

# **Some tips for faculty, grant, and fellowship applications**

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# Plan

- I will be speaking only about how to write strong applications. Tips for interviews after you are getting short-listed will not be discussed today.
- Fundamental assumption: Everyone (including you) is doing a great research. How can you then distinguish yourself from your competitors?
- Order of the presentation:
  1. Faculty application
  2. Grant application
  3. Fellowship application

# Faculty Application

## 1. Most important: Have your “dream paper” plan

- You must have a “research program” of your own
  - As theoretical astrophysicists/physicists, the best approach is to work on whatever is interesting (“opportunistic approach”). However, you cannot say this in the faculty application.
    - What is your big picture? If you do not have any, make one. What would be the title of your “*dream paper*” if everything goes as planned for the next five years?
  - The reviewers are most concerned about your **future** performance. The past achievement is of course pre-requisite and important, but the future plan is more important because they will be investing in you for many years to come.
    - Since you cannot change your past achievements, spend more time in formulating your future vision. You can still make a difference!

# Faculty Application

## 2. Past achievement: Emphasise “one thing” that you have done

- In the application, you must emphasise “one thing” that you are proud of. You do not need more than one (advice from Bohdan Paczynski).
- “What do you work on?” “I work on so many different things.”
  - Bad answer (for the faculty application; not necessarily bad in general!). This implies that you have no plan, and have not done anything important.
- If you indeed have worked on many different things and made significant contributions, pick “one thing” that would excite the person who asked that question, rather than saying you worked on many things.
  - Show off your breadth if they further ask: “Sounds great. What else do you work on?” (This happens!)

# Faculty Application

## 3. Help your committee member!

- When the faculty search committee selects short-list candidates, at least one of the committee members needs to push your application strongly.
- If your application is not clear about the future plan or the most important thing you have done so far, the committee member cannot push you strongly because it is difficult to make a **clear** case to the other committee members.
- Imagine how you can help the committee member advertise your application on your behalf. What should the committee member say about you?
  - E.g., “This applicant is excellent because (s)he achieved XXX which had a tremendous impact in the field, and plans to do YYY which is a hot topic.”
  - If you want the committee member to say this, you should make clear what to say in the application.

# Faculty Application

## 4. Example first lines

- Specify who you are at the beginning. Avoid “cosmologist” - there is no “department of cosmology” at universities (yet). You are either (theoretical) astrophysicist or physicist. Write wisely depending on where you apply.
- *“I am a theoretical (astro)physicist, who is interested in applying XXX to problems in cosmology.”*
  - XXX is your killer skill. E.g., state-of-the-art computational tools, state-of-the-art analytical models, Quantum Field Theory, etc.
- *“I am a theoretical (astro)physicist, who is interested in using YYY to learn about ZZZ in cosmology.”*
  - YYY is your main observable. E.g., cosmic microwave background, large-scale structure of the Universe, gravitational waves, etc.

# Faculty Application

## 5. Example second lines

- Inform the reviewers of the “one thing” that you are proud of.
  - *“I am best known for...” “I have made significant contributions to...” “I am proud to have achieved/discovered...” “I consider myself as a leading expert on...”*
- Although you do not need more than one thing, you could add another achievement if you insist. E.g,
  - *“While my most important achievement is XXX, my research interest is broader. For example, I have made a significant contribution to a different research topic of...”*

# Faculty Application

## 6. Example last lines

- The reviewers want a promising, independent researcher for their new faculty positions. But, they also want someone who can collaborate with the existing members. (They want a lot!)
- A killer paragraph:
  - *“While I am excited about my own new ideas and research programs, I am also open for new challenges and new directions. I am very much looking forward to the fruitful collaboration with all members of the Department of (Astro)physics at the University of XXX. For example, I can foresee a collaboration with Prof. YYY on ZZZ, etc etc”*



# Faculty Application

## 7. The worst beginning

- “I am a cosmologist. The cosmology is in the golden era, with large amounts of observational data coming from on-going and up-coming missions such as AAA, BBB, CCC, DDD, EEE,... To understand these data, we need better analysis and statistical tools. Moreover, we do not know the nature of dark matter and dark energy which occupy 95% of today’s energy density of the Universe. To make progress in deciphering the nature of these mysterious components, we need new theoretical ideas. To this end, I will...”
- My reaction: You did not make these observations (AAA, CCC,...). You did not discover that 95% of the Universe is dark. Don’t tell me what the others have done or are doing. Tell me what you have done!
- Another bad thing about this paragraph: You don’t do research just because there is data. You must have a question that you wish to answer, and the data should only be helping you answer the question. Specify the question first, and data second.

# Faculty Application

## 8. Miscellaneous

- Spend time to create a “killer plot/illustration”, which is simple but conveys the information about your impressive achievement clearly.
  - I know it is difficult to make such a plot, but it is worth spending time on creating one. After all, you are applying for a permanent position. Why not spend a week or two doing your best?
- Also create a plot/illustration to summarise your impressive future plan.
- Do not reduce margins or font sizes. Do not pack too much information in small space. The length of the application is not important. It is the contents that matter.

# Grant Application

## 1. Have clear answers for three “Why” before writing the application

- **Why this topic?**
  - Why should anyone care to study this? What would be broader implications outside your research area?
- **Why now?**
  - Why is it timely? New theory proposed? New code developed? New experiments planned?
  - But, these “new theory” and “new code” must have been published before writing the proposal; otherwise reviewers cannot judge whether these “theories” and “codes” are legitimate or ...crackpots.
- **Why you? [this is most important]**
  - Why are you the best/only person in the world to do the proposed research?

