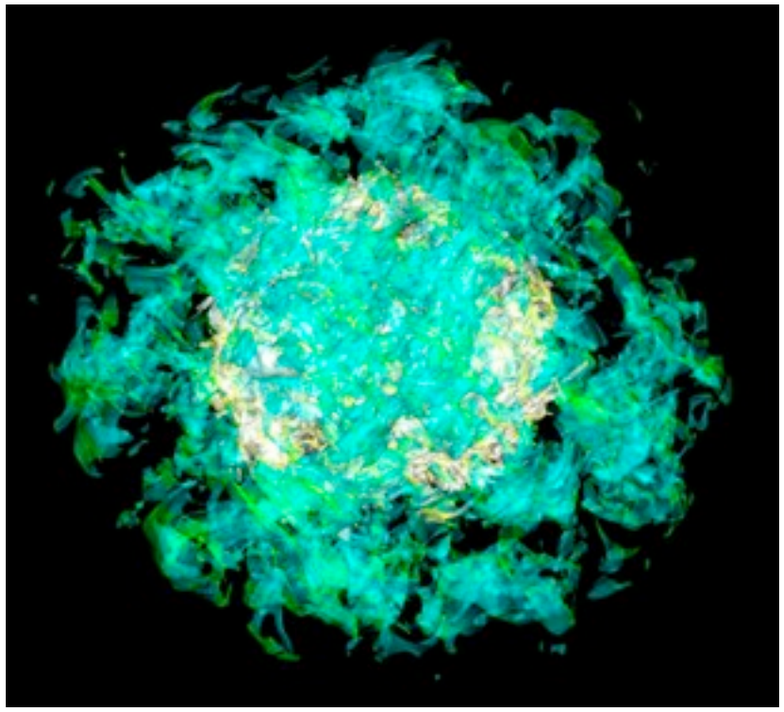
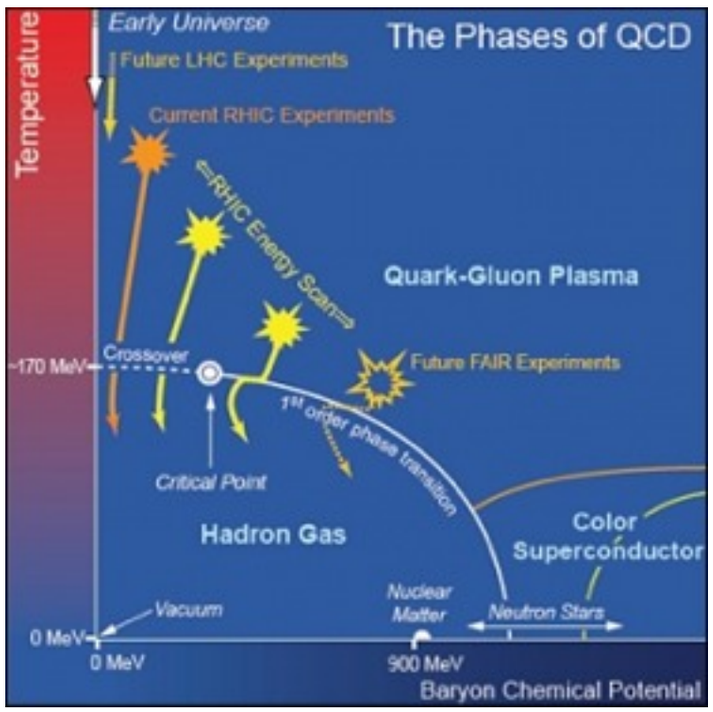
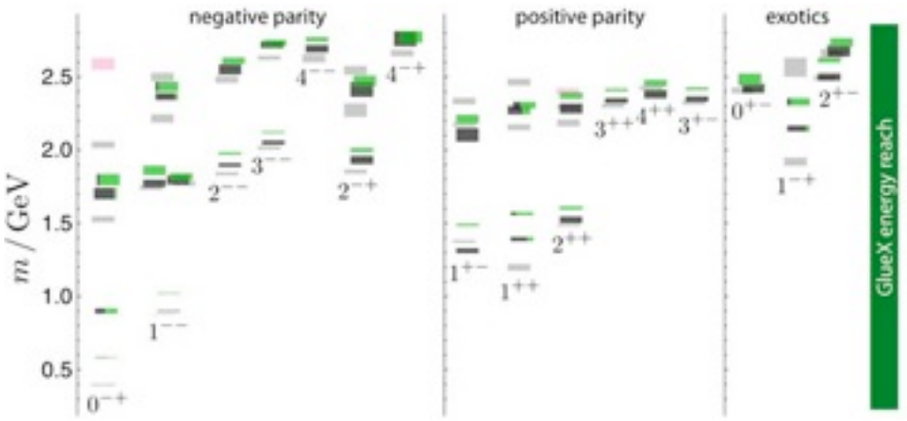
