-less double beta-decay experiment.
- The MJD technology demonstration is planned prior to a down-select with the German GERDA experiment between competing Ge technologies and a planned collaboration together.
- MJD is on track with electroforming and with procurement and processing of enriched Ge.
- MJD plans to go underground with natural Ge in a prototype cryostat at the Sanford Laboratory (South Dakota) in late spring 2012.
- The technology and the location of a future, international tonne-scale experiment is TBD based on the best value and the best science capability.

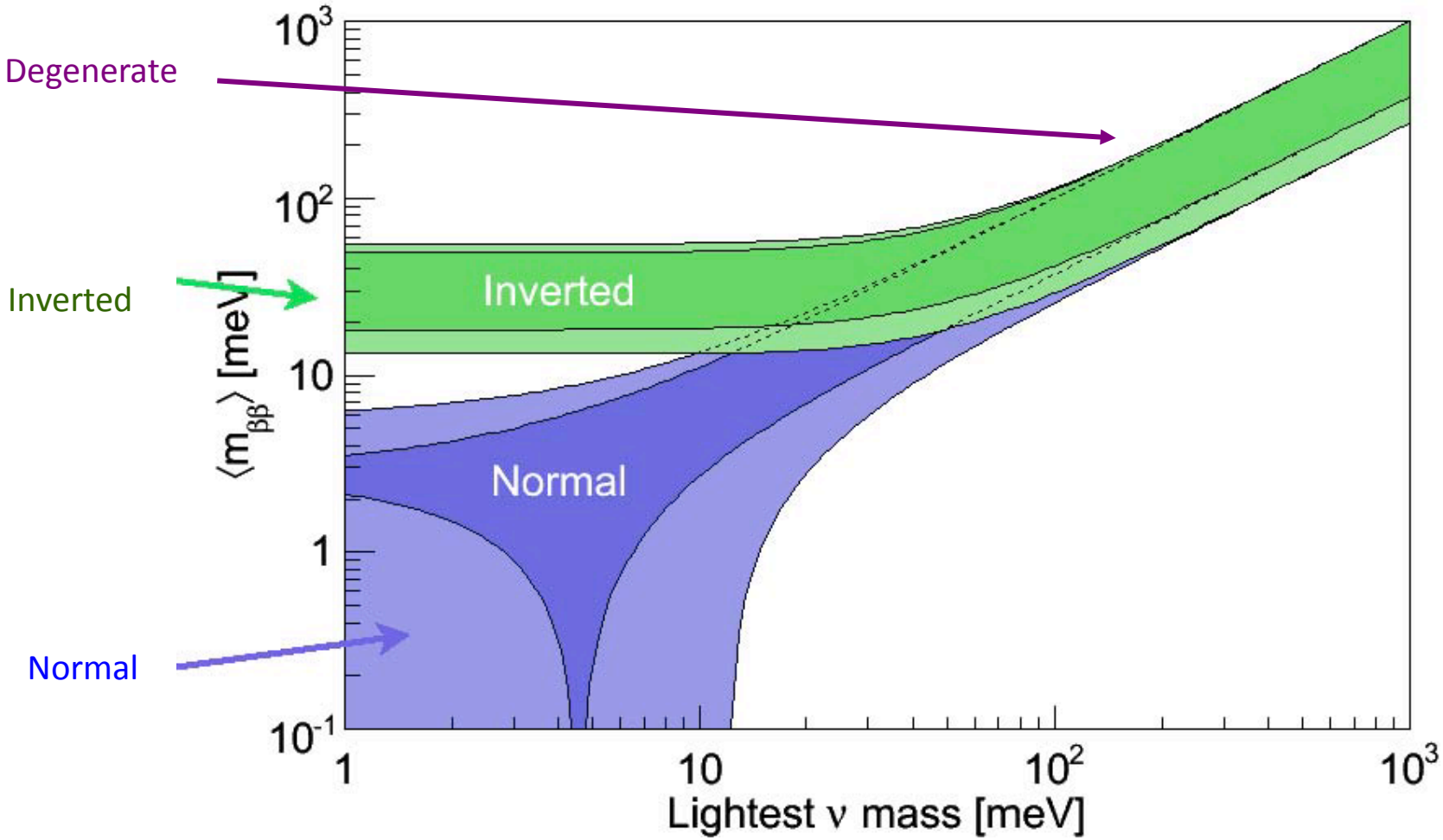
Germanium detector and the cryostat for the Majorana Demonstrator (MJD 40-kg ultra-clean Ge detector).



