# Report on the NSF PHY 2009 Committee of Visitors

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HEPAP Meeting

May 21, 2009

# Outline

- COV charge, process, membership etc
- General Findings
- Programmatic Findings
  - EPP
  - PNA
  - Theory
  - EIR, PLS, PIF, PFC
- Conclusions

# NSF Committee of Visitors (COV)

- From the 2009 NSF COV Guidelines:

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Committee of Visitor (COV) reviews provide NSF with external expert judgments in two areas: (1) assessments of the quality and integrity of program operations and program-level technical and managerial matters pertaining to proposal decisions; and (2) comments on how the results generated by awardees have contributed to the attainment of NSF's mission and strategic outcome goals.

# 2009 NSF PHY COV Charge

- From Tony Chan's charge letter to Dr. Sidney Wolff, COV chair:

By NSF policy, each program that awards grants and cooperative agreements must be reviewed at three-year intervals by a COV comprised of qualified external experts. NSF relies on their judgment to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Reports generated by COVs are used in assessing agency progress in order to meet government-wide performance reporting requirements, and are made available to the public. The COV is charged to address and prepare a report on:

- the integrity and efficacy of processes used to solicit, review, recommend, and document proposal actions;
- the quality and significance of the results of the Division's programmatic investments;
- the relationship between award decisions, program goals, and Foundation-wide programs and strategic goals;
- the Division's balance, priorities, and future directions;
- the Division's response to the prior COV report of 2006; and
- any other issues that the COV feels are relevant to the review.

# COV Process

- 3 day meeting at NSF headquarters on Feb. 4-6, 2009.
  - Materials were posted to the web ahead of time, and subcommittee chairs had a pre-meeting telecon with the Chair
- The agenda began with introductory and overview talks, followed by breakouts into program areas and meetings with program managers
- The subcommittees reviewed proposal decisions (approved, declined, withdrawn) using the electronic e-jacket system
  - A total of 340 funding decisions were reviewed, out of a total of 2,352 for the period FY06-08
  - Subcommittee findings were drafted by the afternoon of the 2nd day
- The panel then reconvened to hear subcommittee reports, followed by presentations on PHY Division-wide issues and discussion
- Final subcommittee reports were completed within 2 weeks and the full report was finished by early March and submitted to the MPS advisory committee

# PHY Division Areas for COV Review

- Atomic, Molecular, Optical, and Plasma Physics
- Education and Interdisciplinary Research
- Elementary Particle Physics
- Gravitational Physics
- Nuclear Physics
- Particle and Nuclear Astrophysics
- Physics at the Information Frontier
- Physics Frontiers Centers
- Physics of Living Systems
- Theoretical Physics

Overall Chair: Sidney Wolff, NOAO

**Division of Physics – Committee of Visitors**
**List of Disciplinary Program Sub-Panel Members**

**AMOP**
Randy Hulet (Chair)
Dan Stamper-Kurn
Edward Thomas
Min Xiao

**EIR**
Beth Cunningham (Chair)
Truell Hyde
Laird Kramer

**EPP and LHC**
Daniela Bortoletto
Natalie Roe (Chair)
Harry Weerts

**Gravity and LIGO**
Thomas Baumgarte
Eanna Flannagan (Chair)
John Friedman

**Nuclear Physics and NSCL**
Gail Dodge
Richard Milner (Chair)
Brad Sherrill

**Physics of Living Systems**
Angel Garcia
Peter Littlewood
John Marko (Chair)

**Particle and Nuclear Astrophysics and DUSEL**
Pat Burchat
Uwe Greife
Angela Olinto
Mike Schaevitz (Chair)

**Physics at the Information Frontier**
John Preskill (Chair)
Uwe Thumm

**Theoretical Physics**
Mark Edwards
Charlotte Elster
Barbara Gentz
Gordon Kane (Chair)
Ann Nelson
Jorge Piekarewicz
Marianna Safronova

**Physics Frontiers Centers**
Larry Gladney
Janos Kirz (Chair)

# General Findings

- Review process:  excellent
  - good use of both panel and written reviews;
  - reviewers have both expertise and diversity;
  - conflicts of interest are handled appropriately;
  - program officers follow recommendations closely;
  - Fastlane is easy to use;
  - decisions are timely (most <6 months)
- However:
  - program officers have very heavy workloads;
  - many excellent proposals are rejected or underfunded due to lower than inflation growth in funding