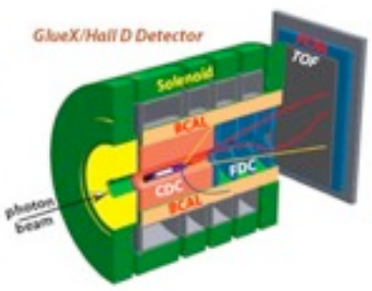
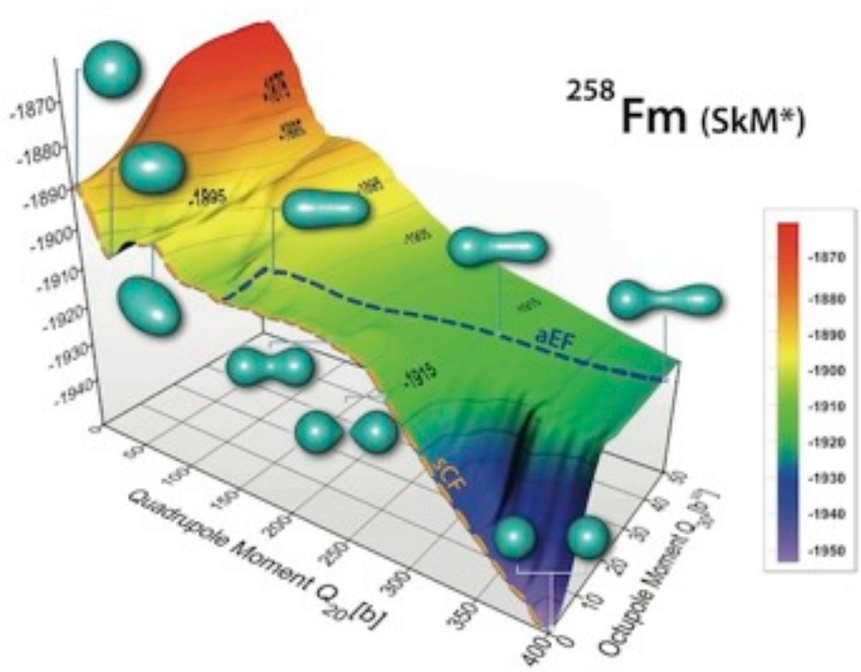
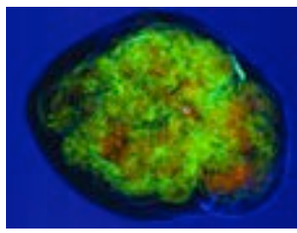




