



Online Ethics Center  
FOR ENGINEERING AND SCIENCE

# **Chapter 1: Ethical Codes in Physics and Related Fields**

## **Author(s)**

Marshall Thomsen

## **Description**

Chapter 1 of "An Instructor's Guide for Ethical Issues in Physics."

## **Body**

# **Chapter 1: Ethical Codes in Physics and Related Fields**

## **Section 1.1: Introduction**

Codes of ethics in scientific organizations serve to identify the consensus on ethical standards within those communities. For the same reason that we might introduce fundamental concepts like Newton's Laws of Motion near the beginning of an introductory physics class, it is helpful to introduce ethical codes early in an exploration of ethical issues of physics. Doing so makes the important point that ethics is not only about what we as individuals believe is right and wrong; it is also about what the physics community believes is right and wrong. An essential element in analyzing ethical issues in a particular situation is considering the relevant

community standards.

This chapter will explore ethical codes within the physics community as well as in closely related fields. Codes from scientific societies tend to focus on issues such as the responsible conduct of research, the treatment of colleagues and subordinates, and the interaction between scientists and society at large. Codes from professional societies in fields like engineering focus more on safety and how engineers relate to their employers.

Codes from professional societies are often connected to other codes and regulations. For instance, the federal government provides a definition of scientific misconduct, elements of which are reflected in various professional codes. This definition is incorporated, often nearly verbatim, into university research misconduct policies. State governments often use engineering codes to establish policies governing the licensing of engineers. Overlapping but nonidentical statements of what is right and what is wrong can, of course, lead to some confusion.

These professional codes are not the only ethical guidance that a physicist might consider when analyzing a situation from an ethical perspective. Other standards related to family, religion, and duty to country, for instance, may need to be considered when deciding on an action to take. With all of these standards and codes, it should come as no surprise that in many situations, conflict arises between the codes or even within a single code.

Conflicts are what make the study of professional ethics particularly challenging. They are also what some physicists may find particularly troubling. Physicists tend to look at the universe as being governed by well-defined, non-conflicting rules that provide unique answers. Even in the realm of quantum mechanics, where physicists acknowledge the probabilistic nature of the universe, we model this uncertainty in outcomes with well-defined wave functions. If two fundamental physics principles appear to conflict with each other, we assume that we need to correct our theories rather than learn how to live with the conflict. By contrast, it is not clear that we will ever be able to escape the conflicts that seem to naturally arise in the area of ethics. It follows then that ethical analysis of a situation may not provide a unique, correct course of action. On the other hand, ethical analysis will often help us separate the more desirable courses of action from the less desirable or undesirable ones.

# Section 1.2: The American Physical Society Guidelines on Ethics

In 2019, the American Physical Society Council approved new, comprehensive Guidelines on Ethics American Physical Society Guidelines on Ethics (19.1) (2019) <https://www.aps.org/policy/statements/guidlinesethics.cfm> (accessed November 22, 2019).. These Guidelines draw together information from several previous position statements and introduce additional topics not previously addressed. The Guidelines have an introduction followed by topical sections, each with a statement of principle and recommendations for implementation. The topics covered are

- The Research Record and Publications: Research Results, Authorship, Redundant Publication, Plagiarism, Peer Review, References in Scientific Communication
- Policies for Handling Allegations of Research Misconduct
- Treatment of Colleagues and Subordinates: Explicit, Systemic, and Implicit Bias, Harassment, Treatment of Subordinates, Code of Conduct for Meetings
- Responsibilities to the Profession: Social Media, Ethical Use of Public Funds, Conflicts of Interest and Commitment
- Improving Education for Professional Ethics, Standards, and Practices

A discussion of the APS Guidelines could easily occupy a full class hour. With the Guidelines assigned as reading prior to the meeting, a reasonable goal for a one-hour block of time would be discussion at a fairly general level. Ideally, this class hour would be followed up with later meetings during which issues are explored in more detail through the use of additional readings. These additional readings are addressed in subsequent chapters of this Manual. Where possible, and as time permits, it is helpful if the students can develop an understanding of why the standards exist. For instance, one standard describes the appropriate assignment of authorship on publications. Why is this standard important to the health of the physics community? Some of this discussion, however, may need to be postponed to a more in depth look at the issues. Finally, greater insight into the APS Guidelines can be obtained by comparing them to other codes within the physics community and in related fields of study. These other codes are discussed briefly in the sections that follow this one.

