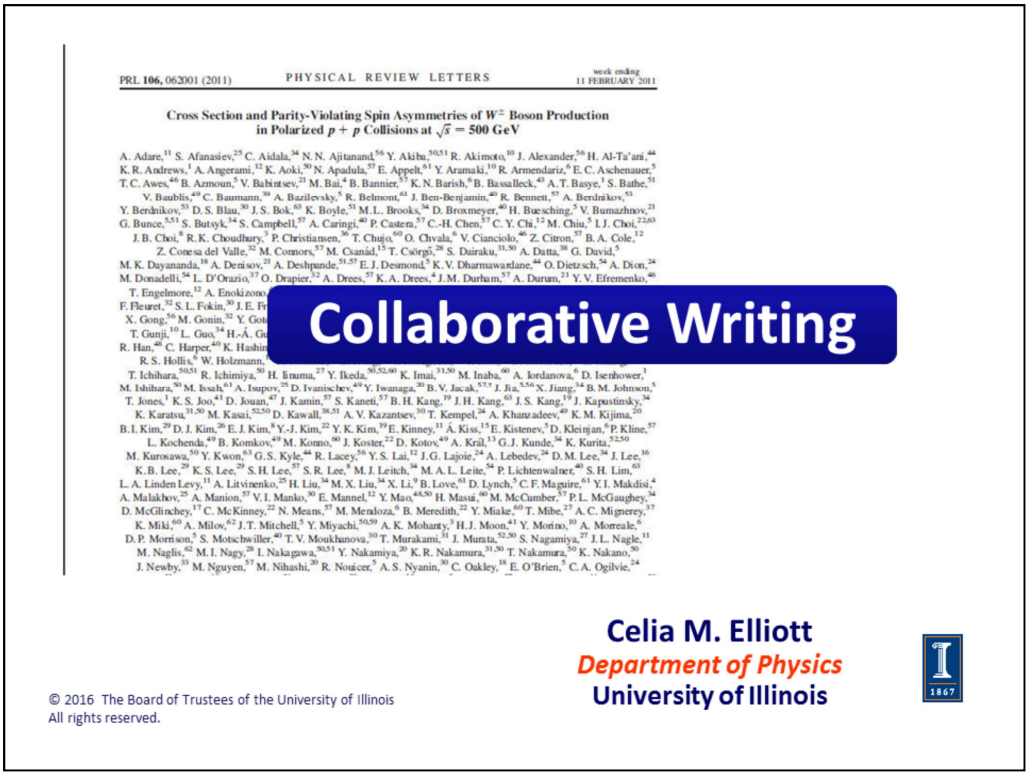


Single-author papers are increasingly rare in physics, except in the case of review papers. Most of the papers you write over the course of your career will be done in collaboration with other researchers. Today we'll look at some of the benefits and challenges of collaborative writing.

Why have multiple authors?

- Subject is too large or too complex for one person
- Subject requires a variety of viewpoints or expertise
- Recognized "experts" add prestige and may assure wider readership
- Common practice in the subfield
  - HEP—everybody who did anything
  - CMP—crystal growers

Complications sometimes arise with multiple authorship

- Opposing judgments about manuscript length, emphasis, publication venue
- Different writing styles
- Different senses of urgency
- Disputes about assignment of credit
- Time needed to resolve differences
- Dilution of responsibility

What APS says about your responsibilities as a coauthor:

"All collaborators share some degree of responsibility for any paper they coauthor"

Accept responsibility for the accuracy and validity of the results being reported

Review the manuscript before submission

Provide prompt retractions or correction of errors in published works

"Any individual unwilling or unable to accept appropriate responsibility for a paper should not be a coauthor"

from "Supplementary Guidelines on Responsibilities of Coauthors and Collaborators," American Physical Society. Adopted by Council on November 10, 2002.

http://www.aps.org/policy/statements/02_2.cfm#supplementary_guidelines1

The APS guidelines on the responsibility of coauthors arose directly from the Hendrick Schön scandal at Bell Labs in 2000. See "Report of the Investigation Committee on the Possibility of Scientific Misconduct in the Work of Hendrick Schoen and Coauthors," M. Beasley, S. Datta, H. Kogelnik, H. Kroemer, D. Monroe, September 25, 2002 - internal Bell Laboratories report, Bell Labs, Lucent Technologies.