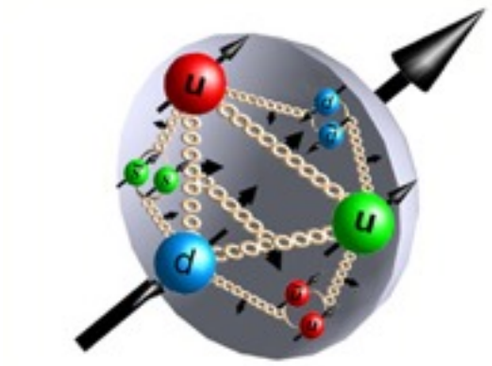
# Computational Nuclear Physics

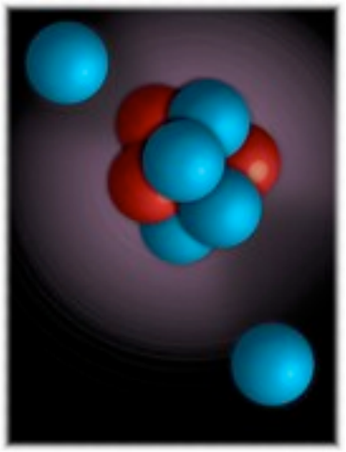
# Welcome and Introduction

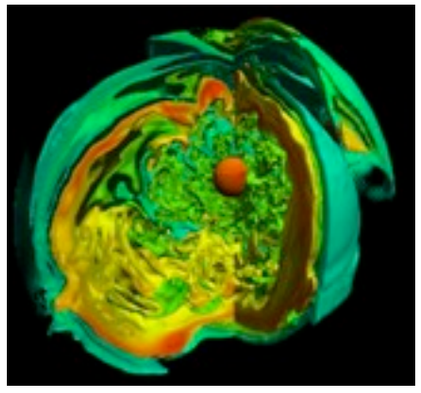
SURA Headquarters
Washington D.C.
**July 23-24, 2012**

