# Report of Ethics Task Force to APS Council

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### Abstract

This task force was convened to examine ethics-related practices in the Society and to make suggestions for future activities. Surveys and interviews were used to gather specific information on the state of ethics education and awareness in the APS and its membership and selected types of institutions. Various policies and practices mainly relating to publication and data handling were assessed. Results are in the form of numerical statistics and numerous written comments. They show that there is little focus on formal ethics education in physics even after the recent highly visible cases of data fabrication. The APS can play a leadership role in improving awareness of professional ethics through new programs and definition of acceptable practices in areas outside of publications.

### Scope of work

The charge to the Task Force is contained in APS Statement 02.4: ...that monitors the activities of the society and its units, and suggests further steps regarding professional ethics, standards and practices for the Society.

To fulfill this charge the Task Force has collected information on ethics education, issues and practices from January – October 2003. Three segments of the physics community were examined: (1) academic institutions (physics department chairs, undergraduates, recent PhDs), (2) the American Physical Society (units, journals, POPA Ethics committee) and related societies, and (3) selected institutions employing physicists (several corporations and large collaborations involving universities and national labs).

Most of the information was obtained using email or web surveys composed with assistance from Roman Czujko, AIP. Surveys were sent to physics department chairs, SPS members who are also APS student members, Junior members and APS Units. More limited surveys were sent to directors of selected industrial labs and to spokespersons for large collaborations. Interviews and web searches were conducted to learn about APS Journal policies, POPA ethics activities, and the status of ethics activities in other physics-related societies. The data collected will be made available in the near future.

The questions in the individual surveys varied, however all contained questions probing awareness of ethics statements by APS, extent of and types of ethics-related training of students/employees, mechanism for handling ethics-related problems, occurrences, if any, of ethics violations at institutions and outcomes, and open-ended requests for comments. The term ethics was used in a broad sense, rather than as a synonym for research misconduct (fabrication, falsification and plagiarism). Together they form several interlocking pictures of ethics education from faculty, undergraduate and new PhD points of view, as well as from an institutional perspective (APS and the world of physics-based institutions). The Junior members' survey was the most extensive of all because this population, being at the early career stage, is unique in having current experience with both the formal educational and the day-to-day aspects of professional ethics.

## I. Academic sector

*a. Department chairs.* The goal of this survey was to assess the level of formal and informal ethics education in physics departments of all types, and to understand the degree to which the faculty was focused on ethics issues either through general interest or direct experience.

Approximately 212 responses were received from surveys sent out to chairs of 766 physics and 38 astronomy departments in all types of universities and colleges. The responses show that ethics have been discussed more than casually within 52% of the departments within the past two years. Issues of professional ethics as they concern students are addressed in lab courses (75%) and faculty consultations with students and postdocs (63%). They are less likely to be addressed in course curriculum (46%), seminars (about 23%) or chair consultations with faculty (37%). Ethical standards in research are discussed with students and faculty 1 or more times a year in 50-60% of the departments, and seldom if ever in the rest. Suggestions were solicited on how to raise the level of concern about ethical practice. 17 suggested seminars and discussions in faculty meetings, 6 did not see the need to change anything.

About 80% of the department chairs did not know if their faculties knew of or had read the APS or federal guidelines. In only 20% of the departments have the data falsification events of the last two years led to new emphasis on ethics. 67% of the chairs said their institutions have policies and procedures for handling professional misconduct, 25% said their institutions did not, and 8% did not know. The chairs were asked whether their institution had experienced cases of unethical behavior in the last 10 years. About 10% answered in the affirmative. It should be noted that the questionnaire did not ask how long the chair had been in his/her position and this response may reflect short-term institutional memory.

26 made suggestions for APS activities or of areas of ethics they are concerned about, these include APS development of videos (3), sharing of task force report with departments to educate them (1), broadening of APS ethics statements to include responsibilities to society (3) and student ethics (1), addressing of issues covered in the APS statements (plagiarism, refereeing, failure to cite contributions of others) (7), honesty in letters of recommendation (2) and relationship of student cheating to professional misconduct (1).

The picture that emerges is that while many physics departments do cover some topics in professional ethics in lab courses, on the whole ethics education is informal. Direct experience with unethical conduct of various types in these departments is not rare.

*b. Undergraduate members of SPS and APS* This cohort was surveyed to complement the chairs' survey. 1451 surveys were sent out and 146 responses were received. About 77% of the students were aware of the APS ethics statements, but only 10% of that group had read them. Less than 20% had received formal ethics training in courses, tutorials or other forms of delivery. 51% of the students had participated in discussions of ethics in undergraduate physics courses and 27% of those in research groups had done so in group meetings with their supervisor. 78% had, however, participated in informal discussions on ethics with other students or faculty. Less than 15% of the students had received formal ethics training in a non-physics department.

