

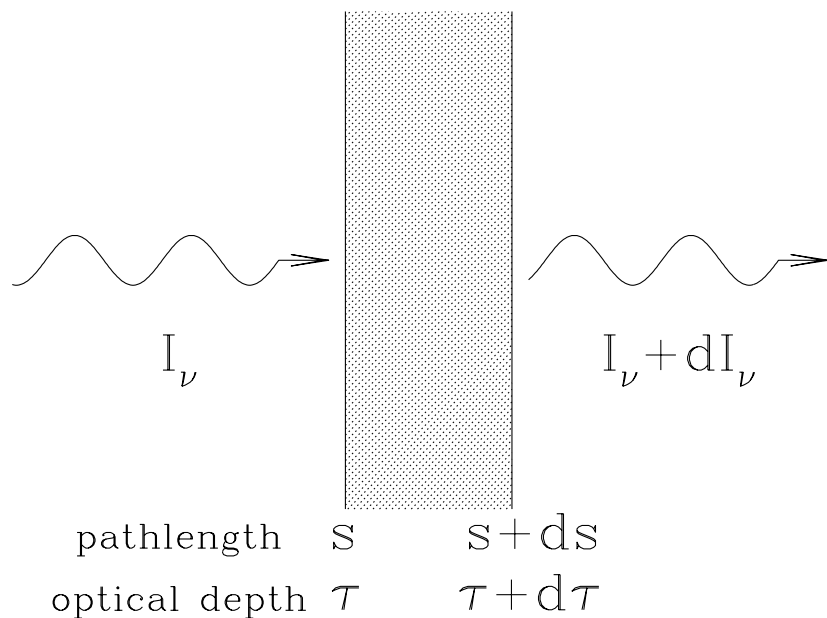
Physics 224

The Interstellar Medium

Lecture #6

Radiative Transfer

Equation of Radiative Transfer ignoring scattering



"emissivity"
net change in I_ν from
spontaneous emission

$$dI_\nu = -I_\nu \kappa_\nu ds + j_\nu ds$$

"attenuation coefficient"
net change in I_ν from absorption
& stimulated emission

Proposals & Presentations

A Skill You Will Need: Writing Competitive Proposals

Type of Proposal	Approximate Acceptance Rate
Hubble Space Telescope	18% (Cycle 23)
NOAO Kitt Peak	40%
NSF Astronomy Grants	10%
Atacama Large Millimeter Array	23% (Cycle 3)
NASA Astrophysics Theory	15% (2014)
NASA Astrophysics Data Analysis	17% (2013+2014)

A Proposal is Persuasive Writing

In a proposal you need to *argue* for why you get the resources instead of all the other people who want them.

We often don't think of science writing as "persuasive"
- why is that?

Proposals are different types of writing than scientific papers.

Paper: "Here is what we have learned."

Proposal: "Here is what we *want* to learn & why it is important."

A Proposal is Persuasive Writing

There are limited resources -
how do we decide who gets them?

Solicit proposals
Peer review of proposals
Allocation of resources

*There is far more interesting science to be done
than there are resources.*

Good proposals are rejected often.

What is a proposal?

from: <http://blogs.discovermagazine.com/cosmicvariance/2012/01/24/unsolicited-advice-xiii-how-to-craft-a-well-argued-proposal/#.VwdJrccfzBs>

A Proposal is a Highly Structured Rigorous Argument

In its most abstract form, a proposal is a piece of persuasive writing that lays out a convincing case that the proposed research is:

1. important
2. feasible
3. efficient

By “important”, I mean that the project must rise above the level of “good to do”, and instead be seen as “must be done”, even by people who don’t work in the field. By “feasible”, I mean that there must be a clear path to a definitive scientific result. By “efficient”, I mean that the particular approach you’ve taken is the optimal one for reaching the important goals you’re targeting (i.e. aim for “Studying X provides the cleanest test of Important Science Y” and avoid building a proposal to study X when studying Z is clearly a more direct approach to Important Science Y — even if you worked on X for your thesis.)

advice from
J. Dalcanton
(PI of 858 orbit
Hubble Treasury
survey of M31)

What defines an “important” project?

There is no unit of “importance” - it is all relative.

What defines an “important” project?

There is no unit of “importance” - it is all relative.

- What is the big picture question that this proposal is working toward? (What is the big picture question that this proposal is working toward?) and work
- Is the proposal needs to have in it *your* narrative of what is important and why the proposal fits that definition!
- Will this project make an impact outside of its specific field?
- Is the project going to move things forward or push the boundaries of our knowledge in its field?

What defines an “important” project?

For the purpose of your proposal
your peers who are reviewing it decide
what is important.

One way to decide if your idea is “important” -
go explain it to a colleague and get their feedback.
“elevator pitch” for your idea

What does it mean to be “feasible”?