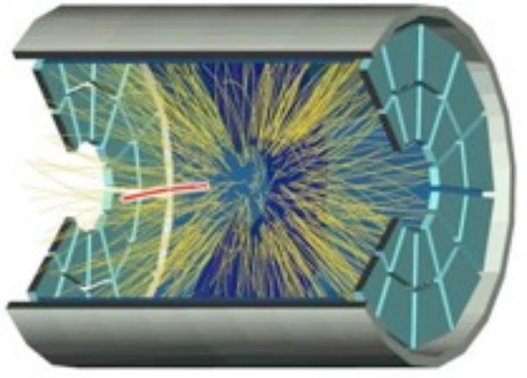
Computational Nuclear Physics

# Computing is Essential for Nuclear Physics Research



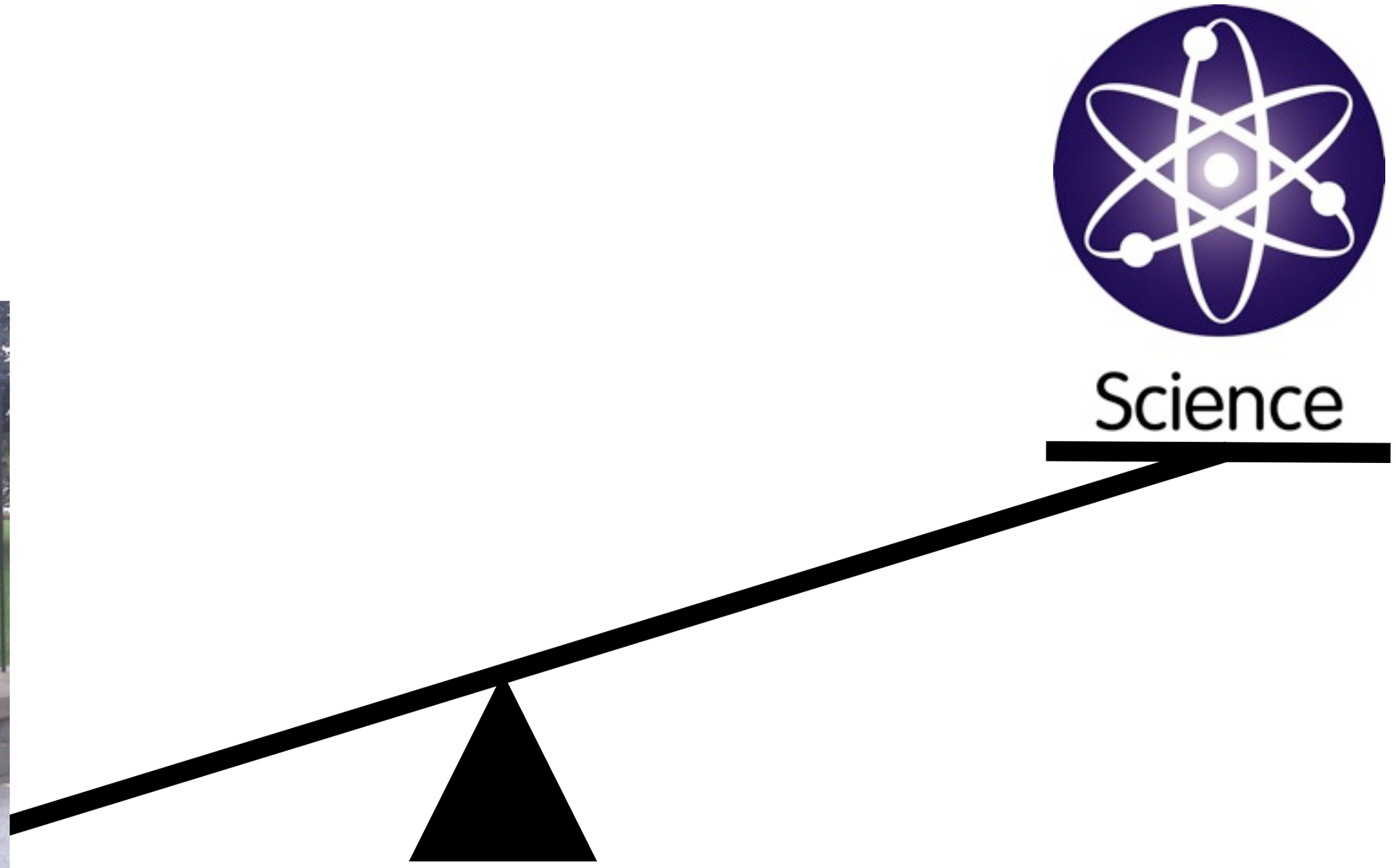




- Remarkable accomplishments and rapid progress
  - in sub-areas
  - connections between sub-areas
- Tied to experimental program
- Collaborative within Physics, and with CS + AM
- Uniquely able to provide reliable predictive capabilities