As a service to the community, the American Physical Society permanently archived the Beasley Commission Report at http://journals.aps.org/reports/ after Lucent/Alcatel removed it from their website. <doi:10.1103/APS.Reports.Lucent>.

The first step is deciding who the authors are going to be

- Ethical considerations of sharing credit with those who contributed to the work
- Choice of coauthors may affect the paper's real and perceived quality
- Things to consider when selecting coauthors
  - Importance of the individual's contribution
  - Writing ability, availability, and interest
  - Prestige and recognition in the field
- Coauthors may not necessarily be co-*writers*
  (but every coauthor must have the opportunity to review the ms. before it is submitted for publication)

Generally, those who contributed most to the success of the project, especially those who have solved major technical problems, should be coauthors; lesser contributors are mentioned in the acknowledgments section.

Ideally, authors are named in descending order of their relative contributions, but practices vary widely among research disciplines and groups. Unless the list is obviously alphabetical, most readers will assume that the first author made the major contributions to the work and is the person to whom questions about the paper should be addressed.

Some journals are now requiring a detailed statement of the contributions that each author made to the work being reported. See, for example, the "Contributions" section of "Aharonov–Bohm oscillations in a quasi-ballistic three-dimensional topological insulator nanowire" *Nature Communications* **6**, 7632 (2016). http://www.nature.com/ncomms/2016/150709/ncomms8634/full/ncomms8634.html#contrib-auth.

Who should be authors of this paper?

"Multi-layered CdSe thin-film switches for tunable optoelectronics"

Ahrends (postdoc) and Anderson (graduate student) built the switches and made the measurements

Arbeiter (engineer) fixed a critical problem with the measurement apparatus

Bartholomew (professor and head of the group) formulated the key idea and told A^2 what to do

Chambers (dept head) had a number of insightful discussions with Bartholomew on the theory

Daniels (technician) showed A^2 how to grow the super-pure thin films

This example is entirely fictitious.

This example is entirely fictitious.

This paper reports on the fabrication of multi-layered semiconducting CdSe thin-film devices to exploit their tunable optoelectronic properties.

Deciding the lead author is nontrivial; do you make it the most senior person, or the person who contributed the most important idea, or the person who did most of the work?

Think about how future authors will cite it. "The fabrication method pioneered by *xxxx* et al." will sound ridiculous if you make one of the theorists (Bartholomew or Chambers) the lead author.

Additional considerations:

- Ahrends stuck Anderson with most of the work
- Ahrends is looking for and desperately needs a job, but Anderson has several years of graduate school left
- Bartholomew is the PI on the grant that funded the work
- Chambers contributed several possible theoretical explanations to account for the unexpectedly long charge carrier lifetimes that were observed experimentally
- Chambers, who can be petty and vindictive, has an ego the size of an aircraft carrier and controls space allocations (and the group needs more lab space)
- Daniels doesn't have a PhD and has a permanent chip on his shoulder because he feels he's not respected

Do these considerations change your ideas about who should be authors or what order individuals should be named in the author list?