You need to lay out a clear path to meeting the goal or answering the question you are addressing.

Most proposals are suggesting to do something *new*
- how do you know new things are feasible?

- use techniques that have addressed similar problems before
 - demonstrate past evidence of solving similar problems
- provide a clear roadmap identifying the obstacles & ways around them

What does it mean to be “feasible”?

You have not yet done the project, so there is no definitive proof it can be done, so you have to *convince* the reader of feasibility.

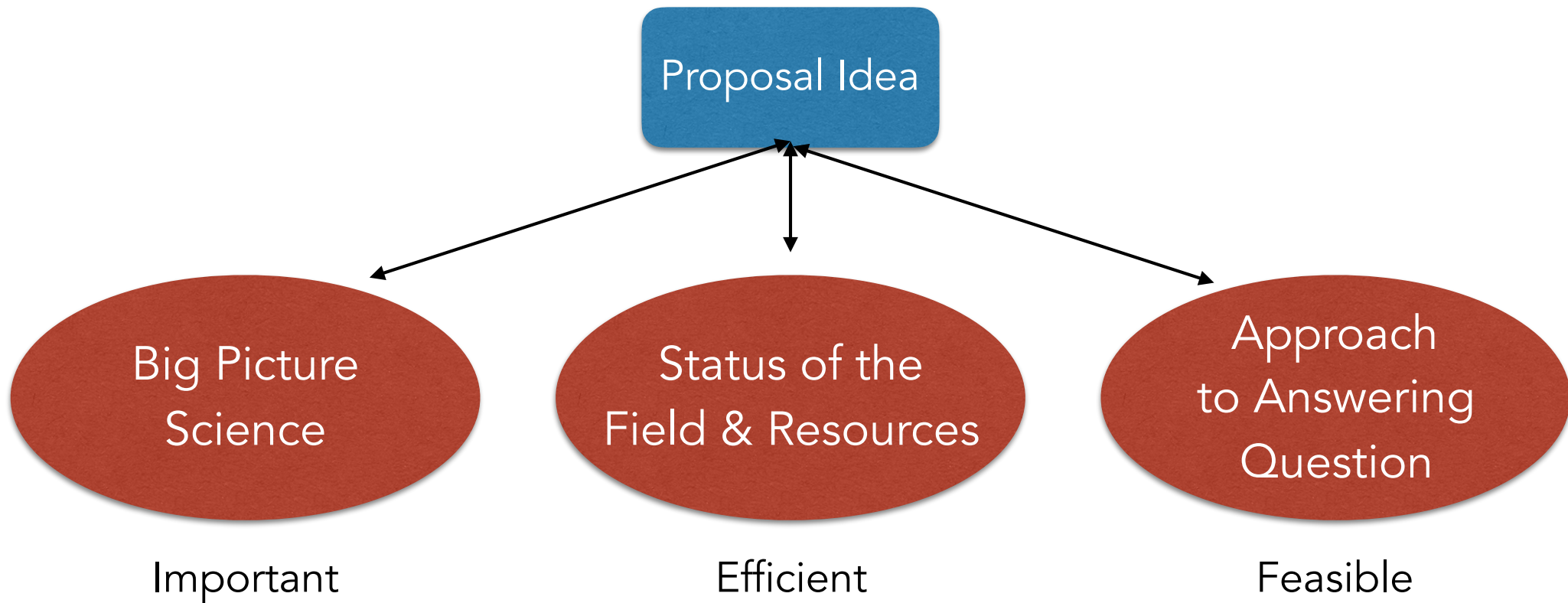
- Have a plan!!
- Be specific (explain needed measurements, calculations, resources, etc).
- If there are potential obstacles, explain how you will get around them.

What does it mean to be “efficient”?

- This is the optimal way to approach this problem.
- Now is the optimal time to do this research.

Resources are limited, many projects are both important and feasible. If the work can be done with resources that are less scarce than what you are proposing for, do that instead!

There isn't always an objective “optimal” way to do things - lead the reader to your definition of optimal.



Before you start writing, outline each of these points.

“...proposals live or die not on the beauty of your prose, but on the structure of your argument.”

from: “Unsolicited Advice XIII: How to Craft a Well-Argued Proposal”
blogs.discovermagazine.com/cosmicvariance/2012/01/24/unsolicited-advice-xiii-how-to-craft-a-well-argued-proposal/#.VwdJrccfzBs

Make things as easy as possible for the reviewer.

This is not their homework!! Don't make them struggle.

You want your narrative to be easy for them to follow
and easy for them to agree with.

Make things as easy as possible for the reviewer.

Aesthetics

- make things nice to look at
- don't remove all the whitespace between sections
- make easy to read figures with clear captions, annotate them, remove unnecessary lines or points (powerpoint trickery),
- repeat structural elements (i.e. bold headings for sections),
- don't overuse bold/italic fonts.