Computational Nuclear Physics

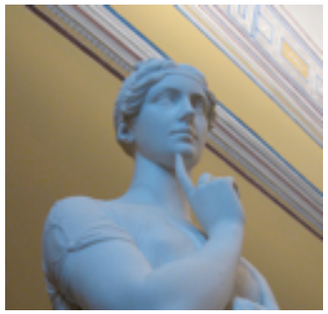
# This Meeting


- constrained budget going forward
- agencies want advice to optimize program

Computational Nuclear Physics

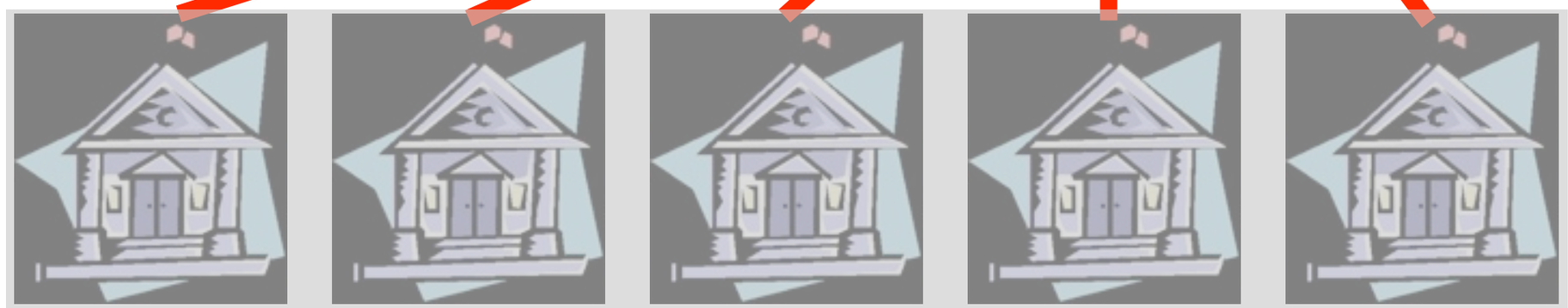
# Process Outline



Nuclear Science Advisory Committee

You are here

30 min talk and short document



Computational Nuclear Physics

# Brinkman/Seidel letter to NSAC

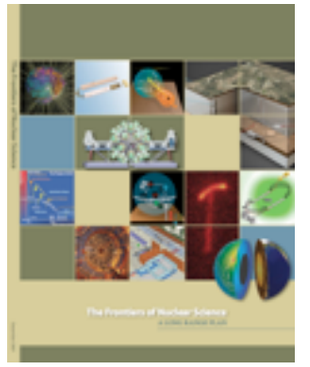
We seek advice from NSAC on implementing the priorities and recommendations of the 2007 Long Range Plan in light of projected budgetary constraints and for guidance on developing a plan to implement the highest priority science in the context of likely available funding and world-wide capabilities. We 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 the overall nuclear science program over the next five years (FY 2014-2018), under at least the following funding scenarios for the nuclear science budgets at the two agencies: (1) flat funding at the FY 2013 request level, and (2) modest increases over the next five years.

-5.8% from 2012

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.

Computational Nuclear Physics

# 2007 Long Range Plan Recommendations



## RECOMMENDATION I — JLab

**We recommend completion of the 12 GeV CEBAF Upgrade at Jefferson Lab. The Upgrade will enable new insights into the structure of the nucleon, the transition between the hadronic and quark/gluon descriptions of nuclei, and the nature of confinement.**

## RECOMMENDATION II — FRIB

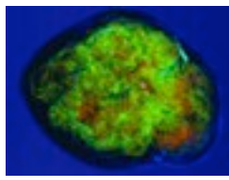
**We recommend construction of the Facility for Rare Isotope Beams, FRIB, a world-leading facility for the study of nuclear structure, reactions, and astrophysics. Experiments with the new isotopes produced at FRIB will lead to a comprehensive description of nuclei, elucidate the origin of the elements in the cosmos, provide an understanding of matter in the crust of neutron stars, and establish the scientific foundation for innovative applications of nuclear science to society.**

## RECOMMENDATION III — DUSEL

**We recommend a targeted program of experiments to investigate neutrino properties and fundamental symmetries. These experiments aim to discover the nature of the neutrino, yet-unseen violations of time-reversal symmetry, and other key ingredients of the New Standard Model of fundamental interactions. Construction of a Deep Underground Science and Engineering Laboratory is vital to U.S. leadership in core aspects of this initiative.**

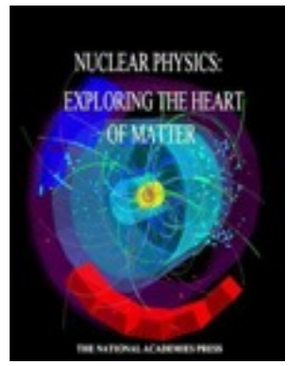
## RECOMMENDATION IV — RHIC

**The experiments at the Relativistic Heavy Ion Collider have discovered a new state of matter at extreme temperature and density—a quark-gluon plasma that exhibits unexpected, almost perfect liquid dynamical behavior. We recommend implementation of the RHIC II luminosity upgrade, together with detector improvements, to determine the properties of this new state of matter.**



**Computational Nuclear Physics**

# 2012 National Academy Report Recommendations




**Finding:** By capitalizing on strategic investments, including the ongoing upgrade of the continuous electron beam accelerator facility (CEBAF) at the Thomas Jefferson Accelerator Facility and the recently completed upgrade of the relativistic heavy ion collider (RHIC) at Brookhaven National Laboratory, as well as other upgrades to the research infrastructure, nuclear physicists will confront new opportunities to make fundamental discoveries and lay the groundwork for new applications.