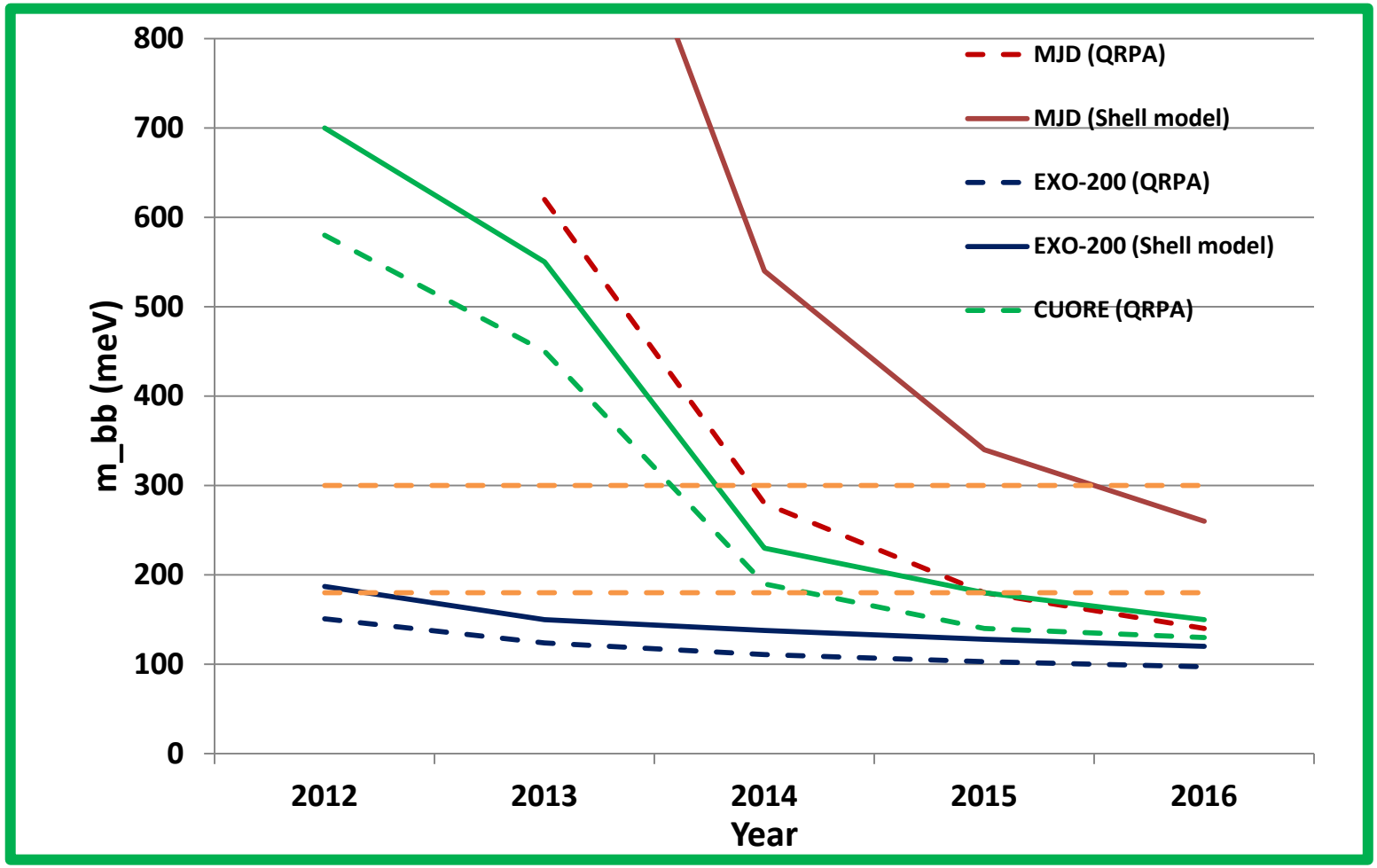


Science goals of 0νββ

DBD experiments are sensitive to the question of whether the neutrino in Majorana or Dirac. For Majorana to see a positive signal 0νββ , ν has to be Majorana and $m_{\beta\beta}$ must be larger than ~ 50 meV.



