

# **Report of the 2019 Committee of Visitors**

## **Division of Physics National Science Foundation**

Robert P. Redwine, Chair '

# COV Membership \$

Felicie Albert, Lawrence Livermore National Laboratory

Jonathan Bagger, TRIUMF/Johns Hopkins University

Andrew Baker, Rutgers University

Emanuela Barberis, Northeastern University

Julio Barreiro, University of California, San Diego

John Beacom, Ohio State University

Elizabeth Beise, University of Maryland

Alain Brizard, St. Michael's College

Philip Bucksbaum, Stanford University

Arthur Champagne, University of North Carolina

Michelle Dolinski, Drexel University

Robin Erbacher, University of California, Davis

Lisa Everett, University of Wisconsin, Madison

Timothy Gay, University of Nebraska

Andrew Geraci, Northwestern University

Maury Goodman, Argonne National Laboratory

# COV Membership (cont'd) \$

Randy Hulet, Rice University

Julie McEnery, NASA/Goddard

Michael Murillo, Michigan State University

Jennifer Pearl, American Association for the Advancement of Science

Robert Redwine (chair), Massachusetts Institute of Technology

Dagmar Ringe, Brandeis University

Catherine Royer, Rensselaer Polytechnic Institute

Aravinthan Samuel, Harvard University

Peter Saulson Syracuse University

Michael Shaevitz, Columbia University

Joshua Smith, California State University, Fullerton

Marius Stan, Argonne National Laboratory

Daniel Steck, University of Oregon

Xerxes Tata, University of Hawaii

James Wells, University of Michigan

William Wester, Fermilab

# COV Subpanels \$

## COV Chair

## Institution

Robert Redwine

Massachusetts Institute of Technology

## Atomic, Molecular, Optical Physics/Quantum Information Science

Julio Barreiro

University of California, San Diego

Philip Bucksbaum

Stanford University

Timothy Gay\*

University of Nebraska

Randy Hulet

Rice University

## Elementary Particle Physics and Cosmology Theory

Lisa Everett

University of Wisconsin, Madison

Xerxes Tata

University of Hawaii

James Wells \*

University of Michigan

\*Subpanel Chair

# COV Subpanels (cont'd) \$

## Elementary Particle Physics Experiment/LHC \$

Emanuela Barberis

Robin Erbacher\*

Michael Shaevitz

Northeastern University

University of California, Davis

Columbia University

## Gravitational Physics/LIGO

Andrew Geraci

Peter Saulson\*

Joshua Smith

Northwestern University

Syracuse University

California State University, Fullerton

## Integrative Activities in Physics

Jonathan Baggar

Andrew Baker\*

Jennifer Pearl

TRIUMF/Johns Hopkins University

Rutgers University

American Association for the Advancement of Science

\*Subpanel Chair

# COV Subpanels (cont'd) \$

## Nuclear Physics, Theory and Experiment

John Beacom*	Ohio State University
Elizabeth Beise	University of Maryland
Arthur Champagne	University of North Carolina
Michelle Dolinski	Drexel University

## Particle Astrophysics

Maury Goodman	Argonne National Laboratory
Julie McEnery*	NASA/Goddard Space Flight Center
William Wester	Fermi National Accelerator Laboratory

## Physics Frontier Centers and Physics at the Information Frontier

Catherine Royer	Rensselaer Polytechnic Institute
Marius Stan	Argonne National Laboratory
Daniel Steck*	University of Oregon

\*Subpanel Chair

# COV Subpanels (cont'd) \$

## Physics of Living Systems

Dagmar Ringe  
Aravinthan Samuel\*

Brandeis University &  
Harvard University &

## Plasma Physics and Accelerator Science

Felicie Albert  
Alain Brizard\*  
Michael Murillo

Lawrence Livermore National Laboratory  
St. Michael's College  
Michigan State University

\*Subpanel Chair

# Charge to the COV '15

By NSF policy, each program that awards grants and cooperative agreements must be reviewed at four-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 2015; and
- any other issues that the COV feels are relevant to the review.

The COV report is made available to the public to ensure openness to the research and education community served by the Foundation.