# Grant Application

## 2. Why you?

- What is the “edge” that you have? What is your “unfair advantage”?
  - For “unfair advantage”, see this inspiring short interview of David Spergel (only 57 seconds): <https://www.youtube.com/watch?v=iS3KDhENzG4>
- Do you have original analytical/numerical tools that the others do not have?
- Do you have privileged access to data that the others do not have?
- Are you a leading figure of a large collaboration?
- Do you have a super star co-PI? [Not really a joke!]

# Grant Application

## 3. Do not overestimate the ability of reviewers

- Yes, I mean “overestimate”, rather than “underestimate”
  - Reviewers are accomplished researchers in their respective areas, which means that they are often too busy to catch up with the latest results in other areas.
  - Therefore, **they cannot understand anything new.** They tend to fund something that they understand.
- This means that you can only propose projects that lead to **an incremental progress**, rather than a breakthrough.
  - Contrary to what you might think!

*Note added (July 23; after feedback on facebook)*

You need to say how your research eventually leads to a breakthrough. But, the actual steps/implementation need to be incremental; otherwise, the panel cannot understand the steps to get there.

# Grant Application

## 4. Strategy

- Start with what you have done already but are not published yet.
  - Package them in a way it sounds new (but not too new), and make a few plots that show basically the main expected outcome of the proposed research.
  - Then talk about possible next steps (which you also have done already, so you know that these next steps work).
  - Then talk about some novel steps at the end, which is what you really want to do with this grant (but don't say that).
- Put these in a broader context of the (astro)physics research landscape. How is it relevant to the important questions identified by, e.g., Decadal Survey? How is it relevant to on-going and planned flagship experiments, e.g., Euclid, WFIRST, CMB S-4, LISA, ...?

# Grant Application

## 5. My unsuccessful (ancient) example

- In 2004/2005, I proposed to use the large-scale structure (LSS) of the Universe to test the physics of inflation, probe the nature of dark energy and dark matter, and measure the neutrino mass.
  - The reviewer's responses: "You can't do that by LSS".
  - These are standard themes now, but too new at that time (only to the reviewers; not to the experts! Everyone knew that we could do this by LSS)
    - Perhaps missing was: *Why now?*
    - Another missing: I presented only the basic ideas, and not really the initial results.
  - One reviewer's comment: "Komatsu is an expert on CMB, but not on LSS".
    - Clearly missing was: *Why you?*

Dark Ages: I was struggling to get any funding for 3 years

# Grant Application

## 6. My successful (ancient) example

- In 2007 I proposed to use perturbation theory to calculate the non-linear matter power spectrum and non-linear corrections to BAO.
  - Based on Jeong & Komatsu (2006), for the matter power spectrum in real space. Presented some of the results that would later be published as Jeong & Komatsu (2009), for galaxies in real space.
  - Also talked about the redshift space distortion, which would be an obvious next step (but would not be obvious to reviewers). I knew it would work.
- Why you? Published already Jeong & Komatsu (2006), which was a big help.
  - **Unfair advantage 1:** Privileged access to one of the biggest supercomputers in the USA: Texas Advanced Computing Center (TACC).
  - **Unfair advantage 2:** Realised and demonstrated the utility of perturbation theory earlier than most of the competitors.

Since this, the success rate for funding improved greatly



# Fellowship Application

## 1. Two kinds of applications

- **Prize (independent) fellowships**
  - What matters most is the number of publications
- **Individual grant-funded postdoctoral positions**
  - What matters most depends on the nature of advertised positions
  - Some people look for candidates with specific skills
  - Others (including me) focus more on the intellectual ability of candidates

# Fellowship Application

## 2. General points

- Good to show that you have your own questions and research ideas.
  - During PhD, most (certainly not all) people do what they are told to do without thinking too much (“Hands rather than a brain”).
  - Some future employers still want hands rather than a brain for their postdoc position... Avoid them.
  - It is OK that you do not have your own research program. But, try to think about one.
- The points to emphasise: You can think creatively; you can initiate and, most importantly, **finish** projects. If any of the PhD work was your idea, say it profoundly. Did you make an innovation? Say it. Basically, show evidence that you can produce something new and write a paper about it.

# Fellowship Application

## 3a. Where to apply

- For postdoc positions funded by individual grants: Where to apply?
  - The best is to find a position advertised by the new junior faculty, because:
    - They have money (start-up funds)
    - They are super motivated, energetic, and ambitious
    - They are hard working themselves because they need to get a tenure
    - You get all of adviser's attention (good or bad :P)
  - But, beware a possible downside:
    - They may not know how to advise postdocs. They could be sometimes overly harsh and pushy because they rely on you to publish. The important thing is to know the person before you apply.

# Fellowship Application

## 3b. Where to apply

- For postdoc positions funded by individual grants: Where to apply?
- But, how about all the famous places? (I don't list names...)
  - Could be a great environment with lively and stimulating discussions etc, but you should be prepared for a competition. If there are a few (often more senior) postdocs working in similar research areas, you may face a fierce competition.
  - They may try to use you: They seduce you to work on their project, but they take the first authorship. Be careful!

# Fellowship Application

## 4. What to write in the application

- Not so different from the faculty application.
  - Who are you? (I am a theoretical (astro)physicist, who is interested in...)
  - What have you done? (During my PhD I am proud to have achieved...)
  - Past research, emphasising your own innovation
  - Future research plan, with one or two impressive plots/illustrations
  - Killer ending phrase (While I have my own ideas, I am open for new challenges and new directions...)
- Avoid “We live in the golden age of cosmology... There will be so much data...”