There are number of horses in the 0νββ Race



Atom Trap Trace Analysis (ATTA) at ANL

ATTA-3 at ANL to be Used to Map Major Aquifers around the World

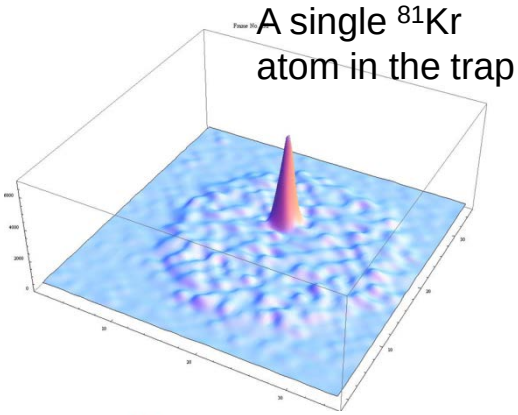
Developed ATTA-3 instrument with greatly improved sensitivity and selectivity

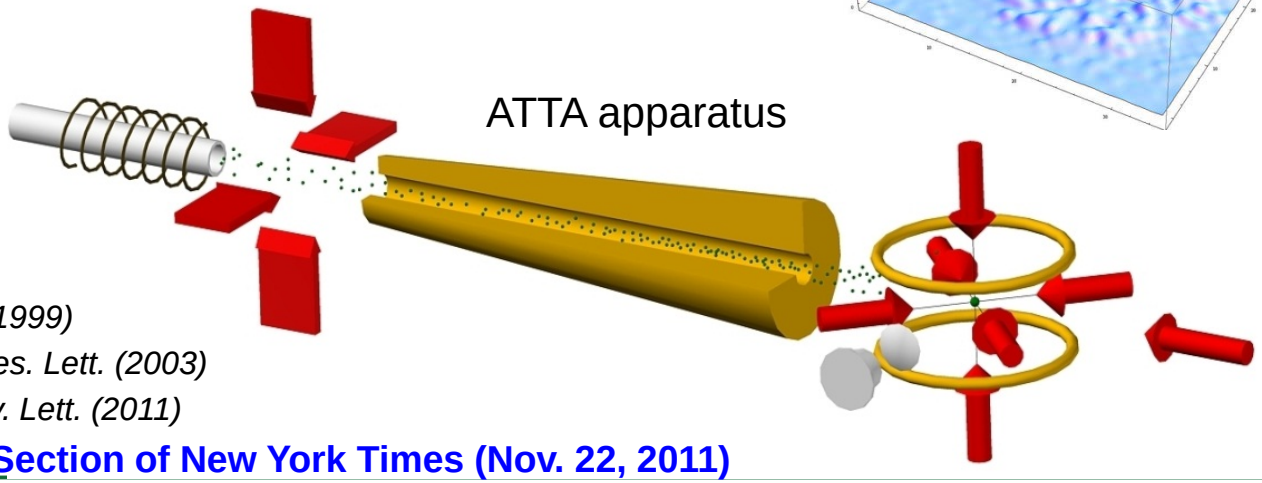
- Sensitivity: Capable of ^{81}Kr-dating with a sample of 10 micro-liter (STP) of krypton gas;
- Selectivity: Analyzed ^{39}Ar in environmental samples at the isotopic abundance level of 8×10^{-16}.

^{81}Kr-dating realized with a range of applications in earth & environmental sciences

Samples to be analyzed in 2011-2012

- Done: Yellowstone National Park, WIPP sites (with Sandia);
- In progress: Great Artesian Basin, Australia;
- In plan: Participate in a comprehensive study of world-wide aquifers (with IAEA).