## Discussion Prompts

*Note that some of these questions are not as relevant to more experienced researchers.*

1. Honesty and proper treatment of colleagues and subordinates are identified as core elements of ethics in physics. How do these elements affect the field of physics?
2. The Guidelines on Ethics document addresses the issues of fabrication and falsification of data in the same section that it addresses issues of proper record keeping and sharing of results. How are these two sets of issues linked?
3. How is authorship of a scientific publication different from authorship of a work of literature?
4. Why is redundant publication considered to be a problem in the physics community?
5. How does the definition of plagiarism extend beyond situations in which the author neglects to put quotes around text written by someone else?
6. What is meant by “peer review”?
7. In what sense is proper referencing in scientific papers a matter of fairness?
8. If you observed someone committing what you believed to be research misconduct, would you know where to report it?
9. Discuss the differences between explicit, systemic, and implicit biases.
10. Have you ever observed behavior that qualifies as harassment as defined by the Guidelines, in the context of physics education or physics research? If so, how did you react?
11. Discuss ways in which the power imbalance between a supervisor and a subordinate may make it difficult for the subordinate to raise ethical concerns with the supervisor.
12. As of this writing, the section on conduct in meetings is the only one that discusses possible sanctions imposed by APS. Why might meetings be singled out in this way?
13. How can the APS policy on social media be viewed as something other than an arbitrary limit on open discourse?
14. Describe a hypothetical situation in which getting research funded by multiple funding agencies would be ethical and a hypothetical situation in which it would be unethical.

15. Is it ever permissible to proceed on a project when you have a conflict of interest? Why or why not?

## Section 1.3: Other American Institute of Physics codes

The American Institute of Physics is an overarching organization of societies in physics, astronomy, and related fields. Depending on areas of specialization of the students, other member societies of the AIP may be relevant.

The **Acoustical Society of America** has a carefully laid out Procedures for Addressing Grievances <https://acousticalsociety.org/procedures/> (accessed November 22, 2019).. The policy refers to unethical behavior without defining that term. A separate Meetings Harassment Policy <https://acousticalsociety.org/harassment-policy/> (accessed November 22, 2019). covers several forms of harassment and discrimination as well as the procedure for reporting an incident.

The **American Association of Physicists in Medicine** updated their Code of Ethics in 2018 <https://aapm.onlinelibrary.wiley.com/doi/full/10.1002/mp.13351> (accessed November 22, 2019).. This Code of Ethics is a lengthy document that outlines ten basic principles and then discusses their implications in the areas of general professional conduct, clinical ethics, research ethics, education ethics, and business/government ethics. The first two principles focus on patients, but many of the remaining principles are analogous to those found in other scientific codes of ethics. Other elements covered that are not typical in physics codes include research with human and animal subjects. The code concludes with a detailed description of the complaint procedure.

The **American Association of Physics Teachers** has an Event Participation Code of Conduct [https://www.aapt.org/aboutaapt/organization/code\\_of\\_conduct.cfm](https://www.aapt.org/aboutaapt/organization/code_of_conduct.cfm) (accessed November 22, 2019).. The focus of this code is harassment, demeaning

comments, and violent behavior at AAPT meetings.

The **American Astronomical Society** specifies reading their Code of Ethics American Astronomical Society Code of Ethics (2017) <https://aas.org/ethics> (accessed November 22, 2019). as a condition of membership acceptance or renewal. After a general discussion of the role of the Code, the first set of concrete issues addressed are those associated with how members relate to others, including the issues of harassment and bullying. Then the focus shifts to research and publication issues. The code also details the procedure for handling complaints.