Make things as easy as possible for the reviewer.

Language

- avoid jargon as much as possible
- define your acronyms & don't use too many of them
- proofread thoroughly
- use simple, clear sentences

Make things as easy as possible for the reviewer.

Organization

- invest some time thinking about the logical structure of your proposal, make sure it is sound
- lead with the important stuff, this applies to the whole proposal, to sections, to paragraphs and to sentences (organize like: “this is important, here is evidence why” instead of “here is evidence, therefore this is important”)
- give only as much detail as you need to make the case (too much is confusing and also opens you up to unnecessary critiques if reviewer disagrees with some particular piece of evidence)

Where does persuasive become unscientific?

This is a question worth thinking about!

What goes into a proposal?

- Title
- Abstract
- Scientific Justification
- Technical Justification (varies depending on type of proposal)
- Figures
- Bibliography

An Abstract Recipe

- Start with one or two facts
- Explain why these facts are important
- State your goal
- Introduce the problem
- Explain why what you are proposing will solve it (strategy/instrument)
- Explain the broader implications of your results

Advice based on
Gurtina Besla's Astro
520 class at Arizona

Example GO Program: Proper Motion Field Along the Magellanic Bridge

Abstract

Facts

Our HST proper motion (PM) measurements of the LMC and SMC have revolutionized our understanding of the Magellanic System, and have spurred new research on its use as a cosmological probe of galaxy formation. The PMs imply that the Magellanic Clouds are likely on their first infall towards the Milky Way (MW). The

Importance

disturbed nature of the Magellanic System is therefore likely due to the LMC-SMC interaction, and not to the MW influence. This has emphasized the importance of dwarf galaxy interactions for galaxy evolution. The

Goal

Clouds are connected by a complex of gas and stars called the Magellanic Bridge. We propose to map the stellar PM field of the Bridge, similar to our prior HST mapping of the LMC PM rotation field. Our state-of-the-art N-

Problem

body simulations show that the PM field will tightly constrain the impact parameter of LMC-SMC orbit at its last pericenter 100-300 Myr ago, which is the main uncertainty in our understanding of the LMC/SMC interaction history. This will test whether the tidal debris between the galaxies is due to a recent direct-hit collision. It will also test models in which the tidal debris is responsible for the observed microlensing events.

HST

Strategy

We will observe once 3 fields for which first-epoch archival data already exists, and observe twice 5 other fields over a 2-cycle time baseline. With the established data reduction techniques of our successful HSTPROMO collaboration, this will yield PM accuracies of 10-25 km/s per field, well below the 130 km/s velocity difference between the Clouds. This will yield the best constraints to date on the LMC/SMC interaction, and will further

Broader

Impacts

test the importance of dwarf-dwarf interactions for galaxy evolution.

Your Proposal To-do's

- Start a list of interesting topics you might want to write about.
- Think about what sort of proposal you are most interested in learning about: observing, archival research, theory, supercomputing, funding, instrumentation, etc.
- Settle on a topic/proposal type combination by late January/early Feb.
- Start reading some literature on the topic - review articles are a good place to start.
- Put together a bibliography of relevant literature.
- Feb 14: abstract & bibliography deadline (so I can give you feedback)

Presentations!

Your Goals & Your Audience

- Who are you speaking to?
- What do you want your audience to learn?
- What is the storyline/logical structure of your talk?
- What visuals do you need to convey your message?

Plan all of this before you start making slides!

Similar to proposal: make following your path
easy for the audience.

Paper Presentation

You will be expected to read the paper and put together a ~15 minute presentation about it that highlights:

- big picture context of the paper
- technical approach
- key findings
- impact on subsequent work in the field (cite a recent paper that builds on this work)

Paper Presentation

1) who are you speaking to?

Your classmates.

Paper Presentation

2) what do you want your audience to learn?

- the important findings of the paper
- the big picture view of the field & why this paper made an impact

Paper Presentation

- 3) what is the storyline of your talk?
- 4) what visuals do you need?

This is up to you!

Paper Presentation

Needs Work

Excellent

Content

1 2 3 4 5

Does the presentation cover the key points of the paper? Is the big picture relevance of the paper clearly explained? Did you learn something from the presentation? Is the impact of the paper on subsequent work made clear?

Knowledge

1 2 3 4 5

Did the presenter have a strong understanding of the topic and material being presented? Were questions from the audience handled well?

Organization

1 2 3 4 5

Did the presentation flow smoothly? Was the timing right? Was the organization of the material logical? Did the organization move beyond chronological explanation of the contents of the paper?

Presentation

1 2 3 4 5

Were the visuals helpful and easy to understand (axes readable, color scheme helpful but not distracting, etc)? Were the slides laid out well? Did the presenter avoid using jargon?