Decisions to award or decline proposals are ultimately based on the informed judgment of NSF staff, based on evaluations by qualified reviewers who reflect the breadth and diversity of the proposed activities and the community. Systematic examination by the COV of a wide range of funding decisions provides an independent mechanism for monitoring and evaluating the overall quality of the Division's decisions on proposals, program management and processes, and results.

# Charge to the COV (cont'd) '

The review will assess operations of individual programs in PHY as well as the Division as a whole for four fiscal years: FY 2015, FY 2016, FY 2017, and FY 2018. The PHY programs under review include:

- Accelerator Science
- Atomic, Molecular, and Optical Physics
- Computational Physics
- Elementary Particle Physics
- Gravitational Physics
- Integrative Activities Physics
- Midscale Infrastructure (Division-wide)
- Nuclear Physics
- Particle Astrophysics
- Plasma Physics
- Quantum Information Science
- Physics Frontiers Centers
- Physics of Living Systems

Where appropriate these include both experimental and theoretical research programs.

# COV Meeting Agenda \$

## Prior to June 20 – Subpanel Sessions (virtual)

60' \$ PHY Program Director Presentations on Individual Programs

120' \$ Discussion of Jackets to address Items I, II, and III on Template

- Integrity and Efficacy of Program Processes for Proposal Actions
- Quality and Significance of Program Investments
- Relationship to Foundation-wide Programs and Strategic Goals
- Additional Topics: Balance between award size and success rate per program; Responsiveness of PHY Midscale program to community needs

60' \$ Executive Session for Subpanel / Formulation of Additional Questions to Program Director  
(Subpanel chairs collect input to Items I, II, and III on Template)

## Thursday, June 20

8:30 \$ Introductions, welcome, and Charge to Committee of Visitors (COV)  
Anne Kinney, Assistant Director, Directorate for Mathematical and Physical Sciences (MPS)

8:50 \$ Introductory Remarks  
Robert Redwine, Chair, COV

9:15 \$ Introduction to Division-Level Review  
Division's Balance, Priorities, and Future Directions  
*Additional Topics:* Division's leveraging of the Big Ideas:  
Balance between core research and engagement in NSF initiatives  
Denise Caldwell, Division of Physics

# COV Meeting Agenda (cont'd) \$

## Thursday, June 20 (cont'd) \$

- 10:15 Full Panel Discussion of Division-Level Questions  
Robert Redwine, Chair, COV
- 11:00 BREAK
- 11:15 Instructions for Breakout Sessions  
Robert Redwine, Chair, COV
- 11:20 Individual Subpanels Discuss Division-Level Questions (*Breakout*)
- 12:30 WORKING LUNCH  
Follow-up on individual programs (*Breakout*)  
If applicable, receive answers from PDs on additional questions
- 13:30 Executive Session to consolidate input to Items I, II, and III (*Breakout*)
- 14:30 Executive Session  
Robert Redwine, Chair, COV
- 15:30 BREAK
- 15:45 Preparation of Program Reports
- 17:45 Executive Session  
(If necessary, formulate additional questions to Division Leadership)  
Robert Redwine, Chair, COV

# COV Meeting Agenda (cont'd) \$

## Friday, June 21

- 8:00 (If necessary) PHY answers to previous evening questions  
Denise Caldwell, Director, Division of Physics
- 8:30 Presentation of Preliminary Program Reports by Subpanel Chairs
- 10:30 Complete drafts of Program Reports
- 12:00 Working Lunch
- 13:00 Discussion on Overall Report  
Robert Redwine, Chair, COV
- 14:00 Complete draft of Overall Report
- 15:00 Closeout Session with AD/MPS and PHY Staff

# Template Response (

## **INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT**

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. ( **Questions about the quality and effectiveness of the program's use of merit review process.** Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

## **QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS**

### **YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE**

1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? **YES**

Comments:

The COV was very pleased with the methods the Physics Division uses for merit review of research proposals. In most cases it is a combination of ad hoc reviews by several experts, panel reviews by other experts, and finally an informed judgment by the relevant Program Director(s). In special cases, for example Physics Frontier Centers, a somewhat different combination may be used, including site visits. In all cases it appears that proposals receive very thorough, fair, and consistent reviews. We hope that the Physics Division will continue to have the resources to provide this commendable merit review process.