# General Findings

- Program outcomes:  excellent
  - Many examples cited showing major research achievements in all areas
  - New program areas have been started in physical biology, information physics
- Broader agency goals:  excellent
  - Diversity among recipients/institutions
  - Many innovative education and outreach projects
  - Genuine commitment to these broad agency goals

# General Findings

- Program Balance:  Appropriate
  - Approx. 55% of funding goes to individual PIs;
  - Remainder goes to large programs like LIGO, LHC, Auger, and to Physics Frontier Centers (~10%).
- However:
  - "Funding desert" for large instrumentation and small experiments ($2M-$100M) continues to be a problem
    - Accelerator Physics and Physics Instrumentation (APPI) program started to address this, but is lacking funds (needs ~$10M/yr)
  - The importance of research support for PIs at 4-year colleges was recognized, due to large number of graduates who go on to obtain PhDs in science

# General Findings - CAREER Awards

- These awards to junior faculty just starting their independent research programs are very competitive (10-20% success rate)
- Some felt that too much emphasis was placed on “broader impacts” – innovation in education and outreach - given the many demands on these young scientists’ time
- This can be particularly difficult for women wishing to start a family during this period in their lives
- Encourage participation in existing education/outreach programs and resources – list available from Physics Education and Interdisciplinary Research (EIR)

# General Findings – Large Projects

- Several big PHY projects are funded by MREFC, or will be in the MREFC queue, eg DUSEL, Advanced LIGO, LSST
- These projects require careful advance planning, including estimation of total life-cycle costs to avoid unexpected budgetary problems
  - This was a major recommendation of the PHY COV in 2006, in the wake of the RSVP cancellation
- Planning for DUSEL to date shows that this message was received
  - Site selection and R&D processes were well conceived
  - Dedicated program officer (J. Kotcher) and selection of a program manager
- However: a thorough cost estimate requires significant resources
  - requires a commitment from the NSF as a whole, as budget may exceed capability of PHY Division
- Increasingly, NSF is partnering with other agencies and countries on large-scale projects, which also brings in greater complexities for management

# General Findings – COV Process

- Overall it went very smoothly, incorporating some suggestions from the 2006 COV
- Only real problem was that reviewers had access only to selected e-jackets
  - Program officers had pre-selected a variety of proposals, and would add others to the list at the reviewers' request
  - Access to all proposals would require a means to prevent access to those on which a reviewer had been a Co-I
  - Presumably this is a solvable problem by the time of the next COV

# Experimental Particle Physics (EPP)

- $56M in FY08 managed by one full-time federal employee (M. Goldberg) and 3 rotators
- Supports university grants, CESR, LHC ops and accelerator R&D (ILC, MICE)
- Work closely with PNA as well as with DOE OHEP
- EPP has been very creative in collaborating broadly across NSF and leveraging a variety of funding opportunities in computing, interdisciplinary research, education & outreach etc

# EPP Findings

- Average award is $180-$200K/faculty with a few large groups (Columbia, Chicago, Cornell) receiving about twice that
- Women, minorities well-represented among PIs
- Good mix of universities across the country serving a variety of communities, with a broad portfolio of research
- Annual requests for funding are ~2x the available funding; CAREER award success rate is only 10-20%

# EPP Findings

- Cornell is making a transition, as CESR has ceased operations for particle physics research
  - Situation was reviewed by Witherell panel in 2006
- Cornell PIs are now funded through smaller competitive peer-reviewed grants
- Overall funding  now includes test accelerator support from both NSF and DOE (CESR-TA)
- We felt that NSF was doing a good job overall at managing this complicated transition period

# Approx. Cornell Funding by Year

| | Historic | FY06 | FY07 | FY08 | FY09 | FY10 |
|---|---|---|---|---|---|---|
| CESR | $20M | $14.6M | 14.7M | $10.7M | $5.5M | 0 |
| Cornell PI | | | 0.6M | $1.9M | 1.9M? | ? |
| CESR TA (NSF) | | | | $5.3M | $5.1M | $5.2M |
| CESR TA (DOE) | | | | $1.0M | $2.0M | $2.2M |
| Total | $20M | $14.6M | $15.3M | $18.9M | $14.5M? | |