The **American Crystallographic Association** has a relatively brief Statement on Ethics focusing on publications. It is worth noting, however, that it has separate statements on the importance of diversity and on conduct at a meeting (“Code of Conduct Policy”). American Crystallographic Association Statements <https://www.amercrystalassn.org/statements-policies> (accessed November 22, 2019). The meeting conduct policy covers respectful treatment of other attendees and of the surroundings.

The **American Meteorological Society** does not appear to have an over-arching code of conduct. However, they have issued numerous statements with ethical content, covering topics such as climate change, access to data, disseminating timely warnings to the public, and freedom of scientific expression. American Meteorological Society: Statements of the AMS in Force <https://www.ametsoc.org/index.cfm/ams/about-ams/ams-statements/statements-of-the-ams-in-force/> (accessed November 22, 2019).

The **American Vacuum Society** has brief statements on conduct at meetings American Vacuum Society Code of Conduct for Meetings, <https://www.avs.org/AVS/files/38/38398049-3926-4ff6-8ca1-85d04495c923.pdf> (accessed November 22, 2019). and on diversity American Vacuum Society Diversity Statement, <https://www.avs.org/AVS/files/69/6940e67d-4ee4-4a90-959a-4acb134f1b51.pdf> (accessed November 22, 2019)..

The **Optical Society of America** has an Anti-Harassment Policy and Code of Conduct that applies to participants in all of its events and activities Optical Society of America Anti-harassment Policy and Code of Conduct, [https://www.osa.org/en-us/meetings/code\\_of\\_conduct/](https://www.osa.org/en-us/meetings/code_of_conduct/) (accessed November 22, 2019).. The policy defines bullying, discrimination, harassment and retaliation, and then describes OSA

procedures for dealing with those situations.

The **Society of Rheology** has a Code of Conduct that applies to all in attendance at its meetings. The Society of Rheology Code of Conduct (2019) [https://www.rheology.org/sor/Annual\\_Meeting/SoRCodeOfConduct](https://www.rheology.org/sor/Annual_Meeting/SoRCodeOfConduct) (accessed November 22, 2019).. It focuses on discrimination, harassment, and retaliation.

## Discussion Prompts

*These prompts are designed to be appropriate for students who have read the APS Guidelines and one or more of the codes in this section.*

1. Some of the AIP member societies have codes that cover only what happens at meetings and similar events. Why might that be?
2. Discuss differences and similarities between any of the codes you have read in this section and the corresponding portion(s) of the APS Guidelines.

# Section 1.4: Physics codes outside of the United States

Examining codes of ethics from physics organizations based outside the United States can give some insight into the extent to which the APS Guidelines reflect an international consensus. This section will introduce codes from three other English-speaking countries.

The **Australian Institute of Physics** Code of Ethics <http://aip.org.au/aip-code-of-ethics/> (accessed November 22, 2019). is a relatively concise statement broken down into twelve points. While many of the points address what might be considered as typical academic issues, such as authorship, data management, and peer review, other points address issues that may be of more relevance to physicists in industry, such as advertising and seeking professional work.

The **Canadian Association of Physicists** has one of the briefest professional codes, containing just three general statements about acting in the interest of the profession, in the interest of the public, and with integrity. Canadian Association of Physicists Code of Ethics (adopted June 1994) <https://www.cap.ca/membership/>

(accessed November 22, 2019).. However, this association has a licensing procedure, and those holding a license are held to standards described in a more detailed code, The P. Phys. Code of EthicsCanadian Association of Physicists P. Phys. Code of Ethics, <https://www.cap.ca/programs/pphys-certification/pphys-code-ethics/> (accessed November 22, 2019).. The seven bullet points, which represent standards in addition to those in the previous code, are very similar to the types of standards found in engineering codes (see next section). One of the requirements to receive a P. Phys. License is agreement to uphold the Code of Ethics.