# Template Response (cont'd) (

2. Are both merit review criteria addressed

In individual reviews? **YES**

In panel summaries? **YES**

In Program Director review analyses? **YES**

Comments:

The COV found that in general both merit review criteria (Intellectual Merit and Broader Impact) were considered in individual reviews, panel summaries, and Program Director reviews analyses. There were some cases in which an individual reviewer probably should have paid more attention to the Broader Impact criterion, but they were relatively rare and it did not seem to have impacted the final decision.

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? **YES**

Comments:

While there was some variation in the degree to which individual reviewers provided explanations of their assessment of the proposals, most reviewers in fact provided extensive and substantive explanations of their assessments. We are sure that this was very useful to the proposers and to the Program Directors.

# Template Response (cont'd) (

4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? **YES**

Comments:

The panel summaries were often concise, but did certainly provide appropriate rationale for the panel consensus. Panels rarely if ever failed to reach consensus.

5. Does the documentation in the jacket provide the rationale for the award/decline decision? **YES**

[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program Director review analysis, and staff diary notes.]

Comments:

The documentation in the jackets was very complete, including all of the appropriate elements. Most impressive typically was the analysis by the Program Director, which clearly took into account all relevant information. In the cases where the Program Director disagreed with the recommendation of a reviewer or panel, the documentation was important and compelling.

6. Does the documentation to the PI provide the rationale for the award/decline decision? **YES**

[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program Director (written in the PD Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]

Comments:

The documentation provided to the PI is in general very informative and complete. In the case of a declination the Program Director often provides perspective on what might be done differently next time. The Program Directors are also available to have additional discussions with the PI if it is requested.

# Template Response (cont'd) (

7. Additional comments on the quality and effectiveness of the program's use of merit review process:

Comments:

The merit review process in the Physics Division is very well respected in the community. A critical component of this is the expertise and judgment of the Program Directors, and all indications are that this is working very well in the Division. It also seems that the criterion of Broader Impact is playing an important role, which is commendable.

**II. Questions concerning the selection of reviewers.** Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

## SELECTION OF REVIEWERS

**YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE**

1. Did the program make use of reviewers having appropriate expertise and/or qualifications? **YES**

Comments:

The COV was most impressed with the expertise and qualifications of the chosen reviewers. It is clear that diversity of reviewers is an important consideration, as it should be. We are also impressed that, for large collaborations where an outsider might not be knowledgeable enough about details, ways are being found to use some insiders as reviewers while still obeying COI guidelines.

2. Did the program recognize and resolve conflicts of interest when appropriate? **YES**

Comments:

The Physics Division clearly takes the issue of conflict of interest very seriously. The COV saw many examples during our reviews of conflict of interest being recognized and dealt with appropriately.

3. Additional comments on reviewer selection: **N/A**

# Template Response (cont'd) (

**III. Questions concerning the management of the program under review.** Please comment on the following:

## MANAGEMENT OF THE PROGRAM UNDER REVIEW

### 1. Management of the program

Comments:

Overall the COV finds that management of the programs within the Physics Division is excellent. We are most impressed with the expertise, judgment, and dedication of the Program Directors. We hope that they can continue to have the opportunity to provide the management that is so critical to these programs. We have some concerns about increasing demands on their time from thrusts like the Big Ideas. We very much hope that NSF leadership will achieve an appropriate balance for these demands.

### 2. Responsiveness of the program to emerging research and education opportunities. "

Comments: "

The COV finds that the programs we have reviewed have done very well in responding to emerging research and education opportunities. The Program " Directors are alert to such opportunities and the interdisciplinary nature of many of the programs means that this issue is always at the forefront. "

### 3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. "

Comments:

The specific process varies considerably across different programs in the Physics Division. For example, for Nuclear Physics and Elementary Particle Physics a strong influence comes from external planning via NSAC, P5, etc. But in general the COV finds that the Program Directors are well plugged into the community and understand the intellectual frontiers that are of highest priority.

# Template Response (cont'd) (

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

In general the COV finds that the Physics Division was appropriately responsive to the 2015 COV comments and recommendations. These recommendations included suggested structural changes among programs and proposed increases in co-funding between programs and divisions. An issue was also raised related to CAREER awards, which we will address again in this year's report recommendations.

