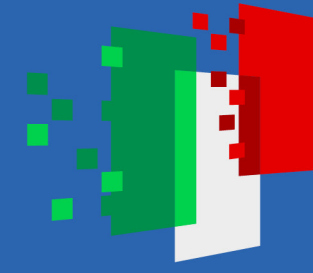




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Introduction to the proposal writing session

Stefano Marchesi

(Università di Bologna, Dipartimento di Fisica e Astronomia, INAF-OAS Bologna)

Contact: stefano.marchesi@unibo.it

Financially supported from the European Union — Next Generation EU under the project IR0000012 - CTA+ (CUP C53C22000430006), announcement N.3264 on 28/12/2021: “Rafforzamento e creazione di IR nell’ambito del Piano Nazionale di Ripresa e Resilienza (PNRR)”

CTAO Summer School - Bertinoro (Italy)

June 17, 2024

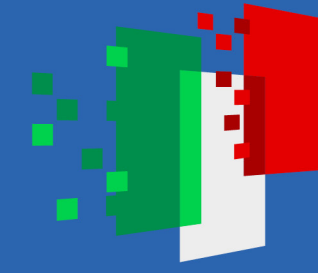




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The job of the observational astronomer: From the idea to the data (and vice versa)

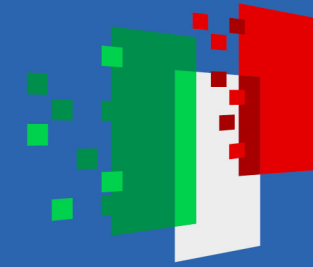
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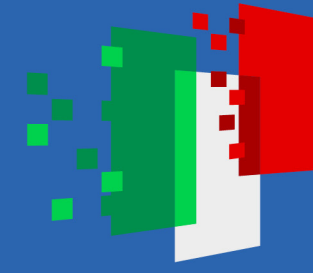
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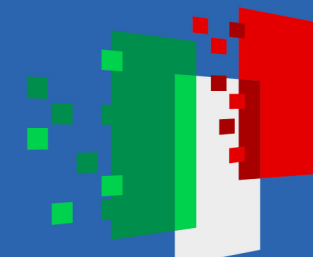
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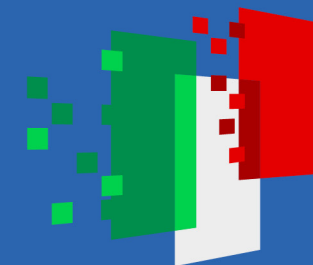
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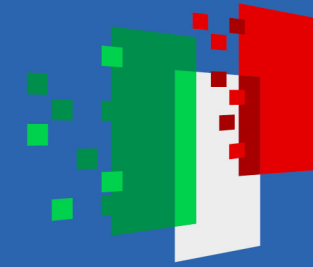
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- There is therefore a continuous, lively dialogue between the two categories, and one does not exist without the other.
- Here, we will focus on one important skill for observers: **write proposals to obtain new observations.**



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The job of the observational astronomer: Exploring archival data

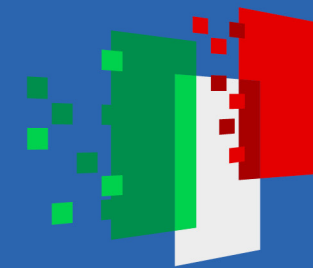
- Astrophysics, more than other branches of physics, follows good practices of data sharing and accessibility (the so-called Open Science Policies).
- Many observatories make their data available through public archives.



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- E.g.: HEASARC archive (<https://heasarc.gsfc.nasa.gov/cgi-bin/W3Browse/w3browse.pl>) of X-ray and Gamma-ray missions (all NASA ones, and many others).