The students were asked whether they had received training in lab courses on acceptable practices for data recording and handling. About 78% had done so. Laboratory ethics training can take place in physics (75%), biology (15%), chemistry (54%) and engineering departments (8%).

57% of the respondents had participated in undergraduate research experiences. Of these, only 48% received formal training in keeping a laboratory notebook, 46% in data retention and archiving, 53% in acceptable and unacceptable ways of analyzing data, 52% in acceptable and unacceptable ways of interpreting data, and 55% in searching the literature to identify prior related work.

These results are consistent with the responses of the department chairs, reinforcing that ethics education of undergraduates is largely informal, even in research settings.

*c. Junior members*

The entire Junior Membership of APS (1777 individuals, defined as within the first 3 years post-PhD) was surveyed via the web.

The goals of the survey were to:

1) assess the level of awareness and concern regarding ethics issues among recent Ph.D. physicists;
2) learn about how most of these young physicists are being trained regarding ethics issues and professional codes of conduct;
3) learn about the level of personal experience and knowledge of ethics violations, as well as the nature of these violations from the perspective of young physicists;
4) collect ideas about what kinds of ethics training would be valuable or effective; and
5) learn what is regarded as the most serious professional ethics issues which should be addressed by the APS.

The response rate was excellent, with slightly less than 50% of the Junior Members filling out the survey. Of the respondents, 60% are postdocs, 20% have permanent positions, 12% are in tenure-track positions and 7% have other temporary positions. Half of the respondents are at universities (with graduate programs), another quarter are in government labs, and the rest are in industry (9%), undergrad colleges (6%) and other types of institutions (8%).

More than half (61%) of the respondents are aware of the APS Ethics statements, but have NOT read them, 20% have read them, and 18% were unaware of the APS Ethics statements. Almost half (45%) of those responding are unaware of either the policy for handling research misconduct or a professional code of ethics at their current place of employment. Only 22% are aware of and have read such a policy, with the remaining 34% "aware of, but have not read it."

Fully 67% of the respondents have NEVER had formal ethics training, whereas 13% indicated they had had some training in an institution-mandated tutorial, and another 13% had had training in group meetings with the research supervisor. Very few (5% each) had received training in undergraduate and graduate-level physics courses.

In contrast to formal training, 87% of the respondents reported discussing informally, with other students or colleagues, professional ethics issues, and 39% indicated that this had been a topic of discussion in group meetings with the research supervisor.

In response to the question as to whether they had ever had training in keeping an accurate "laboratory notebook," 42% said "yes, in a lab course," 44% also said "yes, informally in discussion with supervisor," and fully 30% indicated "no training." In a very similar question regarding "training in acceptable practices for measuring and reporting data" 52% indicated having training in a laboratory course, 55% indicated having training informally with supervisor, and 20% indicated "no training."

A clear majority felt that APS Ethics statements should be broadened to include:

- treatment of subordinates (62%)
- responsibility for how research is used (44%)
- responsibility to the environment (38%)

When asked if they had ever observed or had personal knowledge of ethical violations during their time as a grad student or postdoc, fully 40% responded "yes," and 60% responded "no." When they were asked to expand on a "yes" response regarding the nature of the violation, the top 6 responses included:

- putting non-authors on a paper (20%)
- not including student's name on paper of their work (15%)
- less than truthful description of research technique or analysis (13%)
- not citing relevant prior studies or literature (11%)
- plagiarism (8%)
- deliberately delaying a referee report on a paper (7%)

Interestingly enough, only 4% knew of "falsification of data," which was the central issue in the two recent high-profile cases of ethics violations in the physics community. However, 4% (or 29 responses, about 2% of the junior members) indicating knowledge of "falsification of data" should be of significant concern to the physics community.

While 92% of the respondents reported NOT feeling pressure to violate professional ethical standards, 8% had felt pressure to do so. These pressures described by the 8% were:

- pressures by supervisor to include non-authors on papers (~25%)
- pressures to get out high volume of publications rapidly, for scientific advancement, for research funding (leading to sloppy analysis of data, claims not supported by data) (30%)
- pressures from supervisor (12%) to commit other ethical violations (not specified by respondents)

The large number of thoughtful responses to the two open-ended questions in the Ethics survey discussed above indicated to the Task Force a significant level of concern regarding Ethics in this cohort of young physicists. Fully 30% of the respondents articulated ideas about what kind of Ethics training would be valuable or effective, and 36% of the respondents described what they saw as the most serious professional Ethics issues which should be addressed by APS. The analysis of these text responses has proven to be very challenging as well as educational for the Task Force. In total, these written responses comprised 62 pages, and often included detailed descriptions and carefully worded lists of concerns.