**IV. Questions about Portfolio.** Please answer the following about the portfolio of awards made by the program under review.

## **RESULTING PORTFOLIO OF AWARDS**

### **APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE**

1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity? **APPROPRIATE**

Comments:

The portfolio of programs supported by the Physics Division is remarkably diverse. It also aligns very well with the most important scientific questions in the field. The COV is impressed with the flexibility that the Program Directors maintain to respond to emerging opportunities.

2. Are awards appropriate in size and duration for the scope of the projects? **APPROPRIATE**

Comments:

In general the COV believes the size and duration of awards are appropriate, but it certainly is a complicated dynamics. Given overall funding constraints, the size of awards of course directly influences the success rate of proposals. We heard from several programs that they are worried that many awards are not large enough to support postdocs at this critical time of their careers. The typical duration of an award is 3 years, but this can vary depending on the details of the project. We certainly encourage the Physics Division to continue to give Program Directors the flexibility to apply different sizes and durations of awards depending on the circumstances. They seem to be doing very well at optimizing the scientific and educational outcomes in a complicated, constrained environment. The 2019 COV addresses some of these issues in its main report.

# Template Response (cont'd) (

3. Does the program portfolio include awards for projects that are innovative or potentially transformative? **APPROPRIATE**

Comments:

The Physics Division portfolio includes many examples of awards that are innovative and potentially transformative. This is one of the driving factors that determine success in funding.

4. Does the program portfolio include inter- and multi-disciplinary projects? **APPROPRIATE**

Comments:

The portfolio includes many awards that involve interdisciplinary or multidisciplinary research. This can be seen from the number of awards that have co-funding and from the alignment with some of the Big Ideas thrusts.

5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators? **APPROPRIATE**

Comments:

The COV did not investigate this in a comprehensive way, but it is clear that the portfolio includes PIs from many parts of the country. It is also the case that centers and laboratories around the country are supported by the portfolio of awards. While we did not have the opportunity to look at comprehensive data on this issue, we see no reason to think there is a problem.

6. Does the program portfolio have an appropriate balance of awards to different types of institutions? **APPROPRIATE**

Comments :

The COV found that the Physics Division portfolio includes awards to major research universities but also many awards to smaller universities and RUI institutions. Typically, large experiments include a variety of collaborators from different types of institutions and the Physics Division funding includes the full range.

# Template Response (cont'd) (

7. Does the program portfolio have an appropriate balance of awards to new and early-career investigators? **APPROPRIATE**

NOTE: A new investigator is an individual who has not served as the PI or Co-PI on any award from NSF (with the exception of doctoral dissertation awards, graduate or post-doctoral fellowships, research planning grants, or conferences, symposia and workshop grants.) An early-career investigator is defined as someone within seven years of receiving his or her last degree at the time of the award.

Comments:

The Program Directors in the Physics Division appear to place important emphasis on supporting promising researchers early in their careers. The CAREER award program is an example of such support, but it is by no means the only example. In general the programs have a good balance of awards to researchers at different stages of their careers.

8. Does the program portfolio include projects that integrate research and education? **APPROPRIATE (**

Comments: #

The great majority of awards integrate research and education, either through training of young scientists or through outreach or both. #

9. Does the program portfolio have appropriate participation of underrepresented groups? **DATA NOT AVAILABLE (**

Comments:

The COV believes it does not have enough data to provide a clear answer to this question. #It does seem that proposal success rates for women and/or URM PIs are consistent with their representation in the field, but that representation is of course still low. We encourage NSF to do what they can to collect relevant data, as this issue is definitely an important one.

10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports. **APPROPRIATE**

Comments:

The Physics Division programs are closely aligned with national priorities and the Agency mission. This can be seen from the strong amount of co-funding in the programs and the connections to NSF-wide thrusts such as the Big Ideas. External reports that show the close alignment include the Quantum Initiative, Decadal Surveys sponsored by the National Academies, the Nuclear Science Advisory Committee Long Range Plans, and the Particle Physics Project Prioritization Plan.

# Template Response (cont'd) (

11. Additional comments on the quality of the projects or the balance of the portfolio:

We want to emphasize that we found the quality of the projects funded to be outstanding and the balance of the portfolio to be remarkable. The NSF Physics Division personnel and the community as a whole have every reason to be proud.