RHIC JLab

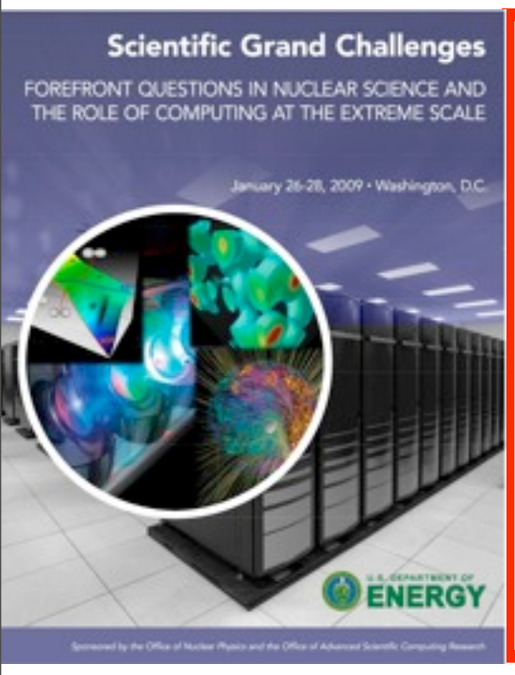
**Recommendation:** The Department of Energy, the National Science Foundation, and, where appropriate, other funding agencies should develop and implement a targeted program of underground science, including important experiments on whether neutrinos differ from antineutrinos, on the nature of dark matter, and on nuclear reactions of astrophysical importance. Such a program would be substantially enabled by the realization of a deep underground laboratory in the United States.

DUSEL

**Finding**: The Facility for Rare Isotope Beams is a major new strategic investment in nuclear science. It will have unique capabilities and offers opportunities to answer fundamental questions about the inner workings of the atomic nucleus, the formation of the elements in our universe, and the evolution of the cosmos.

**Recommendation**: The Department of Energy's Office of Science, in conjunction with the State of Michigan and Michigan State University, should work toward the timely completion of the Facility for Rare Isotope Beams and the initiation of its physics program.

FRIB




**Recommendation:** A plan should be developed within the theoretical community and enabled by the appropriate sponsors that permits forefront-computing resources to be deployed by nuclear science researchers and establishes the infrastructure and collaborations needed to take advantage of exascale capabilities as they become available.


# NSAC
# Tribble Committee Questions

---

(1) What major scientific accomplishments and discoveries have occurred in your area of high-performance computing since the 2007 LRP was drafted?

(2a) What compelling and unique science can be carried out in the program in the next five years assuming support similar to FY13 that includes cost of living increases?
(2b) What additional impact would flat-flat funding to FY18 have on (2a)?

(3) What is the minimum level of support (cycles, new hardware, etc.) needed to maintain a viable program in computational nuclear physics?

(4) What workforce (physicists, CS, AM, students) is needed to maintain a viable program?
What will it require to take the community to the exascale era (e.g., training of students and postdocs)?

(5) What science would you expect to pursue in the program in 2020 and beyond?
What is needed to support this?
What science would you expect to pursue without access to major supercomputer centers?

(6) What is role of the science in your research area in the international context?
If the US effort in high-performance computing were seriously curtailed, to what degree would efforts in other countries fill the gap?
And, to what degree would US scientists be able to advance research in this area by working outside of the country?

(7) How does high performance computing contribute to the educational mission of training the future workforce in nuclear physics and associated applied areas?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Computational Nuclear Physics

# Meeting Output

- ~ 4 page  document
- Respond to all of the questions from committee
- Gather information/slides/data for 30 min presentation
- Maybe homework assignments - hopefully not