Two issues appeared frequently as "the most serious Ethics violations" in the physics community: (1) Falsification of data, and (2) Treatment of graduate students and subordinates in research groups. Each of these issues was listed by approximately 23% of the respondents. The falsification of data strikes directly at the core of what research is all about, and so is seen as a flagrant ethics problem. However, it is clear from responses to other parts of the survey, that there is not a lot of outright falsification going on. Instead, pressures to publish quickly and in high-profile journals can result in data being improperly analyzed and claims regarding measurements "overstated." The ethical treatment of graduate students and subordinates, however, appears to be a very real and serious issue from the perspective of junior members. The concerns range from not giving students credit for research (leaving their names off papers) to phrases describing "exploitation and abuse of graduate students," "slave labor," and the vulnerability of grad students to pressures by the research supervisor to do unethical things.

An additional ethics concern mentioned repeatedly was the refereeing process—for both papers and funding proposals. "Experts in any given field are generally competitors. It is taken as standard knowledge…that particular referees will 'kill' a paper if it 'steps on their toes'." "There is so much rubbish being published because reviewers are not doing their jobs…or are not qualified to judge a work." "There is no reward for good peer review, and it takes a lot of time and effort to do it well." Many expressed the opinion that "big names" get their papers accepted and proposals funded independent of the quality of the work. Several respondents thought that "double-blind" refereeing would improve the fairness in the reviewing process.

A number of respondents questioned the efficacy of formal Ethics training in classes: "I am not sure any training can help." "I seriously question whether or not ethics 'training' can help some people who cannot understand how their actions can hurt others, or are simply unfair." And "The importance of ethical behavior is likely learned (or not) far earlier than professional training as a physicist." However many respondents thought that proper mentorship by supervisors was absolutely key to establishing patterns of ethical behavior. While many suggested mandatory Ethics seminars and discussions in Physics Departments for 1st and 2nd year grad students, there were others who felt that senior professors should be the first to undergo such training and then could lead by example. It was also mentioned by several respondents that students come to graduate school from many different cultures where there are different cultural norms and practices and misunderstandings can arise. For example, some may not realize that plagiarism is wrong. Ethics training would thus be very valuable.

A number thought that the APS could be helpful by putting together a pamphlet of material outlining professional ethics issues, suggesting websites and listing resource material, and holding workshops on ethics issues at national meetings. It was also mentioned that anything the APS did to bring Ethics issues to the community for discussion would be welcome—better than the "silence that exists now" among Physics Department faculties.

Finally, there were many comments and some lengthy paragraphs, blaming the perceived pressures in the field of physics—particularly in academic research—as creating an environment in which shoddy but "flashy" research is rewarded. For example: "The only real answer to the ethics problem is for tenure review boards to stop rewarding the Science/Nature/PRL culture above all else." "Many breaches of ethics arise from the pressure to publish…" "The 'quality' of a researcher, when applying for grants or positions, is always measured simply by the number of published papers—with bonus points for high-profile journals [such] as Nature, Science or PRL. …He or she will not be judged [by] the work spent on each paper, how many back-up checks were performed to confirm the results, etc…" "The research system stimulates continuously competition in fashionable subjects in the search of spectacular results." Many deplored the pressure for a high volume of papers which encourages the publication of "small pieces" of research, and discourages articles which are more comprehensive and "deep." "Our scientific community promotes the search of the surface and superficiality [to the] detriment of content and deepness."

In conclusion, the statements of this cohort of young Ph.D. physicists who are the life-blood of the field, gives the physics community much to think about. The contrast between the physics departments' casual approach to ethics and the level of concern of the Junior members is marked. Discussion of many of the issues raised here would benefit everyone in physics.

## II. American Physical Society and related societies

*a. APS Units* This survey was distributed to 3 of the leaders of each of 23 divisions and topical groups. Its purpose was to elicit information on ethics-related plans and programs in the units, and to learn about some of the norms of the various fields – group size, geographic distribution, types of institutions involved and so on. The latter type of information, it was hoped, would help us determine whether the APS guidelines on ethics in publication, for example, were sufficiently broad in scope to apply to all in the Society.

