Introduction: Why is ethics important for science?
Lecture 01

“Ethical issues in astronomy education, research and enterprise”
Astro 250, Sec. 2, CCN 06830
10:10 AM – noon, Mondays, B1, Hearst Field Annex
Instructor: Paul Kalas
Office: D25-B
Contact: 642-8285, kalas@berkeley.edu
Course web site: http://astro.berkeley.edu/~kalas/ethics/index.html
Requirements: Reading, class participation, writing assignments, quizzes

Paul Kalas (UC Berkeley 2012)
Ethics? Training?

Paul Kalas, Bill Sinton, Susan Ridgway, Klaus Hodapp, Richard Wainscoat
(February, 1990, Hale Pohaku, Mauna Kea)
Are ethical problems due to a few problem individuals, or is it a natural part of the scientific landscape?

Astronomer Fritz Zwicky demonstrating the SB gesture

Paul Kalas (UC Berkeley 2012)
Tuskegee Syphilis Study: 1932 - 1972

- 600 low-income African American men recruited, 399 previously infected with syphilis.
- Initial goal was to understand the progress of the disease and find the best treatment.
- After a year, they study morphed into simple observation of the disease, untreated.
- Penicillin as a treatment established by 1947, but doctors prevented treatment.
- 28 died of syphilis, 100 more from complications, 40 spouses and 19 children infected.

Paul Kalas (UC Berkeley 2012)
Willowbrook School: 1963 - 1966

• Healthy, mentally handicapped children inoculated with hepatitis in a medical experiment, with parental consent (admission to school required consent).

• Experiment stopped due to public protest.

• Researchers argued that kids would have been infected anyway.

• Goal was to understand the progress of the disease and find the best treatment.
Do ethical problems continue today?

Citing Ethics, Some Doctors Are Rejecting Industry Pay

By GINA KOLATA
Published: April 15, 2008

With little fanfare, a small number of prominent academic scientists have made a decision that was until recently all but unheard of. They decided to stop accepting payments from food, drug and medical device companies.

No longer will they be paid for speaking at meetings or for sitting on advisory boards. They may still work with companies. It is important, they say, for knowledgeable scientists to help companies draw up and interpret studies. But the work will be pro bono.

The scientists say their decisions were private and made with mixed emotions. In at least one case, the choice resulted in significant financial sacrifice. While the investigators say they do not want to appear superior to their colleagues, they also express relief. At last, they say, when they offer a heartfelt and scientifically reasoned opinion, no one will silently put an asterisk next to their name.

Researchers Fail to Reveal Full Drug Pay

By GARDNER KARLIS and BENEDICT CAREY
Published: April 15, 2008

A world-renowned Harvard child psychiatrist whose work has helped fuel an explosion in the use of powerful antipsychotic medicines in children earned at least $1.6 million in consulting fees from drug makers from 2000 to 2007 but for years did not report much of this income to university officials, according to information given Congressional investigators.

By failing to report income, the psychiatrist, Dr. Joseph Biederman, and a colleague in the psychiatry department at Harvard Medical School, Dr. Timothy E. Wilen, may have violated federal and university research rules designed to police potential conflicts of interest, according to Senator Charles E. Grassley, Republican of Iowa. Some of their research is financed by government grants.

Like Dr. Biederman, Dr. Wilen belatedly reported earning at least $1.6 million from 2000 to 2007, and another Harvard colleague, Dr. Thomas Spencer, reported earning at least $1 million after being pressed by Mr. Grassley's investigators. But even these amended disclosures may undermine the researchers' outside income become some entries contradicted payment information from drug makers, Mr. Grassley found.

In one example, Dr. Biederman reported no income from Johnson & Johnson for 2001 in a disclosure report filed with the university. When asked to check again, he said he received $3,500. But Johnson & Johnson told Mr. Grassley that it paid him $58,169 in 2001, Mr. Grassley found.

NYT, April 15, 2008
Paul Kalas (UC Berkeley 2012)

NYT, June 08, 2008
How about physics & astronomy?

March 6, 2008

Did Researchers Cook Data from the First Test of General Relativity?

Rumors of data mishandling in an historic eclipse study don't glibe
By JF Minai

On May 29, 1919, two British expeditions, positioned on opposite sides of the planet, aimed telescopes at the sun during a total eclipse. Their mission: to test a radical theory of gravity dreamed up by a former patent clerk, who predicted that passing starlight should bend toward the sun. Their results, announced that November, vaulted Albert Einstein into the public consciousness and confirmed one of the most spectacular experimental successes in the history of science.

In recent decades, however, some science historians have argued that astronomer Sir Arthur Eddington, the junior member of the 1919 expedition, believed so strongly in Einstein's theory of general relativity that he discounted data that clashed with it.

