How to apply for a PhD

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Talk will be available at <u>nms.kcl.ac.uk/eugene.lim</u>

DISCLAIMER

- My experience is for application to Astrophysics, Cosmology, High Energy Physics (particle physics, strings etc).
- I am old and curmudgeonly, so YMMV.
- About me : B.Eng. in Mech Engineering (Malaysia), 3 years in industry (Malaysia + UK). PhD in Astrophysics (U. of Chicago, USA, 5y). Postdoc positions at Yale (3y, USA) and Columbia (3y, USA). Lecturer at Cambridge (2y, UK) and KCL (9y+)

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Do you REALLY want to do a PhD?

- If you **do not want** to be an academic or scientist, then ignore what I will say in the next slide.
- If you **want** to be an academic or scientist, listen carefully.

Academia is....

- A Lifestyle choice : pays like sh*t, no life stability for >10 years, and often determines the kind of social circle you will eventually have. (It's a terrible situation we are trying to change.)
- Extremely competitive : less than 5 in 100
 PhDs get permanent academic jobs eventually.
 Too many PhDs, too few jobs.

Do you really, really, want it?

What is a PhD good outside academia?

PhDs are **awesome** tickets to great non-academic jobs!

People want to hire you because you (1) can do math (2) know how to break down problems (3) demonstrated that you can work on a long term project and succeed.

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Data scienti\$t, Finance, Journalist, Con\$ultant, Al, etc

Ok, I *really* want it, what should I do?

- **Do** : Have a general idea about what you want to do. Theory or Experiment? Cosmology? Particle Physics? String Theory? Astroparticle physics? Condensed Matter?
- **Don't** : Have too specific an idea about what you want to do. "I want analyze Axion Dark Matter." "I want to do M-theory." "I want to do cosmic microwave background in cosmology." "I want to work with prof Z".

Why?

- PhD positions are rare, so don't narrow your search.
- You don't know enough to be overly specific. (Yes, really.)
- But you want to have a broad idea to know which institutions/advisors to apply to.

Big Questions

- Where do I want to do my PhD (UK, USA/ Canada, New Zealand/Australia, Europe, elsewhere?)
- How do I fund my PhD?
- What makes me a good PhD candidate?
- How do I prepare myself?
- Do I really want to do a PhD?

UK Standard PhDs

- PhDs are 3-4 years. You are "hired" by your advisor.
- Funding sources : STFC/EPSRC, Teaching fellowships (usually open for all), University fellowships (competition), advisor funding (his/her grants). Different institutes have different sources : *find out by asking* (don't be shy).
- Other funding sources (nationality specific) : Commonwealth? Overseas Trust? Again : different institutes have different sources. Research/ask!
- Self-funding : doable, and sometimes gives you an advantage. Family money? Your own government?

UK DTP/CDT PhDs (Thanks to Chris Lorenz for this info) DTP - Doctoral Training Programs, CDT - Center for Doctoral Training

- a. BBSRC DTPs ... <u>https://bbsrc.ukri.org/skills/investing-doctoral-training/dtp/</u>
- b. MRC DTPs https://mrc.ukri.org/documents/pdf/doctoral-training-partnerships-allocations/
- c. EPSRC CDTs https://www.findaphd.com/phds/program/centres-for-doctoral-training-4-year-phd-studentships/?p2595f
 - I year taught classes + 3 years of Research
 - Transferable skills training in addition to research, and often has an internship component with industry
 - Slightly better financial terms (research money and stipend) for PhD students.
 - Structured more like a US PhD cohort system (see later).

Home Fee Status

- "Home Fees" vs "International Fees"
- UK Citizens in UK
- Indefinite Leave to Remain (not through EU settlement) + 3 years in UK
- EU Settled/Presettled + 3 years in UK
- I will upload the detailed UKCISA document on my home page (<u>nms.kcl.ac.uk/</u> <u>eugene.lim</u>).

USA/Canada

- Theory PhDs, 4-7 years (average about 5). First year usually taking a lot of "graduate level" courses.
- Experimental PhDs, 8+ years is not uncommon.
- Funding : most top tier schools will fund your PhD once you get in. But not guaranteed.
- You join a "cohort", and then try to find an advisor to take you after you joined. No guarantee : your job is to impress your prospective advisors.
- GRE Tests! Remember to register early!

Where to apply?

- Does Uni X has the field I am interested in?
 Active people (not old and near death)? Do Your Research! (More later)
- Ask people about people! ("Is X a good advisor? Is Y still doing interesting stuff? Is Z present always?") More later.
- If you want to be in academia, try to apply for the "top" schools. It's an uphill climb *always*, so you want to start as high as possible.
- BUT : top schools are not always the best school for you. Don't get obsessed with Harvard, Princeton, Oxbridge etc.

"Top Schools" not always the best

- Plenty of great advisors in other places!
- Better to have a good active advisor than a super high repute shitty advisor. (**IMPORTANT**)
- Most great science is actually not done in the top schools.
- "Small fish in a big pond"

Choosing an advisor

- Active and doing relevant stuff **now**.
- They are and will be **extremely influential** over your current *and* future career choose wisely!
- Your personality fits with theirs (*important!*)
- Do they have a history of graduating students? Getting them jobs (in academia) post-PhD?
- (Ask to) talk to their current students!
- Unsolicited emails: Doesn't hurt, but usually doesn't help.

Am I prepared?

- Grades : 1st class is almost certainly required for UK, and USA, but 2.1 still possible (field dependent). 3y Bsc won't be convincing for most USA places. Show upward trajectory!
- **Extra-curricular** (President of X, local champ in chess etc) : useless, so do that stuff because you like it, not because you want to pad CV.
- **Take extra courses** : extra prep, and also to challenge yourself. (We like these kind of people.)
- Even more prep : Cambridge Part III, Imperial QFFF, Perimeter Institute PSI, Oxford Part III knockoff etc.

Research Experience?

- Have tangible results or experience, that you can describe authoritatively and show that you know your stuff.
- Bad : "I spend 3 months at Uni X reading up on Y".
 Good : "I coded up a 3+ID RK4 PDE solver, which supports a hybrid OpenMP/MPI architecture, and use it to solve the Vlasov equation for low Reynolds' number flow...".
- No need to be the same field as your PhD : we want to know you have the mindset to do research.
- **Quality** of experience >> type/where/who

Personal Statement

- This is your voice before the interview stage.
- Tell a compelling story make us want to invite you for the interview.
- Don't follow "the template". **Be different**.

Reference Letters

- Yes, they matter a lot.
- Get to **know your Tutor** so they can write glowingly about you.
- Get to know people in the dept who are working in the field you are interested in. ("Hey Eugene, a student of yours Y has applied to our school to do a PhD, what do you think of her?")
- Help us write you a good letter : get good grades, do projects with us, talk to us about physics, *impress* us.

The Interview (UK) Standard stuff : Be prepared, be enthusiastic, be knowledgable about the people who are interviewing you.

- **Don't BS** : we can tell right off.
- Be prepared to engage in scientific discourse. If you are not sure about the answer, don't be shy to offer what you think. We want to know if you can do science, and doing science during the interview is the best proof we can have.
- Don't be afraid to be wrong! Doing science is mostly about having the courage to try things and get them wrong a lot.

Final Thoughts

- Do you really want to do a PhD? Lots of **sacrifices**.
- Be **single minded** about your pursuit. There is no place for half-hearted attempts.
- Start **early** in preparing yourself.
- Get good grades at all costs. "I'd rather really learn the physics instead of doing well in exams = dead".
- Make your own luck by being prepared to take advantage of good fortune.

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