References

- ATTA-1: *Chen et al., Science (1999)*
- ATTA-2: *Du et al., Geophys. Res. Lett. (2003)*
- ATTA-3: *Jiang et al., Phys. Rev. Lett. (2011)*

- **Featured in the Science Section of New York Times (Nov. 22, 2011)**

Speaker's Remarks

Based on Science

For nEDM the science goal continues to be stronly motivated and R&D continues; a decision point is expected within ~ 2 years whether to proceed with the full experiment

On Majorana, a necessary condition to proceed will be whether the Majorana Demonstrator in fact reaches the sensitivity level required. A compelling science case in the context of international efforts and the status of neutrino science at the time the decision is made will also be essential.

It is noted that there are other ideas percolating (proton EDM)

The more substantive proposed experiments, as for all such experiments in NP, will have to compete with other opportunities across the portfolio, and all such experiments will need to be in the "re-write the textbooks" category of impact

Nuclear Theory

Research in nuclear theory spans the entire NP program.

The essential role of a strong nulcear theory effort goes without saying:

- Poses scientific questions that lead to the construction of facilities
- Helps make the case for, and guide the design of new facilities, their research programs and their strategic operations plan
- Provides a framework for understanding measurements made at facilities
    - Theory effort is key to understanding flow, charmonium, etc. at RHIC
    - Ab Initio calculations of nuclear structure, reactions, are essential for understanding drip lines, nucleosynthesis, atomic EDMs, …
    - Calculations of nuclear and nucleon matrix elements are crucial for:
        - Understanding and interpreting weak decays ➔CKM matrix elements ➔ new standard model
        - Understanding and interpreting neutrinoless double beta decay

Existing Topical Theory Collaborations

Topical Theory Collaborations

Selection announced Dec 14, 2009

"Jet and Electromagnetic Tomography (JET) in Heavy-Ion Collisions "
Principal Investigator/Project Director: X-N. Wang (LBNL), eight collaborating institutions

"Advancing the Theory of Nuclear Reactions with Rare Isotopes: From the Laboratory to the Cosmos "
Principal Investigator/Project Director: I. Thompson (LLNL), four collaborating institutions

"Neutrinos and Nucleosynthesis in Hot and Dense Matter"
Principal Investigator/Project Director: S. Reddy (INT formerly LANL), six collaborating institutions

Topical Collaborations are fixed-term, multi-institution collaborations established to investigate a specific topic in nuclear physics of special interest to the community, which is well aligned with programmatic NP goals.

Isotopes and Radioisotopes in Short Supply Provided at Full Cost Recovery by the Office of Science to Support U.S. Needs and Industrial Competitiveness