# Particle and Nuclear Astrophysics

- PNA (est 2000) is a ~$16M program with a broad portfolio:
  - Cosmic rays, gamma rays, 0v2b decay, solar, HE and reactor v's, direct detection of dark matter, proton decay
- Managed by 1 federal employees (Whitmore) and 3 IPAs, including 1 dedicated to DUSEL (Kotcher)
  - This is a big improvement, in response to 2006 COV
- Many PNA programs are inter-disciplinary, requiring reviews by multiple programs and/or divisions, eg DUSEL, Auger, IceCube
  - Larger proposals (>$1M) are reviewed separately from the usual panel review process
  - DUSEL has become a model for how to manage large, multi-program, multi-agency projects
- PNA is commended for their stewardship of this very broad and complex field of research during a period of rapid growth

# Theoretical Physics

- Total annual funding of $20M supports AMOP, Nuclear, Particle and Mathematical theory
  - Overall funding per PI is low, ~$70K and provides on average 0.3 postdocs and 0.6 students/PI
  - Some areas have limited number of grants while others reduce grant amount – there is no good solution
  - Request for stimulus support for postdocs and young faculty
- Strong support for the Kavli Institute for Theoretical Physics (ITP) at UCSB
  - The "CERN" of US theoretical physics
  - Should not be limited by the 10% cap on total funding for PFCs; request 15-20% step up in annual funding
- Should add support for theory in PNA/DUSEL research areas, but cannot afford to take away support from other areas

# Education and Interdisciplinary Research

- EIR was recently established with one federal program officer (K. McCloud) and ~$5M budget to support
  - Education and outreach
    - REU is 2/3 of budget
    - Other program eg I2U2, an online educational framework
  - Expanded participation for women, minorities, and the disabled
  - Interdisciplinary programs that do not find a natural home elsewhere ("incubator"); good example is PLS
- Recommend increased funding and NSF-wide framework for ID programs
- Encourage alternative funding for RET program in wake of cancellation of MPS Office of Multidisciplinary Activities (OMA) support

# Physics Of Living Systems

- First awards made in 2006 after "incubation period" in EIR; one full-time program officer (K. Blagoev), $4.7M annual budget
- Supports research on the fundamental physical principles of life at all scales
  - In vitro molecular studies are co-reviewed with NSF-BIO
  - Only 17% of proposals are funded (10% in 2008), lower than other areas
  - Example: discovery of new retinal ganglion cell by Alan Litke (UCSC) and co-workers

# Physics at the Information Frontier

- PIF was founded in 2005 to continue support for awards begun in 2000 under NSF's Information Technology Research (ITR) program
- Program management was in transition at time of review; high praise for leadership of B. Schneider/M. Goldberg
- Annual budget of $8.5M supports grid computing (40%), quantum information science (40%) and computational physics (20%)
  - Open Science Grid (OSG) program receives 75% of grid funding; important for LHC, LIGO
  - Substantial overlap in QIS and CP with other areas, eg AMOP, lattice physics, NSF CISE etc
  - OSG award expires in FY10; suggest that it should not be supported in PHY any longer due to commercial availability of grid-like solutions, and anticipated growth in other areas

# Physics Frontier Centers

- Intended to support large university-based groups to foster transformational research
  - Nine current PFC's funded at $1M-4M/year for 5 years
  - 2 day site visit after 3 years
- 5-year cooperative agreement includes possibility of renewal
  - Current PFC's can compete with new proposals; half will compete at a time on a 3-year calendar
- 2008 process: 69 pre-proposals; 19 invited to submit full proposal; 12 reverse site visits; 5 funded, including 3 renewals. 2 existing PFC's phased out
- PFC's represent a "stellar collection of outstanding clusters of leading scientists… The impact… is profound"

# List of Current NFS PFC's

- Joint Institute for Nuclear Astrophysics – University of Notre Dame
- Center for the Physics of Living Cells – UIUC
- Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas – University of Wisconsin
- Center for Theoretical Biological Physics – UC San Diego
- Joint Quantum Institute – University of Maryland
- Kavli Inst. for Theoretical Physics – UC Santa Barbara
- JILA AMO Physics Frontier Center – University of Colorado
- Kavli Institute for Cosmological Physics – University of Chicago
- Center for Ultracold Atoms – MIT

# Conclusion

- COV Process shows NSF's commitment to good stewardship and transparency
- The 2009 PHY COV demonstrated many successes across a broad front of science as well as genuine commitment to "broader impacts"
- No major problems were identified except for a lack of funding – stimulus money can certainly be well spent in many areas
- The major issues that require ongoing attention include management of large projects, and the proper care and feeding of  interdisciplinary research