The **Institute of Physics**, based in the United Kingdom and Ireland, has their Code of Professional Conduct incorporated into their RegulationsInstitute of Physics Regulations April 28, 2016. [http://www.iop.org/about/royal\\_charter/file\\_67323.pdf](http://www.iop.org/about/royal_charter/file_67323.pdf) (accessed November 22, 2019).. Section 10 begins with a preamble and then lists seven requirements, including promoting the health of the profession, avoiding unnecessary risk to health and safety arising from one's work, and acting with integrity while conducting and reporting on research. Separate subsections deal with conflicts of interest, continuing education, not practicing outside one's area of expertise, and reporting infractions of the Code. Section 11 then discusses disciplinary procedures. Consequences for violations of the Code include written warnings, suspension of membership, and expulsion from the IOP.

## **Discussion Prompts**

1. The codes of conduct discussed in this section along with the APS Guidelines vary greatly in length. What are the advantages and disadvantages of a society establishing a concise code of conduct as opposed to a lengthy code of conduct?
2. Are there general topics that you think are essential to a code of conduct for physicists that are not addressed by *all* of the codes you have read in this section and by the APS Guidelines?
3. Pick one topic discussed by several of these codes and compare the wording used in each of the codes. Are there any differences, significant, or subtle?

## **Section 1.5: Codes from other fields**



The **American Chemical Society** has a set of seven Ethical and Professional GuidelinesAmerican Chemical Society Ethical and Professional Guidelines, (<https://www.acs.org/content/acs/en/careers/career-services/ethics.html> (accessed November 22, 2019).. Their Guidelines for Academic Professional Chemists addresses standards for faculty, postdocs, and students, as well as for their departments and the institution (usually the university) as a whole. This appears to be one of the few codes that spells out what an institution needs to provide in order to facilitate ethical activity by the society's members. The Chemical Professional's Code of Conduct focuses on chemists in industry. The Ethical Guidelines to Publication in Chemical Research reads like a detailed version of guidelines linked directly to journals, until the end of the document where guidelines for publishing outside of scientific literature are discussed. Most of what is discussed in the Professional Employment Guidelines could apply equally well to other professions, but the special attention paid to intellectual property and health and safety hints at the influence of the chemistry field on the document. The statement on Scientific Integrity in Public Policy addresses the ethical standards both for scientists involved in policy formation and for all government officials involved with policies that have a scientific component. The Volunteer/National Meeting Attendee Conduct Policy covers territory similar to the other meeting conduct policies discussed in the previous section. The Global Chemists' Code of Ethics addresses in broad terms the issues related to the environment, research, publications, safety, and security of dual use chemicals.

The **American Institute of Biological Sciences** has a relatively concise Statement on EthicsThe American Institute of Biological Sciences Statement on Ethics (revised March 22, 2002), ([https://www.aibs.org/about-aibs/ethics\\_statement.html](https://www.aibs.org/about-aibs/ethics_statement.html) (accessed November 22, 2019)., covering topics of research integrity common to many of the preceding codes. In addition, and not surprisingly, it addresses research on living organisms.

The **American Society of Civil Engineers** has eight canons in its Code of Ethics The American Society of Civil Engineers Code of Ethics (updated July 29, 2017) (<https://www.asce.org/ethics/> (accessed November 22, 2019).. As is common in engineering codes, the first canon deals with the safety, health, and welfare of society. Much of the remaining code looks at the relationship between engineers and their employers. Each canon begins with a general statement and then has several specific applications.

The **Institute of Electrical and Electronics Engineers** Code of Ethics (IEEE Code of Ethics, <https://www.ieee.org/about/corporate/governance/p7-8.html> (accessed November 22, 2019)). covers many of the same issues as the ASCE code but is more concise.