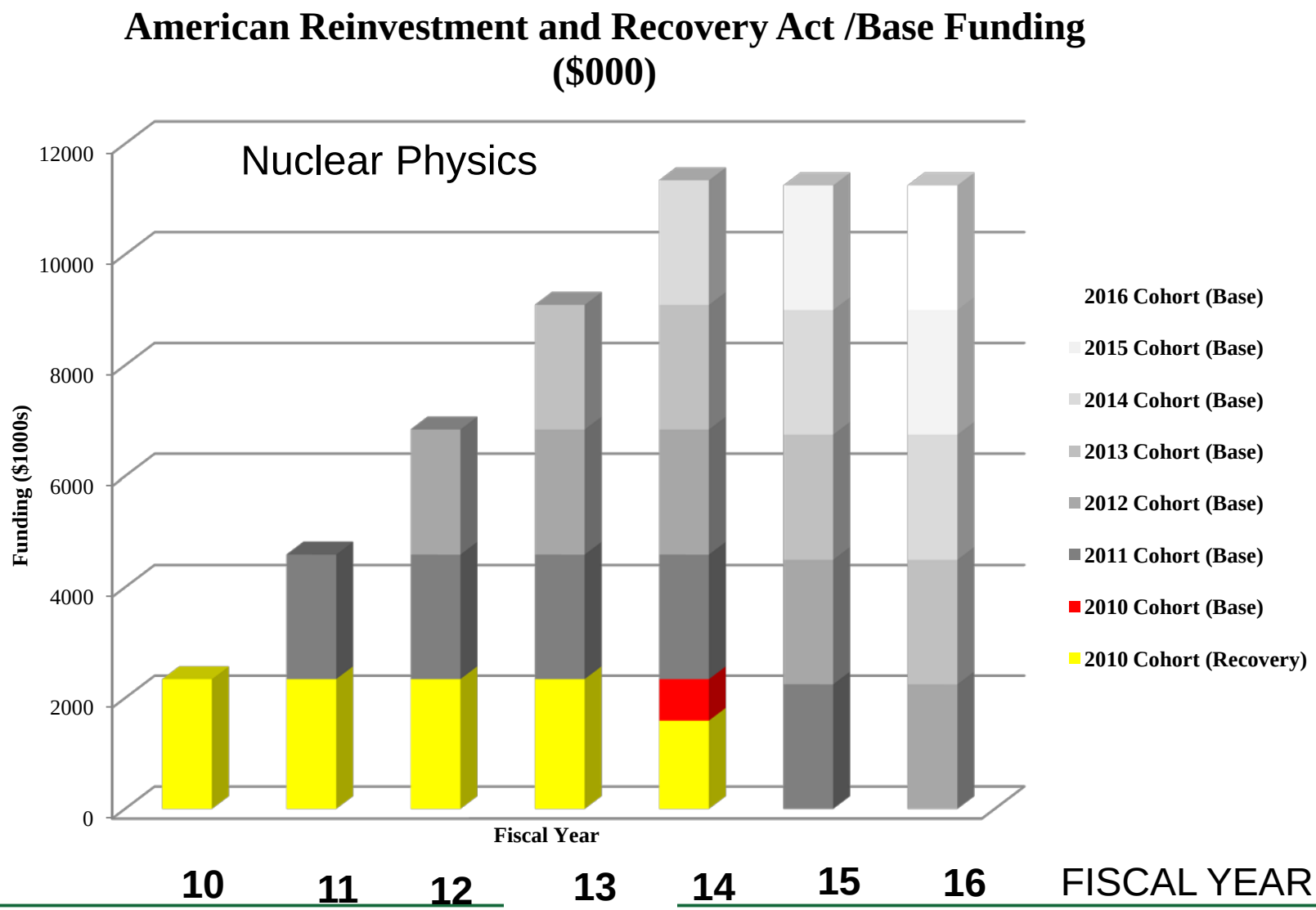
Some key isotopes and radioisotopes and the companies that use them

Strontium-82, Rubidium-82	Imaging / Diagnostic cardiology
Germanium-68, Gallium-68	Calibration / PET scan imaging
Californium-252	Oil and gas exploration and manufacturingcontrols
Selenium-75	Radiography / Quality control
Actinium-225, Yttrium-90, Rhenium 188	Cancer / Infectious disease treatment
Nickel-63	Explosives detection at airports
Gadolinium-160, Neodymium-160	Tracers and contrast agents for biological agents
Iron-57, Barium-135	Standard sources for mass spectroscopy
Sulfur-34	Environmental monitoring
Rubidium-87	Atomic frequency / GPS applications
Lithium-6, Helium-3	Detection of Special Nuclear Materials
Samarium-154	Solar energy /transportation applications

Bracco Diagnostics Inc.