One solution might be multiple papers

Ahrends and Anderson write a paper about the switches, methods, and results for *J. Appl. Phys.* or *Adv. Opt. Photon.*

Bartholomew and Chambers write a theory paper for *Phys. Rev. Lett.* or *Phys. Rev. B*

Daniels and Arbeiter write a technical paper for *Optics & Photonics News* or a similar trade journal

BUT—each paper must present a new and unique contribution to the literature

Acknowledgments*

- Acknowledge contributions by professional colleagues who are not listed as authors—do not include titles or academic degrees
- Acknowledge financial support
- Do not include purely personal acknowledgments (your mother, the office mate who always kept the coffee pot full)

**N.B.* No *e* between the *g* and the *m* in the US English spelling of *acknowledgment*

Physicists use one of three approaches

"Plug-and-Play" method

- Each author writes a section, which is assembled into a final draft
- Exploits individual expertise and knowledge
- Inconsistencies in style, tone, tense among sections

"Best-Ball" method

- Everyone writes his own version of the whole article
- Group selects the best from each
- Inconsistencies in the final version

"Filter" method

- Group creates a draft using either of the two methods
- One person with "artistic control" writes the final version to ensure consistency of style and form

Multiple authors may make it difficult to maintain consistent tone, style, word usage.

Joining individually written segments in one document can result in a disorganized, poorly written mess unless one person has editorial control.

Many authors preparing the entire document is usually least efficient and most time-consuming.

Some caveats:

The more coauthors…

- The more time it takes to get a first draft
- The more coordination and communication is required
- The more disputes are likely
- The more time it takes for revising and polishing the manuscript
- The less responsibility any one person feels about getting the damned thing finished

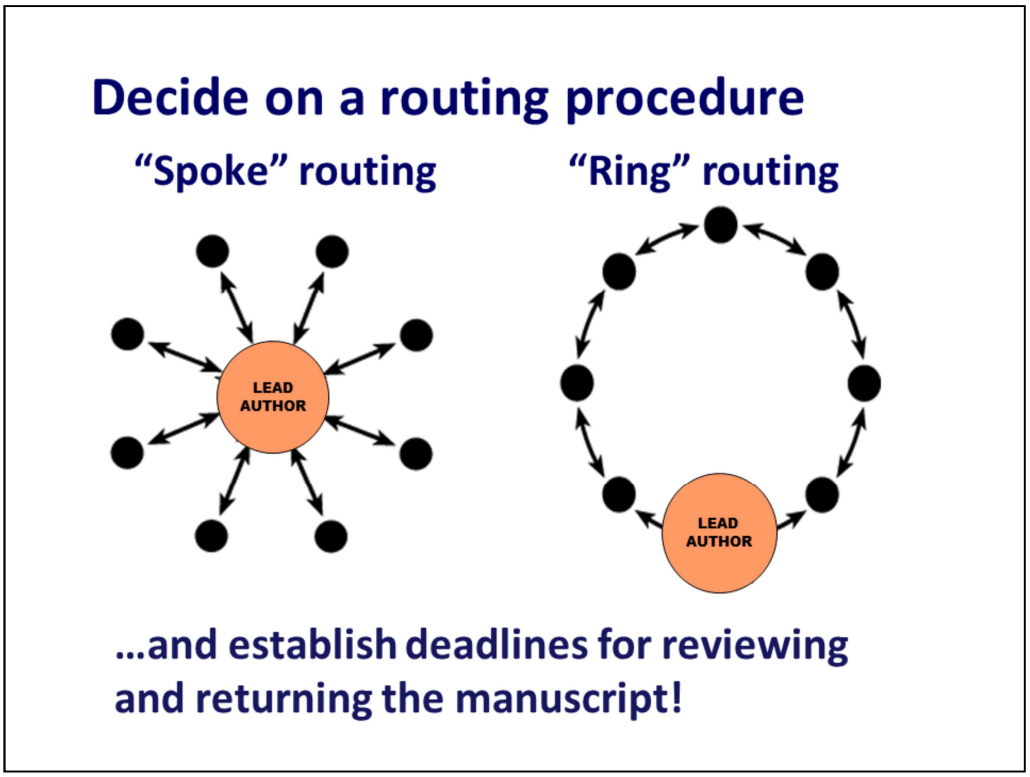
Steps to creating a collaborative paper

- Appoint a "general" who will lead the effort and who has the authority to direct others
- Identify the tasks that must be done
  - Assign them to specific people
  - Set firm deadlines
- Establish an approach and a routing procedure
- Agree on a protocol for recording comments as the manuscript circulates
- Collect and circulate comments
- Discuss and make changes to the document
- Circulate the final draft for all authors' approval