In 1919 general relativity was on the cusp of eclipsing Sir Isaac Newton's law of universal gravitation, put forth in 1687. Newton's law cast gravity as a type of bond between objects, all floating within the gridlike arena of space and time. Einstein's insight was that gravity is the grid, which is warped by massive objects such as the sun. As a consequence, light passing the sun should literally fall toward it like a moon rover clipping the edge of a giant crater and falling in.

Eddington, then director of the University of Cambridge Observatory, convinced his senior colleague and England's Astronomer Royal, Sir Frank Dyson, to mount the expedition. The group split into

TOTAL ECLIPSE OF REASON? In the physics equivalent of an urban legend, the late astronomer Sir Arthur Eddington is sometimes alleged to have rejected data that didn't fit his preconceptions in a famous test of Einstein's general relativity during the 1919 solar eclipse.

©ISTOCKPHOTO/PETR MASEK

Scientific American, March 6, 2008
Paul Kalas (UC Berkeley 2012)
New Purdue Panel Faults Bubble Fusion Pioneer

The third time was no charm for Russ Taleyarkhan, the “bubble fusion” pioneer at Purdue University in West Lafayette, Indiana. After two previous investigations looked into alleged scientific misconduct by Taleyarkhan, a third panel has now cited Taleyarkhan for two cases of misconduct. Both cases centered on efforts by Taleyarkhan to make experiments carried out by members of his lab appear as independent verification of his previous work.

Taleyarkhan first sparked controversy after he and colleagues reported in Science in 2002 that they had generated nuclear fusion with a simple tabletop setup. Fusion, the process that powers the sun, normally takes place at pressures and temperatures intense enough to cause atomic nuclei to combine and give off energy in the process. Decades’ worth of efforts to harvest energy from that process in reactors on Earth have failed. In their original Science paper, Taleyarkhan, who was then at Oak Ridge National Laboratory in Tennessee, and his colleagues reported that firing a pulse of ultrasound and neutrons at a cylinder of acetone in which the hydrogen atoms had been replaced by deuterium atoms caused bubbles to form, swell, and collapse. The heat and pressure at the center of the collapsing bubbles reportedly fused deuterium atoms together, liberating nuclear byproducts and excess energy.

The work raised the promise of limitless energy and spurred numerous early attempts to replicate it, all of which failed. Taleyarkhan moved to Purdue in 2004 and set about reproducing the original bubble fusion results. That winter and spring, according to the panel’s report, Taleyarkhan’s post-doctoral assistant Yihua Xu conducted bubble fusion experiments and wrote up the results, which were submitted to Science. The paper was rejected and later resubmitted to Physical Review Letters. PRL too rejected the paper; according to the panel’s report, a reviewer commented that it was “unusual” that the experiment was done by one person “so that needed crosschecks and witnessing of results seem lacking.”

In early 2005, Taleyarkhan asked Adam Butt, a master’s degree candidate in his lab, to proofread the paper and check some of its numbers. After Butt did so, the paper lists his name as added as an author of the paper, which was then submitted to Nuclear Engineering and Design (NED) and quickly accepted. “In this context, it is plain that the intent was to create the appearance of a joint author who participated in the experimentation itself,” the panel’s report concludes. “This is research misconduct.” The panel flagged Taleyarkhan for a second count of misconduct for a 2006 PRL paper in which Taleyarkhan and colleagues cited the NED paper as proof of independent confirmation of bubble fusion. Although the panel concluded that several other allegations did not constitute scientific misconduct, the report was still deeply critical of Taleyarkhan’s behavior and in some cases his scientific procedures.

In an e-mail to Science, Taleyarkhan says that the new report “is flawed from various perspectives and incorporates factual errors,” though he does not spell them out. He adds: “The current state of matters represents a major setback for university faculty members in general—a sort of selective victimization to meet political-funding priorities of a huge institution (with relatively incomparable resources vs. the sole individual) could happen to any other faculty member.”

Kenneth Suslick, a chemist at the University of Illinois, Urbana-Champaign, and a longtime critic of bubble fusion, calls the report “some kind of vindication.” Suslick says the report didn’t more squarely address questions of possible scientific fraud that have been raised about the research (Science, 17 March 2006, p. 1532). The report states that although such allegations were made to a previous panel investigating Taleyarkhan’s work, they were not forwarded to be made part of the current panel’s investigation—but it does not explain why. The current report also did not attempt to evaluate the original scientific results behind “bubble fusion.”

The latest panel was set up in March 2007 following complaints to the Inspector General of the Office of Naval Research (ONR), which helped fund some of Taleyarkhan’s experiments. The panel was chaired by Purdue biochemist Mark Hermodson, and four of its six members came from outside Purdue University. Although the current panel submitted its report to ONR in April, it was formally accepted and made public only on 18 July.