## **Discussion Prompts**

1. Discuss similarities among the American Physical Society Guidelines, the American Chemical Society's Guidelines for Academic Professional Chemists, and the American Institute of Biological Sciences Statement on Ethics.
2. Discuss the differences between the three codes mentioned in Discussion Prompt 1 and the American Chemical Society's Chemical Professional's Code of Conduct and the two engineering codes of ethics.
3. How does the Global Chemists' Code of Ethics differ from the Guidelines for Academic Professional Chemists and the Chemical Professional Code of Conduct?
4. Which of the elements of the American Chemical Society's Scientific Integrity in Public Policy are discussed in any of the other codes you have read up to this point?

## **Section 1.6: Ethical standards implied by institutional policies**

Academic institutions receiving federal funding are required to have a research misconduct policy that includes procedures for responding to allegations of research misconduct. Researchers working in academia need to be aware of their institutional policy because primary enforcement takes place at the institutional level. While ideally this information is readily accessible on the institution's website, in practice it is sometimes hard to find. A good exercise for students is to ask them to determine how they would go about reporting suspected research misconduct. If it takes your students a long time to locate this information, you may want to contact your institution's Misconduct Policy Officer or Research Integrity Officer and ask that the information more accessible.

The procedures for investigating allegations of research misconduct may well come as a surprise to faculty and students alike if they have not yet had occasion to read through the institutional policy. In particular, if an allegation against a researcher has been made and it cannot be dismissed as frivolous, it is common practice to sequester all relevant evidence promptly. This sequestration may involve an unannounced visit to a lab during which the investigators take control of lab books, external hard drives, and computers. While being the subject of an allegation is rare, it is probably not going to be pleasant. It will be a bit easier to tolerate if one is already familiar with what the procedures are and why they are set up that way. Also, as students become familiar with the standard procedures for inquiries and investigations, they may gain a better appreciation for the importance of good record keeping.

### **Discussion Prompts**

1. How does your institution define research misconduct, and how does that definition relate to research standards described by the ethical codes you have studied in this chapter?
2. What topics are addressed by the ethical codes you have read that are not addressed in your institution's misconduct policy?
3. What parts of your institutional research misconduct policy had you not anticipated finding there?
4. If you observed behavior by someone else in your department that had the appearance of being research misconduct, what would you do? Would it make any difference if the person you observed was your supervisor, advisor, or instructor?

## **Section 1.7: Human subjects research issues: sometimes overlooked in physics**

It is not common for physicists to engage in research involving human subjects. For physicists who do so, once again, institutional policies will provide limits on such research. Education research may well be the most common situation where

physicists interact with human subjects. Two issues can hamper physicists being in full compliance with the relevant regulatory requirements. First, physicists in academia who teach may start studying educational issues informally, with the initial goal of improving their own teaching. If the insight gained is sufficiently interesting, it would be natural to formalize and disseminate the results. Somewhere in this progression, the line that divides study for self-improvement from a research study will be crossed, and the faculty member may not be aware that human subjects research guidelines have become relevant. Second, there is terminology that some physicists may find confusing. Much of physics education research falls into the “Exempt” classification. At first glance, it might appear that this means human subjects research standards do not apply. However, it turns out that the individual researcher is not allowed to decide if the proposed research is, in fact, Exempt. The standard procedure is to file an application with the Institutional Review Board and let them determine the appropriate classification. If the project is classified as Exempt, then close oversight of the project will not be required, unless changes to the research protocol are necessary. However, the researcher remains responsible for following institutional policies related to human subjects research. In order to comply with federal and institutional policies, it is essential to understand your own institution’s human subjects research policy *before* embarking on research involving human subjects, such as physics education research.

## **Discussion Prompt**

Read your institution’s policy on research with human subjects and discuss any aspects that you had not anticipated finding there.

[Continue to Chapter 2: Laboratory Practices](#)

## **Notes**

# **Acknowledgments**

The author is grateful for the time and effort of the anonymous reviewers of this work and for their numerous helpful suggestions.

## **Rights**

Use of Materials on the OEC

**Resource Type**

Instructor Materials

**Topics**

Social Responsibility

Research Misconduct

Publication Ethics

**Discipline(s)**

Computer, Math, and Physical Sciences

Physics

Research Ethics

Teaching Ethics in STEM