## OTHER TOPICS

1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

Comments:

More than one of the subgroups noted that it appears that the Theory part of a subfield is often funded relatively more sparsely than the Experiment part. In particular this seems to have the result of limiting the number of postdocs in theory. We comment on the postdoc funding issue elsewhere as well.

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

Comments: **N/A**

3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

Comments:

It appears that the meta-program funding mechanism, compared to a separate solicitation, makes it much easier to leverage cross-cutting projects with already existing funding programs. For example, the Windows on the Universe thrust is already helping to support important projects in the Physics Division, while the Quantum Leap thrust is not.

The expertise and dedication of the Program Directors in the Physics Division is really commendable. The Division and the Agency as a whole should do everything possible to continue to attract and retain such wonderful scientists. This includes continuing to give them the flexibility to really manage their programs as well as avoiding overloading them with more and more tasks.

# Template Response (cont'd) (

4. Please provide comments on any other issues the COV feels are relevant.

Comments:

The numbers of grants, success rates, and typical grant sizes have not changed greatly in the last decade. At the same time, the quality of funded research and of investigators has been consistently high. However, the cost of doing research has significantly risen. This raises the obvious point that the impact of the typical reward has diminished. The COV understands that solving this issue is not possible for NSF or the Physics Division alone, but it is important to raise the issue.

We encourage the Physics Division to pursue co-funding projects with private foundations whenever possible.

5. NSF would appreciate your comments on how to improve the COV review process, format and report template. #

Comments: #

Overall the COV found the current review process to be a significant improvement over previous processes. The availability of e-jackets before the meeting # meant that the committee could find time to review the jackets and iterate with their subgroup colleagues prior to the in-person meeting. #

Some committee members did find it difficult to access the information needed to carry out the COV evaluation. Documents were spread out over several sites # and with different file formats. We suggest creating a consolidated source of information that includes the relevant reports, proposals, and other documents. #

# Observations, Suggestions, and Recommendations

1. *Observation:* The COV was impressed with the processes for evaluating funding proposals that the Physics Division uses. The result of these processes is a portfolio of projects that contains excellent science, important educational thrusts, and considerable flexibility to respond to emerging opportunities.

2. *Suggestion:* An important factor in the success of the award processes is the expertise and dedication of the Program Directors. The Physics Division is fortunate to have a group of excellent Program Directors in these key roles. We suggest that the Division leadership continue to do everything possible to make these positions as attractive as possible to talented people.

3. *Observation:* The Physics Division has responded appropriately to the recommendations of the 2015 Committee of Visitors.

4. *Suggestion:* The issue of broadening participation by underrepresented groups in the projects funded by the Division is important. We are pleased that the Division clearly takes this issue seriously and we are optimistic that progress will continue to be made. As pointed out by previous COVs, improvements should be made to the processes of collecting data on the diversity of proposers and their groups.

5. *Observation:* In the 4-year period under review by this COV, funding for the Physics Division has remained relatively constant, while the number and size of research proposals have increased. This has meant that the success rate of proposals has decreased and that pressure to reduce the size of awards has emerged. We believe the Program Directors have handled this situation in a thoughtful and consistent way. However, unless overall funding increases the situation will become increasingly difficult. We very much hope that NSF will see a significant increase in funding, as such an increase is certainly justified by the scientific output of the programs.

6. *Suggestion:* The COV found in a number of programs that funding for postdoctoral scholars seems to be a consistent problem. This is concerning, as such positions are important both for workforce development and for achieving research goals. Presumably this problem is directly related to the average size of grants. We suggest that the Physics Division examine the priority that is placed on postdoctoral support in grants, although we are not suggesting that there is an easy solution.

# Observations, Suggestions, and Recommendations (cont'd) -

7. *Suggestion:* We heard from the various programs different opinions on the optimal length of grants. It seems that the situations do indeed vary. We suggest that the different programs define the default length of a grant according to their situation and needs, but also that the Program Directors have the flexibility to assign lengths according to the needs of different grants.

8. *Suggestion:* In looking for ways to enhance the buying power of grants, some members of the COV noted that, while a typical research grant is expected to cover the full tuition of graduate students supported by the grant, NSF Graduate Fellowships are capped at a generally lower level and universities cover the remainder. We suggest that NSF may want to explore with universities whether a similar standard amount for tuition and fees would be appropriate for graduate students supported by research grants.