Taleyarkhan’s lawyer, John Lewis of Lewis and Williams LLP in Indianapolis, says Taleyarkhan plans to appeal the report’s findings. However, he adds that he is “not optimistic” the appeal will succeed, given that it will be conducted by the university.

Purdue spokesperson Joseph Bennett says that Purdue officials will not comment on the report until after any appeal is complete next month. The ONR letter states that the funding agency will keep the case open until Purdue takes corrective action to prevent similar occurrences in the future.

—ROBERT F. SERVICE
Astronomy Ethics Course

• Reading & homework
• Class discussion & participation
• Practice case studies and write our own
• Disseminate results through departmental web site.

Paul Kalas (UC Berkeley 2012)
Why is ethics relevant to astronomers?
Origins of science ethics codes
Scientific Method

• Self-regulating & self-correcting.
• Learn science ethics from your mentor and peers.
• Principles of the Scientific Method
  – Honesty
  – Integrity
  – Objectivity
  – Collegiality
  – Other?
• Rules for Research
  – Respect for primary data
  – Adherence to verifiable research methods
  – Reporting negative findings
  – Other?

Paul Kalas (UC Berkeley 2012)
Origins of science ethics codes

Nuremberg Code (1946)

• 1st document in contemporary society addressing ethical issues of using human subjects for scientific research

• Written during the Nuremberg war crimes trials – doctors & scientists prosecuted for their leadership roles in Nazi human experiments

• Doctors argued there no international laws existed regarding human experiments

• Ten Principles in the Nuremberg Code, including:
  • Introduced concept of informed consent (#1)
  • Do the greatest good for society (#2)
  • Avoid unnecessary human suffering.
  • Risk/Benefit analysis (#6): “The degree of risk to be taken should never exceed that determined by the humanitarian importance of the problem to be solved by the experiment.”

Paul Kalas (UC Berkeley 2012)
Origins of science ethics codes

Declaration of Geneva (1948)
Declaration of Helsinki (1964)

• Adopted by the World Medical Association

• Guidelines for the practice of medicine and medical research involving human subjects

• “It is incredible to think that although the founders of medical ethics, such as Hippocrates, published their works more than 2000 years ago, the medical profession, up until now, has not had a basic, universally used, curriculum for the teaching of medical ethics.” WMA Medical Ethics Manual (sponsored by Johnson & Johnson).
Three “Basic Ethical Principles” for medical research in the U.S.

1. Respect for Persons
   - Human dignity (autonomy)
   - Honor a person’s rights to opinion, freedom (choices) and privacy.
   - Protection of those with diminished autonomy
   - Example in astronomy?

2. Beneficence (an obligation to act kindly or with charity)
   - Human welfare: Action to help others and/or prevent harm.
   - Benefits may need to be foregone because of the risks.
   - Example in astronomy?

3. Justice (Fairness)
   - Distribute the benefits & burdens of research fairly
   - Example in astronomy?

Paul Kalas (UC Berkeley 2012)
Case study: “Competition and the TAC” (C-Attach)

- Keck Observatory has commissioned a new instrument, and Tom, a new postdoc at UC Berkeley, wishes to submit a proposal to the NASA Time Allocation Committee to pursue a cutting edge science topic. His target list derives from one year of previous work analyzing of the 2MASS catalog, but he is concerned when he finds out that a competitor is a member of the NASA TAC. The competitor has a reputation for opportunism, and according to the Keck schedules, the competitor has 3-4 nights of observations scheduled per year through her own university that manages its own TAC for the telescope. Tom submits the proposal and three months later he is notified that it is rejected. Six months after that the competitor publishes a ground-breaking paper on exactly the same targets, based on data taken three months earlier, with exactly the same instrumental setup. Tom is furious, claiming that the idea from his proposal had been stolen.

1. What are the facts of the case? Does Tom have all the facts that he needs to make a case for unethical conduct? If not, what is missing?
2. Which parties may have acted unethically? Why (i.e. what principles, imperatives, standards or codes are possibly violated)?
3. What should Tom do? How might the other parties respond?
4. Is the scientific method damaged in cases like this?

Paul Kalas (UC Berkeley 2012)
Homework for Lecture 2

• Read NAS “On Being a Scientist” (pg. 3-26 in the pdf) and “Ethics and Values” from the American Physical Society.

• Make sure to read through the case studies in “On being a scientist”. Which ones can be converted into an astronomy case study?

• Write down one or more key questions that you would like to ask in class.

• Are these documents useful? If you had to improve on these document, what would you do?

• If you see a research ethics example in the news, please share it with the class.

Paul Kalas (UC Berkeley 2012)