Most Requested Missions

- [Chandra](#) [**CXC,CSC**]
- [IXPE](#) [**MSFC**]
- [ROSAT](#)
- [WMAP](#)

- [Fermi](#)
- [MAXI](#) [**JAXA**]
- [RXTE](#)
- [XMM-Newton](#) [**XSA**]

- [HaloSat](#)
- [NICER](#)
- [Suzaku](#)

- [Hitomi](#)
- [NuSTAR](#) [**Caltech**]
- [Swift](#)

Other X-Ray and EUV Missions

- [Ariel V](#)
- [Copernicus](#)
- [Ginga](#)
- [SAS 3](#)

- [ASCA](#)
- [Einstein](#)
- [HEAO 1](#)
- [SRG/eROSITA](#) [**MPE**]

- [BBXRT/Astro-1](#)
- [EUVE](#) [**MAST**]
- [Kvant](#)
- [Uhuru](#)

- [BeppoSAX](#)
- [EXOSAT](#)
- [OSO8](#)
- [Vela 5B](#)

Other Gamma-Ray Missions

- [AGILE](#) [**ASDC**]
- [HETE-2](#)
- [RHESSI](#)

- [CALET](#) [**JAXA**]
- [INTEGRAL](#) [**ISDA,ISDC**]

- [CGRO](#)
- [SAS 2](#)

- [COS B](#)
- [Gamma-Ray Bursts](#)

Missions and Facilities

- [AKARI \(IR\)](#) [**Project**]
- [FAUST/Atlas-1 \(UV\)](#)
- [Herschel \(IR-submm\)](#) [**ESA**]
- [ISO \(IR\)](#) [**IDA**]
- [Planck \(submm-radio\)](#) [**ESA,IRSA**]
- [UIT/Astro-1 \(UV\)](#) [**MAST**]

- [ANS \(UV\)](#)
- [FUSE \(UV\)](#) [**MAST**]
- [HST \(UV-NearIR\)](#) [**MAST**]
- [IUE \(UV\)](#) [**MAST**]
- [SDSS \(Opt\)](#) [**Project**]
- [WISE \(IR\)](#) [**IRSA**]

- [COBE \(IR/sub-mm\)](#) [**LAMBDA**]
- [GALEX \(UV\)](#) [**MAST**]
- [IceCube \(Neutrino\)](#) [**Project**]
- [LPF](#) [**ESA**]
- [Spitzer \(IR\)](#) [**SSC**]

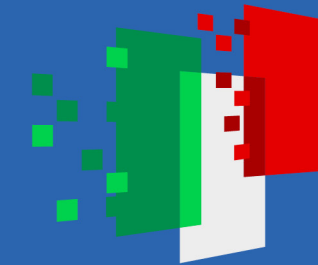
- [CoRoT \(Opt\)](#) [**CNES**]
- [Ground-Based \(Opt-Radio\)](#)
- [IRAS \(IR\)](#)
- [MSX \(UV-IR\)](#)
- [TD1 \(UV\)](#)



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- Gaia Archive (<https://gea.esac.esa.int/archive/>): “astrometry, photometry, and spectroscopy of nearly 2000 million stars in the Milky Way as well as significant samples of extragalactic and solar system objects”

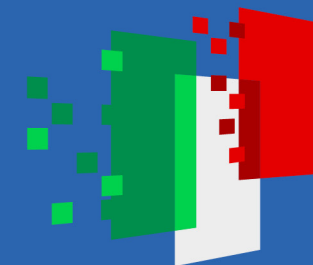




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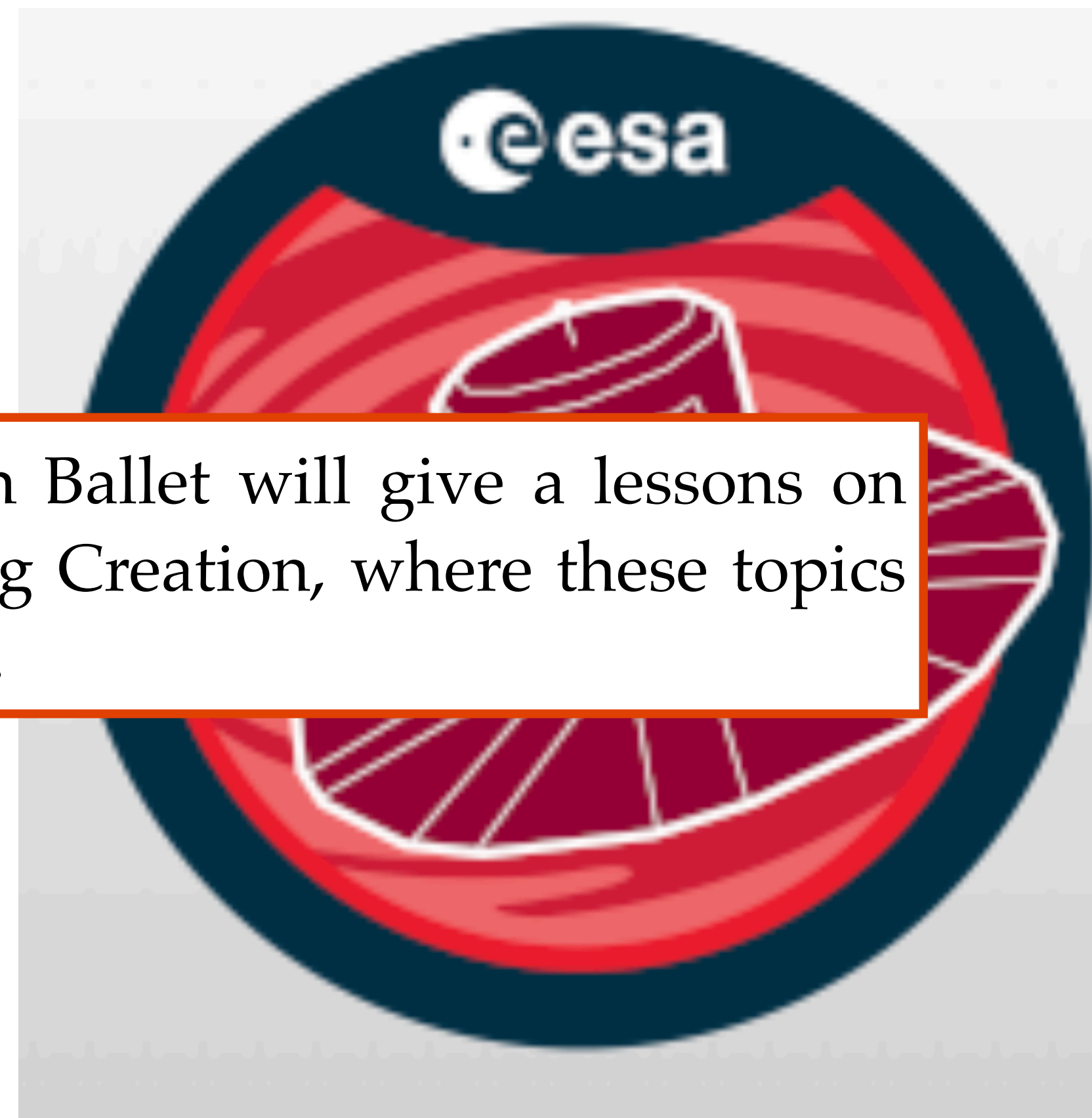
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Wednesday afternoon, Dr Jean Ballet will give a lessons on Source Association and Catalog Creation, where these topics will be treated in greater detail.

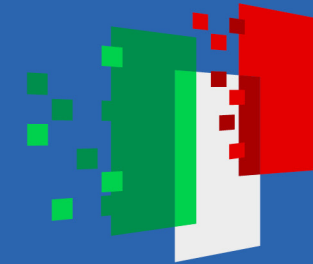




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The job of the observational astronomer: CTAO and an Open Access approach for the VHE science