9. *Observation:* The Midscale program appears to be a good fit for some important projects supported by the Physics Division. This is a welcome development.

10. *Observation:* The review of the Physics Frontier Centers program currently underway should provide important guidance for the Physics Division. We look forward to the results of the review.

11. *Observation:* For some subfields within the purview of the Physics Division, there are well-established processes whereby the community sets long-range research priorities on a regular basis. Examples include the Long Range Planning process for nuclear physics, the Particle Physics Project Prioritization Process for elementary particle physics, and the National Academies Decadal Surveys for several subfields. We believe that these processes, generally involving FACA committees, are very important in gathering community input and in providing guidance to the relevant funding agencies. It appears that the Physics Division is well connected to these processes and we expect that they will continue to use this external input as an important part of setting priorities.

# Observations, Suggestions, and Recommendations (cont'd) -

12. *Recommendation:* There are a number of recently launched NSF-wide initiatives, including the Big Ideas. In general the Physics Division has done a commendable job of engaging with these research and process initiatives to enhance the overall portfolio of research projects. Concerning the Big Ideas, the Division has important connections to two of them: Windows on the Universe and Quantum Leap. Because these two have different funding mechanisms, it seems that it has been much easier to leverage Windows on the Universe to empower existing programmatic priorities than the Quantum Leap. The COV believes that this difference is unfortunate and somewhat artificial. We thus recommend that the NSF examine how the initiatives can all be made straightforward to coordinate with existing programs. The COV also recommends that staffing be enhanced in areas where Program Director workloads have increased as a result of their obligations to support Big Ideas initiatives.

13. *Suggestion:* It is our understanding that proposers are now supposed to describe other sources of support and commitments and how they relate to what they are proposing. Review panels are also supposed to comment on these relations. From our review it appears that compliance with these guidelines is sporadic. We suggest that the Division examine the situation and take appropriate action.

14. *Recommendation:* The COV heard concerns, from a number of directions, about what information is provided by the NSF to proposers and others. For example, it is not clear that, following evaluation of a proposal, the complete results are provided to all PIs on the proposal, not just the principal PI. Also, the NSF Award Search on the public web page has problems; it is difficult to use and one cannot tell if the dollar amounts are for one year or for multiple years. We also believe that the instructions for annual reports from grantees could be improved. We recommend that the Physics Division take a comprehensive look at their system for providing information to proposers and others and make improvements as needed.

15. *Observation:* We note that, while the observations, suggestions, and recommendations included in this section represent the overall perspective of the COV, the subgroup reports contain more detailed observations and recommendations that should be especially useful to the individual programs.

# **Additional (or Supplementary) Specific Issues )**

## **Broadening Participation**

We commend the Physics Division for the development of a diversity plan and for its skillful use of internal co-funding in support of broadening participation. Our committee heard, in a number of different contexts, concerns related to the collection and analysis of data on diversity and inclusion in physics research. The previous COV recommended that the Division change the timing of requests for such data from PIs and this recommendation has been addressed to some extent. But we believe that at least at the Physics Division level, and perhaps at a much more general level, it is important to assess how one can most effectively collect, analyze, and use data related to diversity and inclusion.

# **Additional (or Supplementary) Specific Issues (cont'd) )**

## **Continued Support for Program Directors**

As indicated throughout this report, the COV was very impressed with the work done by the Physics Division in identifying and supporting high-quality research in physics, especially the work done by the Program Directors. We strongly endorse the model in PHY, in which the Program Directors are highly respected in their own scientific disciplines and respected by the community in general. This is crucial to NSF's effectiveness in driving the science forward – the Program Directors have a significant level of autonomy in decision-making, along with time and resources to communicate with individuals within the research program and best understand their needs and circumstances. We congratulate the Division leadership for supporting the work of the Program Directors in this way. Given the increasing demands on the Program Directors' time, due to NSF-wide initiatives and continuing funding concerns, we hope that the Division will be able to preserve the special and effective roles of the Program Directors.