Decide on routing and file naming

- Ensure that *somebody* retains an original of each version of the file
- Ensure that the most recent version of the file is what is circulating
- If team members are going to make revisions to the original document and save a new version, devise a file-naming strategy so that the changes can be tracked (be aware that some operating systems truncate file names)

Some operating systems will open files with long file names but then will truncate them when the file is saved. If you've devised a file naming strategy that includes important information in longer file names, that information may be lost if someone with a incompatible system opens the file.



"Spoke" routing

- Document goes to all members of the group at the same time.
- Members make their comments and return the document to the originator.
- Faster turnaround.
- Somenone will have to incorporate all the comments into a single document for the next round.

"Ring" routing

- Document circulates to each member of the group successively.
- Each member revises the file, saves it under a new name, and passes it on to the next person in the group.
- File naming protocol very important.
- Considerably slower, as each person must wait for authors earlier in the chain to complete their work.
- As the document moves, authors at the end of the chain may not have anything left to add to the document and will start commenting on the comments.

Decide on how you will comment

Commenting via email

- Someone in the group will have to collect and synthesize individual comments

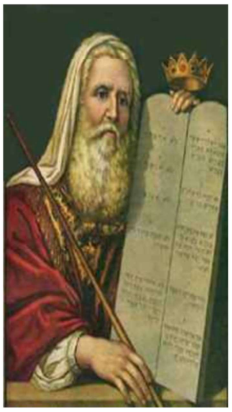
Inserting comments directly into the text

- Original document may become very hard to read

Local Electronic Phenomena: From Solids to Molecules

~~The original idea of~~ Binnig and Rohrer's original idea was actually not to build a microscope, but rather to develop a technique for ~~performing spectroscopy~~ spectroscopic measurements ~~with~~ of electron tunneling on the nanometer scale using a positionable electrode. [add ref. cme] Tunneling spectroscopy, ~~has been~~ one of the traditional tools methods of solid-state physics, has been an important tool since studies of planar metal-oxide tunnel junctions in the 1960's partially confirmed the B~~ardeen C~~ooper S~~chrieffer~~ [according to the APS Style Guide, BCS does not have to be defined; *Nature* may not concur [cme]] theory of superconductivity for conventional metals. But similar to~~like~~ other spectroscopic techniques, planar tunneling provides only spatially average~~d~~ information and can not directly access measure spatial variations of electronic phenomena in solids. The STM ~~invention~~, however, ~~has~~ added ~~the~~ a ~~new~~ critical new component—the ability to perform spatially resolved spectroscopy on the atomic scale. As recent work demonstrates, the STM's combination of image and spectroscopy with the STM is providing provides new perspectives of electronic phenomena, such as ~~such as~~ superconductivity and magnetism, which up to now have been mostly examined primarily characterized by techniques ~~with~~ relying on macroscopic~~ally~~ average ~~techniques~~. In its now ~~more~~ more established role as a spectroscopic tool, the STM ~~spectroscopy~~ is finding applications in a wide range of systems—from superconductors to nanostructures and single molecules.

Team-Writing Commandments



- Name a lead author who has final editorial control
- Limit the size of the team
- Strive for a mix of "thinkers" and "doers"
- Decide who has veto power
- Discuss upfront how to resolve conflicts

Never *ever* put somebody's name on a paper without his or her explicit permission

cmelliot@illinois.edu

Limit the size of the team—eliminate upfront members who cannot, or will not, contribute.

Consider mentioning some contributors in the "acknowledgments" section instead of making them coauthors.