Update from NSAC
NuPECC Meeting Budapest

Susan J. Seestrom
NSAC Chair
Outline

• Overview of NSAC
• U.S. funding agency views
• Status of major construction
NSAC Overview

• Charter: “…provide advice upon request to both the Department of Energy and the National Science Foundation on determining the scientific priorities within the field of basic science research…”

• Charges
  – Recurring (Committee of Visitors, Performance Measures)
  – Advice on specific issues (e.g. Long Range Plan, Isotopes, Rare Isotope Beam Taskforce, …)
Priorities of the Long Range Plan
Recommendations of the LRP

I. 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.

II. 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.

III. 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.

IV. 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.
2011 NSAC Members

Jeffrey Binder (ORNL)
Jeffery Blackmon (LSU)
Gail Dodge (ODU)
Richard Furnstahl (Ohio)
Alexandra Gade (MSU)
Carl Gagliardi (TAMU)
Susan Gardner (Kentucky)
Peter Jacobs (LBNL)
David Kaplan (INT/UW)
Dimitri Kharzeev (BNL)
Josh Klein (Penn)
Karlheinz Langanke (GSI)
Zheng-Tian Lu (ANL)

Allison Lung (TJNAF)
Curtis Meyer (CMU)
Julie Velkovska (Vanderbilt)
Susan Seestrom (LANL) Chair

Bill Zajc/Bob Tribble (DNP)
Michael Bronikowski (ACS)
Robert Atcher (SNM)
NSAC had two charges in 2011

• Public Access to Research Results – sub-committee Chair Allena Opper (George Washington) - complete

• Neutron Charge – sub-committee Chair Krishna Kumar (U. Mass.) (acting NSAC Chair Peter Jacobs) – draft report
Public Access to Research Results

• America COMPETES Reauthorization Act of 2010 addresses public access to research results, particularly in the forms of scholarly publications and digital data.

• Charge from DOE Office of Science: “Identify and assess current practices, policies and procedures to research results with report by 1-jul-2011.”

(Public = general public AND scientists outside the group producing the research)
Neutron Charge

• Background
  – 2003 subcommittee recommended launching of nEDM and FNPB
  – 2007 LRP: Neutron physics part of FS Initiative

• Evaluate current and proposed research program
  – physics potential in the context of the larger FS subfield
  – scientific capabilities and specific opportunities
  – international context
Neutron Physics Themes

- nEDM experiment
  - compelling physics case in larger context
  - significant fraction of funding and effort

- Weak Interactions with Neutrons
  - lifetime is a fundamental parameter
    - current results inconsistent at the 1 s level
  - correlations comprehensively probe neutron charged weak current
    - evaluate in larger context based on sensitivity to BSM physics
  - hadronic parity violation
    - fundamental description of non-leptonic weak interactions
  - Experimental program
    - Evaluate recent progress: degree of difficulty vs physics payoff
Neutron EDM Priority

The successful completion of an nEDM experiment, the initiative with the highest scientific priority in US neutron science, would represent an impressive scientific and technical achievement for all of nuclear physics, with ramifications well beyond the field.
67% of the NP budget supports operations or construction of facilities & instrumentation. The percentage devoted to major projects grows to 16% in FY 2012.

**FY 2012 Congressional Request Nuclear Physics by Major Function**

**FY 2012 Congressional Request Total = $605.3M**

**FY 2010 Appropriation with SBIR/STTR Total = $535.0M**
Nuclear Physics at NSF

- NP Experiment
  - Structure
  - Heavy Ions
  - Symmetries
  - Hadrons and QCD
- NP Theory
- Particle and Nuclear Astrophysics
  - Astrophysics (Notre Dame, FSU)
  - Neutrinos (Borexino, $\beta\beta$, $\theta_{13}$)
- Frontier Center (Joint Institute for Nuclear Astrophysics)
- NSCL
- FY2010 total: $49M
Jefferson Lab - 12 GeV Upgrade Project

Scope of this $310M project includes:
- Doubling the accelerator max beam energy
- New experimental Hall and beamline
- Upgrades to existing Experimental Halls

An exciting scientific opportunity:
- Explore the physical origins of quark confinement (GlueX)
- New access to the spin and flavor structure of the proton and neutron
- Reveal the quark/gluon structure of nuclei
- Potential new physics through high precision tests of the Standard Model

Highlights:
- Construction 49% complete
- Cost & schedule performance within 5% of baseline plan
- Very successful 6-month accelerator installation period (May - Oct 2011)
- Dedicated 12-month installation planned (May 2012 - May 2013)
- Beam commissioning to Hall A (Oct 2013) ; Hall D (April 2014)
- Beam commissioning to Halls B & C (Oct 2014)
- Project Completion (June 2015)
12 GeV - GREAT PROGRESS

- 12 GeV cryomodule
- Upgraded arc magnets
- Tunnel extension
- Hall D Solenoid
Preliminary Civil Design Complete & Integrated with Technical Systems; Final Design Started
Driver Linear Accelerator Lattice Frozen; Design Integrated with Civil Design

- **Tunnel is**
  - 550 ft long
  - 70 ft wide
  - 25 ft underground

ECR Ion Sources
Room Temperature RFQ Accelerator
Quarter Wave Resonators
Quarter Wave Resonators
Target Beam Delivery System
Superconducting Bend
Half Wave Resonators
Half Wave Resonators
Cryogenic Distribution Line
Charge Stripper

FRIB Project Update, October 2011
• Conceptual design completed 9/2010 (CD-1)
• Preliminary design 2010-2012
  – CD-2/3A (civil) review in April 2012
• Civil construction begins 2012
• Final design 2012-2013
  – CD-3B (technical) review in 2013
• Technical construction begins 2013
• Integration/commissioning 2016-2018
• Early project completion 2018
• Project completion 2020
Long Range Plan?

Long range plans have been issued every ~6 years; preparation extends over about 2 years, so hypothetically: