

Some (very biased) thoughts on Grant Writing

by Andrii Tykhonov

Don't wait for external push...

- A common trend I noticed in colleagues, friends and myself: some of us wait for a push, (**usually by current supervisor**), so that some tell you "now it's time to write your project"
 - Don't expect your supervisor to guide you through the possible project calls (especially if these are career grants). Some supervisors may push for it, others not. Keep in mind that your supervisor is likely employed at a permanent position and does not keep track on up-to-date trends in career grants...
 - Take initiative in your hands.
 - There is never too early to apply for a project (for example: you can apply for Marie-Curie project as your first "post-doc")

Don't hesitate!

Where to start? (before you write anything)

- **Step 1: discuss with the head of the group (or your contact person) in the Host Institution (HI) where you want to implement your project - get the green light from them**
- Step 2: reach out to National Contact Point (NCP) at HI (usually this is the same office for ERC, Marie-Curie, other Horizon projects, as well as national calls) - they will tell you what to do step-by-step and provide relevant training for the specific call you aim for
 - Don't re-invent the wheel, don't hold it to yourself - talk to right people from the very first day! By no means, don't be scared of people stealing your ideas!
 - There will be also some paperwork to be done (official support letter by HI) - NCP takes care of this - not you! (But reach them out as early as possible)

Don't hesitate!

Where to start? (before you write anything)

- Step 3 (optional but **highly recommended**): find someone to share with you at least one example of successful proposal (that's what I did multiple times...).

➡ I also shared mine later to friends/colleagues

Don't hesitate!

Feedbacks

Once you write your first draft of the project, seek for feed-backs right away, don't wait!

- Colleagues
- Friends
- **National Concat Points (NCP)** - usually NCP will provide you one feed-back by a professional scientific writer (at least this is the case for ERC) - extremely useful - profit of it if such an opportunity exists!

CAUTION: depending on the mood and setting, can appear (on a surface) demotivating. Example: the first review I got (while being nothing but constructive) got me frustrated (even angry). I took a deep breath, and implemented all the suggestions. later I realized that this was one of the key points of success

Feedbacks

- **Pay attention to non-expert feedbacks!**
 - Example: If you're a theoretician - you must be able to convince experimentalists (and the other way around)
 - In ERC panel there is a ~dozen of referees. If we take PE9 panel (Universe science) there will be people representing cosmology, neutrinos, cosmic rays, astronomers, theorists, experimentalists, experts in solar physics etc... If you're lucky - 1 or 2 persons might have a clear understanding of what you are doing/proposing (and might actually try helping you implicitly) - but you need to convince the others as well!
 - In Marie-Curie project there are usually 3 referees - but the same idea, most likely they are not directly working in your field. For example, a GW expert might be reviewing your project on neutrinos ...

Luck often comes when you don't expect it

Even if your project is not selected - keep it for the next call (might be with different funding scheme/agency the same year), next year etc. Remember: the work/time you invested in the project writing is never lost!

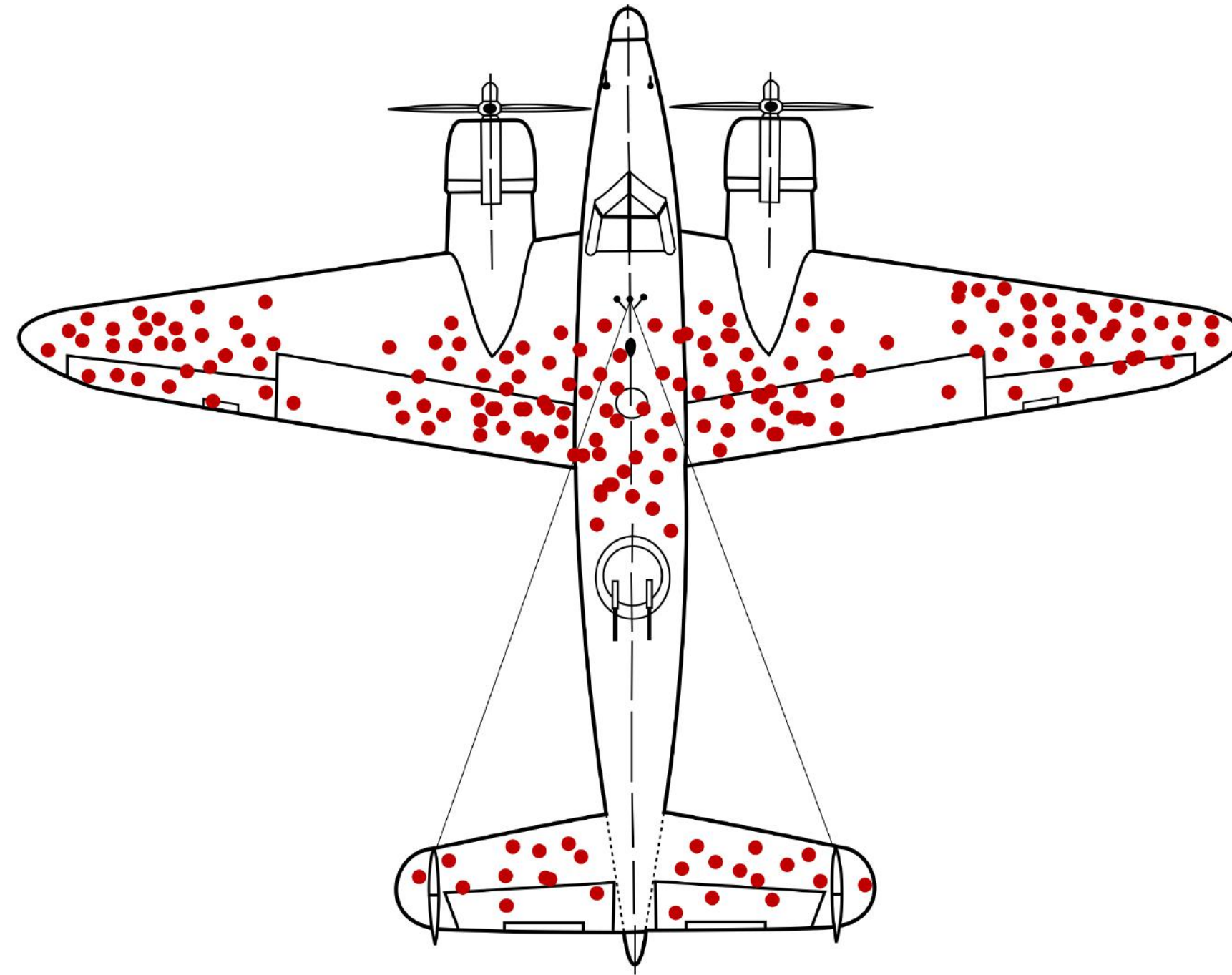
- Example: my First ERC - I never really thought it will pass through, I just did it to clear my mind (and I was running out of post-doc options ...)
 - ➡ Idea was there around (and not just in my head) - it's about packaging it
 - ➡ Both of my ERC projects - I was aiming on national funding agency in first place
 - ➡ Tried ERC as a kind-of last resort (I had the project already prepared - so I submitted it to two funding agencies, ERC and the national one)
 - ➡ My second ERC: I was even more sceptic about it ...

Don't hesitate!

Seek support of good scientific writers

- If the funding allows for it (the one of your current group or the one in your target HI) - hire a professional scientific writer to review your proposal and provide feed-back
 - ➡ Depending on the country that service may cost ~2-3K EUR). That is clearly a worthy investment. It is not strictly necessary but it will increase your chances significantly (may be the last missing drop to fill the cup..)
 - ➡ Even if the project do not pass, this investment is not lost! You will use the project next year, year after etc. (I know people who did 3-4 application with ~same project year-after year before they get an ERC)
 - ➡ I didn't do it for my first ERC, but I profited from it for the second one...

Mind the survival bias!



Survivorship bias or survival bias is the logical error of concentrating on entities that passed a selection process while overlooking those that did not. This can lead to incorrect conclusions because of incomplete data. If you have a change, **look at the examples of unsuccessful projects as well**

Tailor your project to the call!

- For example: evaluation criteria for Marie Skłodowska-Curie (MC) grant/call are equally accentuated on the project/science itself and the career perspectives of the applicant. ERC criteria, on the other hand, focus entirely on the project itself and the **capability of the applicant (PI) to realize the project**.
- Another example, ERC proposals, by definition, are slightly more leaned towards risky projects compared to MC (in fact they encourage fair portion of risk, given that you adequately anticipated and described mitigation strategies).

- Excellence (**50%**)
- Impact (**30%**)
- Quality and efficiency of the implementation (**20%**)



- "Excellence" (100 %)

Tailor your project to the call!

Evaluation Criteria

Excellence (50%)	Impact (30%)	Quality and efficiency of the implementation (20%)
Quality and pertinence of the project's research and innovation objectives (and the extent to which they are ambitious , and go beyond the state of the art)	Credibility of the measures to enhance the career perspectives and employability of the researcher and contribution to his/her skills development	Quality and effectiveness of the work plan, assessment of risks and appropriateness of the effort assigned to work packages
Soundness of the proposed methodology (including interdisciplinary approaches, consideration of the gender dimension and other diversity aspects if relevant for the research project, and the quality of open science practices)	Suitability and quality of the measures to maximise expected outcomes and impacts , as set out in the dissemination and exploitation plan, including communication activities	Quality and capacity of the host institutions and participating organisations, including hosting arrangements
Quality of the supervision, training and of the two-way transfer of knowledge between the researcher and the host	The magnitude and importance of the project's contribution to the expected scientific, societal and economic impacts	
Quality and appropriateness of the researcher's professional experience, competences and skills		



Tailor your project to the call!

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Quality and appro professional expe skills		

Make sure the referees easily find this keywords in your proposal. In fact, make sure they can copypase entire sentences from your proposal in their evaluation report, for example "the **project goes beyond the state-of-the-art** because ..."

MARIE CURIE

Your CV is the first thing a referee reads!

You have to convincingly demonstrate your capabilities to realize the project of your own:

- Leadership
- Adequate level of independence from your supervisor(s)
- Capability to finish projects (important papers, patents, hardware R&D solutions, ...)

Remember: you reached the point when you think of your project - this means you already have the above qualities - you just need to adequately show them. For example:

- **emphasize talks at renown conferences (e.g. ICRC)** (important to get ones for your CV - supervisor must help you with this - his/her direct responsibility)
- papers with your leading contribution
- leadership roles in collaborations

Some tricks for the proposal text...

Deliver key message as quick as possible!

The DArk Matter Particle Explorer (DAMPE) mission has recently marked a new epoch in astroparticle physics, extending the direct measurements of cosmic ray spectra beyond a TeV with unprecedented energy resolution. With this project, based on my leadership position in DAMPE and its unique data, I propose to fundamentally improve the precision of direct cosmic ray measurements at the highest energies – in the TeV–PeV range, using for the first time a state-of-the-art artificial intelligence approach. The project will help to solve the century-long problem of cosmic-ray origin at such high energies and its effects on the Universe composition. It will study the cosmic-ray spectrum close to the region of a mysterious decline, so-called “knee”, and shed light on the nature of Dark Matter through the discovery of characteristic fine structures in cosmic-ray spectra. On my expertise I propose: i) to develop the TeV–PeV artificial intelligence techniques, using a deep learning or similar artificial intelligence programme to iteratively improve the precision of cosmic ray measurements in the TeV–PeV energy domain, based on the available DAMPE data. The developed techniques will be applied to the processing of DAMPE data and will be used in the next generation High Energy Cosmic Radiation Explorer mission. The project is designed to reduce drastically the dominant uncertainties of the cosmic-ray measurements in space, related to the particle type/direction identification and modeling of hadronic interactions in the detector. As a result of the project, cosmic ray spectra will be directly measured in space in TeV–PeV energy range with qualitatively higher precision, opening up unprecedented opportunities for new discoveries.

Abstract Example

Deliver key message as quick as possible!

Abstract

The DArk Matter Particle Explorer (DAMPE) mission has recently marked a new epoch in astroparticle physics, extending the direct measurements of cosmic ray spectra beyond a TeV with unprecedented energy resolution. With this project, based on my leadership position in DAMPE and its unique data, I propose to fundamentally improve the precision of direct cosmic ray measurements at the highest energies – in the TeV–PeV range, using for the first time a state-of-the-art artificial intelligence approach. The project will help to solve the century-long problem of cosmic-ray origin at such high energies and

Why this is important? Referees are reviewing/evaluating tens of projects at the same time. If your message is not clear right from the start, even excellent project idea may get rejected simply because referee did not understand it or didn't have time to dig enough into details. You have to **catch the attention first!**

Make sure the project is clearly written

- GOTO: Feedbacks - give to as many people as you can. If you are able to explain the importance and relevance of your project to people outside your field (e.g. mathematicians, solid-state physicist) - you're already half way to success...
- If it is Marie Curie call - don't ignore the other two criteria apart from the Excellence (Impact and Implementation) - even though they give less weight...
- **IMPORTANT: referees are not obliged to follow the references!** By default, they **evaluate proposal based on what you have written!** If you miss to convey a critical piece of information and put a reference instead - your message will likely not be heard - you will not be able to refute the referee's decision (because referee is not supposed to follow the reference/links/etc.)

First page of your proposal

- **Try to have your entire project in a nutshell on the first page of your proposal.** This is not mentioned anywhere as a formal requirement (in fact it may be even in slight "tension" with the imposed structure of the proposal document)
 - I learned this trick from another person who did a successful ERC and I use it since then...

First page of your proposal

Tykhonov

Part B1

PeVSPACE

Section a: Extended Synopsis

The existence of Cosmic Rays (CR) is known for more than a century, however their origin and propagation mechanisms at TeV and higher energies remain disputable. Recent astrophysical results [1] suggest a significant contribution from **Dark Matter** (DM) to the CR flux. DM candidates are predicted to decay to Standard Model particles, leaving distinctive feature in CR and gamma-ray spectra [2]. This opens up a window for indirect DM discovery through high-precision CR measurements in the TeV–PeV range. Such searches will be carried out with DAMPE and HERD detectors in this project.

The energy spectra of direct CR measurements by spaceborne and balloon-flight experiments are normally bound by an upper limit of 1–2 TeV, due to the low counting statistics and limited energy acceptance. The DArk Matter Particle Explorer (DAMPE) is the first experiment that extends the CR electron flux measurement beyond 1 TeV break at 0.9 TeV [3]. C d further tructures in the spectrur liminary results on the bserving for the first tin ed in the CR ion flux [5] sting the existence of a ts of CR proton/ion anc her they will either pro : of DM, as well as CR

DAMPE v ral years more. The suc imed for launch around s/ions up to PeV energie e and as well by severa

The identi: lamental challenge. Th d by CR interactions in energies become almos arlo sim- ulation leads to an unknown systematic bias in the CR proton/ion energy reconstruction. Existing techniques can not fully cope with these problems, resulting in large uncertainties in CR measurements. Hence, potential **fine structures in CR spectra** related to the new physics and DM will be likely missed. To tackle this, **novel techniques** have to be developed in order to **fully exploit** and **qualitatively increase** the unique potential of DAMPE and HERD. This very challenging task will be performed during the project.

The main objective of this project is to radically improve/optimize the techniques for CR and gamma-ray detection in the TeV—PeV energy region, including particle reconstruction, identification and simulation using state-of-the-art **Artificial Intelligence** (AI) approach. As a result, CR spectra/composition will be measured first with the DAMPE detector and then subsequently with HERD, with **unprecedented precision**, which could not be achieved otherwise. There are two main innovations in the project. First, the application of AI techniques in astroparticle physics will be **pioneered at the highest energies**, in an unconventional use case. Second, the Monte-Carlo simulation models will be **tested and corrected for the first time** at such high energies.

The project will break new grounds in the study of CR origin/propagation mechanisms and high-energy gamma-ray astronomy and will facilitate potential Dark Matter discovery. It will provide new tools for studying the emerging topics like CR anisotropy [7], gamma-ray-emitting counterparts of gravitational waves and multimessenger astronomy [8] amongst others [9]. As a part of the results dissemination, the AI track reconstruction technique developed in the project will have a great potential for application in medical physics, notably in hadron therapy, as suggested e.g. in [10]. The improved precision of hadronic models at high energies, obtained from this project, will also have a strong implication for future high-energy collider facilities.

The project has the potential to discover the origin of Dark Matter thanks to the utmost precise CR spectra measurements. In addition, the established research programme and developed techniques will help to guide the preparation for HERD data taking, bearing in mind the increase discovery potential with larger data statistics and higher energy reach.

Example



ERC: B1 (extended synopsis) is your entry ticket

- In all the trainings you will be taught to prepare the full proposal (B2 - 20 pages) and the extended synopsis (B1 - 5 pages) with the same level of quality. But here comes a practical concern:
 - Referees DO NOT have access to B2 (full proposal 20 pages) in the first evaluation stage. They only read CV and B1 (5 pages). So B1 is your entry ticket to the interview.
 - You should still try doing your best with B2 as well at the submission stage, but at least there you will have your chance to correct the flaws during the interview...



Don't be too humble...

- Being humble (in a healthy way) is a very good quality that helps you to maintain relations with your colleagues and ecological working environment.
 - ➡ In the papers/conference one never says ("I did, I achieved" - even if you did 90% of work for a certain paper etc.)
- Yet, the scientific proposal is one place where you should not be overly humble.
 - ➡ In the proposal it is important that you stress your own contribution "I did", "I achieved", "I proposed a new method" etc. In fact, this is **essential for the referees** in order to assess your personal capability as a PI of your own project.
 - ➡ In the proposal, leverage a good balance between emphasizing **your strengths, skills relevant for the project, leadership roles** while not "overselling" yourself or showing red flags of disrespect to the work of others