Spectrum Techniques

Science Early Career Research Award Program Funding



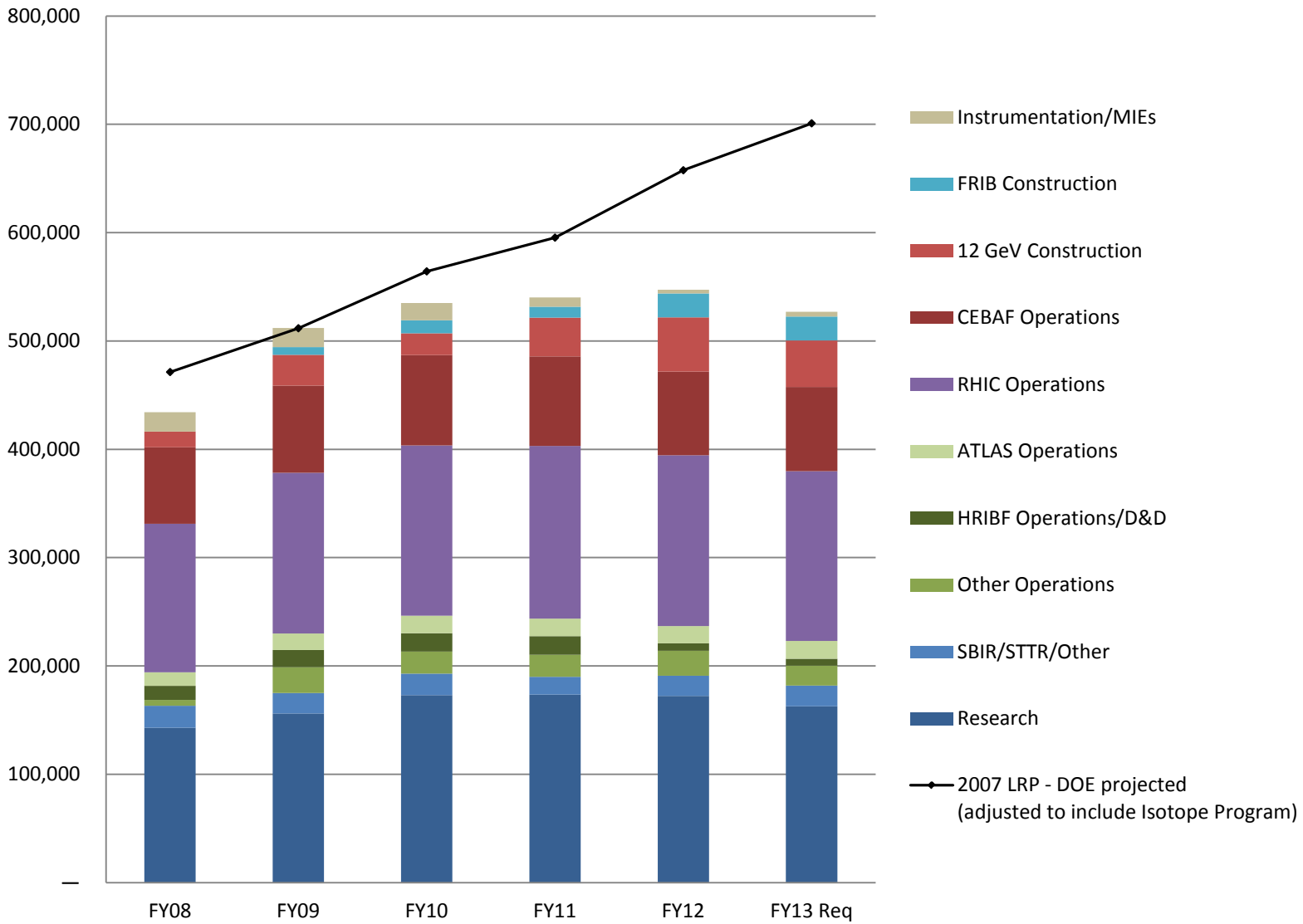
Speaker's Remarks

Based on Science

NP continues to seek an opportunity to address the NSACI recommendation for a dedicated isotope research facility

NP's commitment to young scientists will continue

Nuclear Physics Funding Distribution
FY 2008 – FY 2013



From the DOE—NSF Charge to NSAC

DOE and NSF are making significant progress toward achieving the vision of the 2007 Long Range Plan for Nuclear Science. However, DOE and NSF now seek your advice to continue the vision in the Plan so that the recommendations can move forward in light of projected constrained budgets.

We seek advice from NSAC on implementing the priorities and recommendations of the 2007 Long Range Plan in light of projected budgetary constraints and for guidance on developing a plan to implement the highest priority science in the context of likely available funding and world-wide capabilities. We request that NSAC examine the existing research capabilities and scientific efforts, assess their role and potential for scientific advancements, and advise the two agencies regarding the time and resources needed to achieve the planned programs. Your report should describe how to optimize . . .

Based on the priorities and opportunities identified and recommended in the 2007 Long Range Plan, the report should discuss what scientific opportunities will be addressed, and what existing and future facilities and instrumentation capabilities would be needed by the Federal nuclear science program to mount a productive, forefront program for each of the funding scenarios.