In a related point, apparently in the last significant reduction in funding for science, the individual grants supported by the Physics Division bore the brunt of the burden, largely because of decisions made well above the Division. If there are similar situations in the future, we recommend that the process be transparent and that the Program Directors have a strong voice in deciding the appropriate balance of cuts.

# Additional (or Supplementary) Specific Issues (cont'd )

## Pressures on Individual Grants

The size and number of individual grants are of some concern. The implementation of broad initiatives, while commendable in many ways, can have the unintended consequence of squeezing individual grants unless the total amount of funding available increases significantly. The COV understands that such increases are not always possible in the short term, and we applaud the Division for putting priority on maintaining the importance of individual grants. In particular, we strongly endorse the policy of not letting the individual grants total drop below a 50% floor level with respect to the Physics Division research funding level. One issue related to this came up in discussions of several programs within the Division. That is, the limited size of many grants is making it increasingly difficult to fund postdoctoral positions. This is very disturbing, as the availability of such positions is critical not just for workforce development but for the advancement of science as well.

# **Additional (or Supplementary) Specific Issues (cont'd) )**

## **Length of Grants**

The COV discussed the issue of the appropriate length of a grant, which currently can be as long as 5 years. Overall, we recommend that the Program Directors continue to have flexibility when it comes to the length of the grant. An important issue is the default length of a grant. There are several factors that ultimately determine the best length for any specific grant, and these factors vary between the different program areas. Some areas believe there is significant motivation to change to a 5-year grant cycle as a baseline expectation, which would help with the workload on the PIs and the NSF staff. In other program areas, 3 years appears to be the right time scale for the reviews, as it helps PIs and Program Directors react to changing science opportunities, trends, funding, and performance. We recommend that different program areas have the flexibility to adopt the length of cycle that best fits the program's needs and that within that guideline the Program Director still have some flexibility.

# Additional (or Supplementary) Specific Issues (cont'd )

## CAREER Award Program

The CAREER award program at NSF has some complications. Most of the complications apparently result from misunderstanding between PIs and their institutions and the NSF concerning the goals of the program. The NSF states that the CAREER award, while intended for promising junior researchers, is not strictly a research excellence award. Instead, it is an alternative research funding program with an educational component. Many institutions apparently believe that the program is a research excellence award program and thus strongly encourage their junior researchers to apply for the award. Such blanket pressure can burden some junior researchers with applying for a type of award they are not especially well suited for, at some cost to their research productivity.

A contributing factor to the misunderstandings described above is the fact that there is a similarly named program (the Early Career Award program) at the Department of Energy that is indeed a research excellence award program.

We also point out that the NSF description of the CAREER award as not being a research excellence award is actually inconsistent with the fact that the CAREER award program is NSF's funnel to the competition for PECASE awards.

The COV recommends that NSF aggressively clarify for the community, including the leadership of academic institutions, the goals of the CAREER award program.

# Additional (or Supplementary) Specific Issues (cont'd )

## Connections of the Physics Division to the Big Ideas Thrusts

The current connections of the Physics Division to the Big Ideas thrusts (Windows on the Universe and Quantum Leap) present interesting contrasts. The COV understands that these two thrusts involve different funding mechanisms. Windows on the Universe is a meta-program and Quantum Leap is a solicitation requiring at least 3 PIs from at least 3 different disciplines. Given this difference, it is striking that the Windows on the Universe program is showing signs of much greater effectiveness at providing significant additional funding to an important research area. We hope that the NSF leadership will take a hard look at these programs and, if possible, change the structure to make it easier for the programs to be effective in initiating and supporting important research, including ongoing research in the already existing programmatic areas of relevance.

We also note that when the funding for a multi-disciplinary Big Idea program ends it may leave financial burdens in its wake that can heavily burden the core programs. We strongly encourage the development of mechanisms that will minimize these adverse impacts.

# **Additional (or Supplementary) Specific Issues (cont'd)**

## **Structure of the COV Process**

The structure of the COV process has changed significantly in recent years because of the availability of e-jackets and of better electronic communications. We believe that, because of these changes, the process has definitely improved and the COV discussions are more in depth and thoughtful. However, the process also now involves substantially more total time commitment from the COV members and most likely from the NSF staff as well. More guidance from NSF about the scope of effort could possibly help keep the time commitment under control.