14 responses were received from 13 units. All respondents have some awareness of APS and federal conduct guidelines. About half have read them, and less than half of those have discussed them in executive committee meetings. 3 units have agenda items on ethics, and 1 (Division of Plasma Physics) has a standing committee and a formal activity planned. No conclusions can be drawn concerning typical research groups in various subfields in physics since few answered those questions.

It can be concluded from this survey that the APS units are primarily focused on technical matters rather than ethics education and issues.

*b. APS Journals* Martin Blume and Amy Halsted were interviewed to learn about how the journals handle allegations of professional misconduct. They have a well-defined process for investigation and adjudication of any complaints and provided us with summaries of how 3 typical cases were handled. In 2002 there were 16 cases of suspected misconduct out of about 25,000 submissions. Of these, 2 were groundless, 5 involved plagiarism, 3 involved duplicate submissions, 3 concerned authorship disputes, 2 involved data fabrication and 3 concerned referee misconduct. Significant time can be spent researching and resolving issues, exacerbated in part because there are currently no standards to guide institutions' responses to publication ethics issues. Journal editors of various nations are currently working to develop a set of standard internationally accepted processes to handle publication issues.

The recent practice of discouraging publication of full papers in the Physical Review following an earlier report in Physical Review Letters has been revised in order to ensure that complete descriptions of studies are published.

*c. POPA Ethics committee* An interview was conducted with Jim Tsang, 2002 chair of POPA, to learn about the ethics committee's plans to follow up on their considerable activities in 2002 (http://www.aps.org/exec/bylaws/reports/popa02.html). POPA wants to be sure that the lessons of recent cases of data fabrication are not forgotten. Activities they envision include working with physics departments to improve education, creation of a web site for ethics and professional standards in physics that would include, for example, case studies and model curricula, and organization of periodic events at meetings like the evening panel held at the 2003 March meeting. POPA also believes that subdiscipline-specific practices concerning authorship in groups of various sizes and the definition of data and data retention in the electronic age should be examined.

*d. Other Societies* Web sites and leadership of several societies that cover physics-related science were consulted to learn of their ethics programs.

- American Chemical Society: has a comprehensive professional ethics standards on the web and in journals, and is considering creating a standing committee
- American Geological Union: has a policy on the web on fabrication, falsification, plagiarism, covering up misconduct, and certain actions within AGU

- Materials Research Society: has no statement or web site
- Institute of Physics: is considering forming an ethics task force or committee
- IUPAP: is considering action
- IEEE: has a comprehensive code of ethics on the web

**III. Research institutions**

*a. Large collaborations.* On behalf of the Task Force, an email letter was sent to spokespersons of several large collaborations in high-energy, nuclear, and astrophysics. We requested access to collaboration documents describing rules for inclusion of authors, how names are ordered in author lists, other methods of acknowledgement of contributions, internal procedures for approval of manuscripts for submission, including procedures for resolving objections from individual authors, and responsibilities of EVERY author, that is, including those not directly involved in the particular analysis being reported.

The solicitation was sent to: CDF and D0 at Fermilab, the B-factory experiments BaBar and Belle, the Brookhaven heavy-ion collider experiments PHENIX and STAR, the large neutrino detector experiments SNO and Super Kamiokande, the Sloan Digital Sky Survey, and the gravitational wave experiment LIGO. 6 responses were received, primarily in the form of web links or attached documents. Some common threads are found.

Authorship-related documents tend to be very formal. Some length of service and level of commitment is required be on the author list and in some collaborations there is explicit inclusion of "builders" of the experiment. The default is that all members of author list appear on all papers, with the exception of one collaboration in which members can request to be added to individual papers. In another collaboration each potential author must submit a statement reading "I have read this paper and agree with its conclusions. Please include me as an author." "Technical" papers relating to, say, apparatus, have more limited author lists. One collaboration strongly discourages individual authors from withdrawing their names from an individual paper while another explicitly allows it. Listing of authors on a paper is alphabetical in all cases except one that has a "2-group" rule: contributors to the given analysis in the first group, all other authors in a second group.

Publication procedures are equally formal. Each draft paper goes to a review committee, which may be an ad hoc committee for each paper, or an overall review board. In most cases the committee has explicit responsibility for verifying results. Documentation backing up the claims in the paper must be provided at the outset. In some collaborations this documentation must be sufficient so that any collaborator can understand the result. After approval by the committee, the draft goes to the whole collaboration and there is a comment period. All comments and responses are available to full collaboration. In one collaboration the authors of the draft made the decisions on incorporating suggestions.

These groups DO have a lot of scrutiny of results. They do not, in general, have guidelines for the responsibilities of individual authors. Despite the careful publication processes in place, there were several comments from junior members noting that in practice the pressure to publish quickly may lead to less than thorough reviews.