NSAC Subcommittee Members

Professor Adam Burrows, Department of Astrophysical Sciences, Princeton University
Dr. Joseph Carlson, Los Alamos National Laboratory
Dr. George Crabtree Material Science Division, Argonne National Laboratory/ University of Illnois
Professor Brad Fillippone, Department of Physics, California Institute of Technology
Professor Stuart Freedman Department of Physics University of California
Professor Haiyan Gao, Triangle Universities Nuclear Laboratory Duke University
Dr. Donald Geesaman (NSAC Chair), Physics Division, Argonne National Laboratory
Professor Barbara Jacak Department of Physics & Astronomy State University of New York
Dr. Peter Jacobs, Nuclear Science Division, Lawrence Berkeley National Laboratory
Professor David Kaplan Institute of Nuclear Theory University of Washington
Professor Kirby Kemper Department of Physics Florida State University
Professor Krishna Kumar Department of Physics University of Massachusetts Amherst
Professor Naomi C. R. Makins Department of Physics University of Illinois
Professor Curtis Meyer Department of Physics Carnegie Mellon University
Professor Jamie Nagle Physics Department University of Colorado
Professor Witold Nazarewicz Department of Physics & Astronomy University of Tennessee
Professor Krishna Rajagopal Department of Physics Massachusetts Institute of Technology
Professor Michael Ramsey-Musolf Department of Physics University of Wisconsin
Professor Lee Sobotka Department of Chemistry Washington University
Professor Robert Tribble (Chair) Cyclotron Institute Texas A&M University
Professor Michael Wiescher Department of Physics University of Notre Dame Notre Dame
Professor John Wilkerson Department of Physics & Astronom University of North Carolina

Message to the DNP from NSAC Subcommittee Chair, Bob Tribble

To members of the DNP:

The first meeting of a new NSAC subcommittee was held on May 15, 2012. The subcommittee has been charged to provide advice on implementing the priorities and recommendations of the 2007 NSAC Long Range Plan in light of projected budgetary constraints and for guidance on developing a plan to implement the highest priority science in the context of likely available funding and world-wide capabilities. The subcommittee used its first meeting to hear presentations from DOE and NSF representatives and to begin setting the agenda for the next meeting, which will mostly focus on presentations from the four major areas of science that were covered in the 2007 Long Range Plan. Also some significant time in the first meeting was devoted to the issue of community input to the process.

While the subcommittee is not carrying out a new LRP, it recognizes that the impact of the present effort will be significant for the field. We welcome input from individual members of the community and have a link on the subcommittee website

http://cyclotron.tamu.edu/nsac-subcommittee-2012

for DNP members to post comments to the subcommittee.

Message to the DNP from NSAC Subcommittee Chair, Bob Tribble

For those interested in using this mechanism, comments will need to be submitted with your name and email address so that they can be approved by a moderator before they are posted. For those of you who are involved in a program at a major US user facility, it may be more appropriate to work through your User Group to provide input to the subcommittee. Other groups may want to 'self organize' in order to have their collective voice heard.

Since this is not a new LRP exercise, extended White Papers detailing all of the potential avenues of research will likely not be very useful to the subcommittee. More concise summaries putting the importance of the science in clear language would be particularly valuable. In addition, the DNP Executive Committee has agreed to set aside time at the fall DNP meeting in Newport Beach (likely in conjunction with the Town Meeting) for community input to the process. More information on the Fall Meeting plans will be forthcoming.

Bob Tribble
NSAC Subcommittee Chair

Outlook

The future of nuclear science in the United States may not go exactly as we had envisioned it, but it remains rich with science opportunities.

The United States continues to provide resources for and to expect:

- U.S. world leadership in discovery science illuminating the properties of nuclear matter in all of its manifestations.
- Tools necessary for scientific and technical advances which will lead to new knowledge, new competencies, and groundbreaking innovation and applications.
- Strategic investments in tools and research to provide the U.S. with premier research capabilities in the world.

Nuclear Science will continue to be an important part of the US science investment strategy to create new knowledge and technology innovation supporting US security and competitiveness