Computational Nuclear Physics

# The Agenda

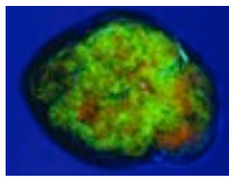
| Monday, July 23 , 2012 | | |
|---|---|---|
| 8:30 8:35 | Welcome | Jerry Draayer |
| 8:35-8:45 | Introduction | Martin Savage |
| 8:45-9:45 | Cold QCD | Tom Luu, Balint Joo |
| 9:45-10:45 | Hot QCD | Peter Petreczky, Swagato Mukerjee |
| *10:45-11:15* | *Coffee Break* | |
| 11:15-12:15 | Nuclear Structure and Reactions | Joe Carlson, Ewing Lusk |
| *12:15-13:15* | *Lunch Break* | |
| 13:15-14:15 | Astrophysics | Adam Burrows, Bronson Messer |
| 14:15-14:45 | Additional Opportunities for Computational Nuclear Physics-5 Minutes and Maximum of Two Transparencies From Floor | |
| *14:45-15:15* | *Coffee Break* | |
| 15:15-15:35 | Whitepaper: Aims and Plans | Martin Savage |
| 15:35- | General Discussion, With Attendance by Agency Representatives | |
| **Tuesday, July 24, 2012** | | |
| 8:25 8:30 | Introduction to the 2nd Day | Martin Savage |
| 8:35-10:00 | Computational Requirements Working Session | Robert Edwards (Chair) |
| *10:00-10:30* | *Coffee Break* | |
| 10:30-12:00 | Evolution of Computational Physics and Cross-Cutting | David Dean (Chair) |
| *12:00-13:00* | *Lunch Break* | |
| 13:00-14:00 | Summary, Resolutions, and Closeout | Witold Nazarewicz, David Richards |
| 14:00-15:30 | Writing Group Session | |

30 min Physics
15 min CS/AM
15 min Discussion

Q : 1,2,3

Q : 1,2,3,5,6,7

Q : 4,5,6,7



Computational Nuclear Physics


# END

Computational Nuclear Physics

# Budgets

**Nuclear Physics**
**Funding Profile by Subprogram and Activity**

(Dollars in Thousands)

| | FY 2011 Current | FY 2012 Enacted | FY 2013 Request |
|---|---|---|---|
| Medium Energy Nuclear Physics | | | |
| Research | 37,922 | 37,296 | 35,374 |
| Operations | 82,563 | 77,372 | 80,651 |
| SBIR/STTR and Other | 1,648[a] | 17,909 | 19,235 |
| Total, Medium Energy Nuclear Physics | 122,133 | 132,577 | 135,260 |
| Heavy Ion Nuclear Physics | | | |
| Research | 40,203 | 39,977 | 38,630 |
| Operations | 161,391 | 160,617 | 158,571 |
| Total, Heavy Ion Nuclear Physics | 201,594 | 200,594 | 197,201 |
| Low Energy Nuclear Physics | | | |
| Research | 57,310 | 52,194 | 48,946 |
| Operations | 38,114 | 31,533 | 27,072 |
| Facility for Rare Isotope Beams | 10,000 | 22,000 | 22,000 |
| Total, Low Energy Nuclear Physics | 105,424 | 105,727 | 98,018 |
| Nuclear Theory | | | |
| Theory Research | 34,776 | 32,047 | 30,246 |
| Nuclear Data Activities | 8,159 | 7,360 | 6,933 |
| Total, Nuclear Theory | 42,935 | 39,407 | 37,179 |
| Isotope Development and Production for Research and Applications | | | |
| Research | 4,060 | 4,827 | 4,453 |
| Operations | 15,610 | 14,255 | 14,255 |
| Total, Isotopes | 19,670 | 19,082 | 18,708 |
| Subtotal, Nuclear Physics | 491,756 | 497,387 | 486,366 |
| Construction | | | |
| 06-SC-01, 12 GeV CEBAF Upgrade, TJNAF | 35,928 | 50,000 | 40,572 |
| Total, Nuclear Physics | 527,684[a] | 547,387[b] | 526,938 |

[a] Total is reduced by $12,430,000: $11,098,000 of which was transferred to the Small Business Innovation and Research (SBIR) program and $1,332,000 of which was transferred to the Small Business Technology Transfer (STTR) program.
[b] The FY 2012 appropriation is reduced by $2,613,000 for the Nuclear Physics share of the DOE-wide $73,300,000 rescission for contractor pay freeze savings. The FY 2013 budget request reflects the FY 2013 impact of the contractor pay freeze.