*b. Industrial institutions* A brief survey was sent to 10 Directors of R&D organizations in a selected group of companies that employ significant numbers of physicists. The survey addressed primarily issues of awareness of ethics among the employees. Two responses were received, both

from large corporations with established research centers. In both companies all employees receive training in ethical practices. The level of awareness among the staff physicists of APS and federal guidelines and statements on ethics was unknown. Both institutions have a mechanism for handling ethics-related problems, however it was not described. Recent well-publicized professional misconduct in physics has led to new emphasis on ethics. Both stated that they have had no instances of ethics violations in the last 10 years.

## IV. Summary of results

*1. Academic Sector*
The data show that formal ethics training at graduate and undergraduate levels is limited, with at most 20% of students receiving training in courses or seminars. At most 80% of all students receive formal training in data handling and reporting in lab courses. Ethics are often seen by departments as a research issue, and not as important for undergraduates in courses. The surveys show, however, that even in research settings undergraduates only receive training in good professional practices 50% of the time and 20-30% junior members report having never received such training. About 80% of department chairs stated that recent events of data falsification have not led to new emphasis on professional ethics in their departments. While many consider formal training in ethics to be extremely important, there are some who consider it a waste of time since it would not change the behavior of fundamentally dishonest people. The reported levels of unethical behavior (broadly defined) are not inconsequential: for example, 10% of the departments had incidents in the past 10 years and 40% of junior members had personal knowledge of unethical behavior.

*2. APS and related societies*
The main focus in APS is on publications issues, as evidenced by the statements and guidelines. The Journals and the POPA ethics committee are the most active, while the units are mainly concerned with technical matters. The ethics-related activities in other US-based societies vary greatly. International activities are at the discussion stage. The department chairs and junior members see a role for APS in provision of educational programs, role models and fostering ongoing discussion of ethics. The junior members called for broader ethics statements and education in the areas of treatment of subordinates, responsibilities of mentors, hyping and misrepresenting one's own work, incomplete referencing of previous work, and fair refereeing.

*3. Research institutions*
Non-academic institutions formalize specific aspects of ethics training and practices. Large collaborations have very formal processes for review of work prior to publication. Industrial laboratories have employee training.

## V. Recommendations to Council for Ethics programs

The Task Force has found a clear need for actions by the APS that will lead to improved ethics education and awareness.

***1. APS guidelines and statements***
The ethics statements should be expanded to include

- treatment of subordinates
- social responsibilities of physicists
- intellectual property issues

The ethics statements and guidelines should be reviewed to be sure that the existing language covers

- best practices for co-authorship and publication for all types of research teams (interdisciplinary, multi-institutional etc)
- good refereeing procedures for journals and proposals
- proper referencing of previous work

***2. Ethics education***

The APS should develop long-term and short term ethics education programs that would include the following:

- Sponsorship ongoing discussion of ethics issues. This would help develop a common understanding of what is ethical
    - Organization of workshops
    - Development of a speakers' bureau
    - Articles in publications such as APS News, etc
- Sponsorship of the development of physics-centric training materials eg videos, case studies including consequences
- Creation of a database of model programs and materials
- Training for mentors and students
    - Professional ethics and responsibilities in all aspects of physics (education, research, publication, organizations)
    - How to recognize and deal with unethical students or colleagues
    - Distinguishing between the annoying and the unethical.
    - Different cultural norms and behaviors
- Assistance to department chairs and group leaders to proactively address ethics issues
    - Facilitate intra-departmental discussions (students, postdocs, junior and senior faculty etc) regarding ethics/professional conduct issues

***3. Recommended practices for data documentation and retention***

There is a clear need for definition of new standards to augment existing paper-based practices.

- protection of the research record in the electronic age
- awareness of legal requirements

***4. International standards***

The APS should work with IUPAP and other responsible organizations to help develop international ethics standards in all areas of the physics enterprise including publications.

***5. Consider whether to have formal standing committee on ethics***

Such a committee would be charged with initiating and coordinating APS ethics programs. Its relationship to the existing POPA ethics committee should be determined.

Finally, the Task Force believes that the physics community needs to think about the consequences of pressures on researchers to publish quickly in high-profile journals.

## VI. Acknowledgments

The Task Force is indebted to Roman Czujko for his considerable contributions to the surveys. We thank Judy Franz and Ken Cole for their valuable suggestions and assistance in carrying out its work. We especially thank all those who took the time to fill out the surveys and answer our questions, and offer support and advice.