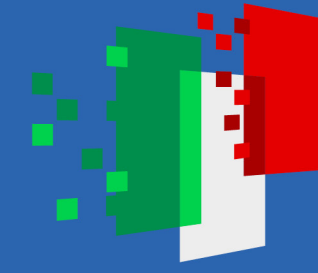
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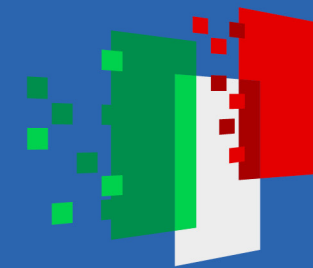
- Astrophysics, more than other branches of physics, follows good practices of data sharing and accessibility (the so-called Open Science Policies).
- This is less true when moving to the Very High Energy Astrophysics field, but one of the commitments of CTAO is to be the first Open Access VHE Observatory, as mentioned in the CTA White Paper.



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Together, the northern and southern CTAO arrays will constitute the CTAO, which will be the first ground-based gamma-ray observatory open to the world-wide astronomical and particle physics communities as a resource for data from unique high-energy astronomical observations. The CTAO will be operated as an open, proposal-driven observatory for the first time in very high-energy astronomy. This is expected to significantly boost the scientific output of the CTAO by engaging a much wider research community.

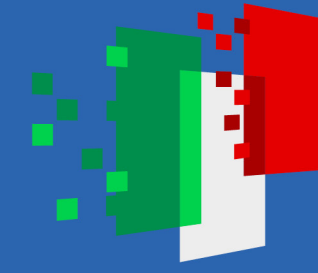
Additionally, the CTAO will feed its data into a virtual observatory, which will allow scientists to probe multiple data centres seamlessly and transparently, provide analysis and visualization tools and give other observatories a standard framework for publishing and delivering services using their data.



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When archives are not enough Time to write a proposal

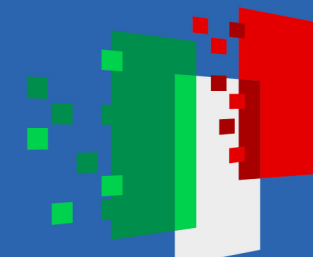
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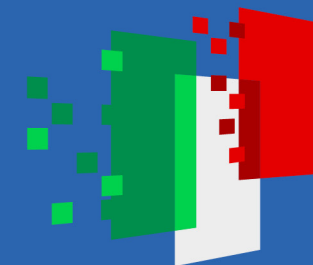
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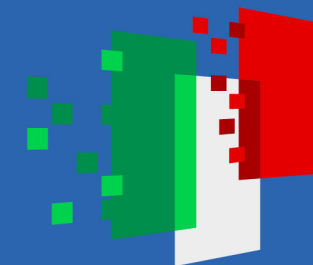
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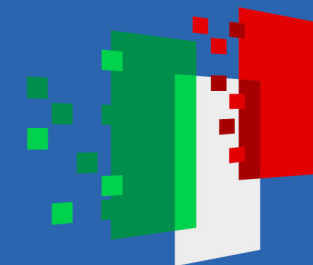
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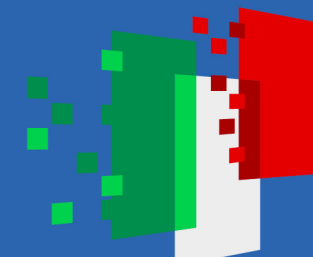
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- Each group should also have at least a general idea of the type of proposal they wish to write, and of the **target(s) they would like to observe**.



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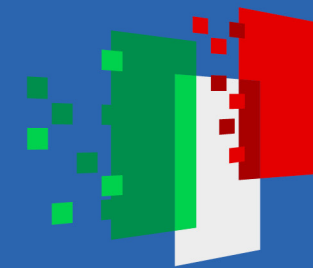
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Writing an LST-1 proposal: technical setup

- First part contains technical information: source name and coordinates (be sure that the source can be observed by LST-1!), zenithal angle range, sky darkness, wobble setup (i.e., way in which source and background are observed), exposure time request, observation type (where main distinction is: does your observation take place after some triggering event, or is it ok to observe it whenever there is the chance?).

Source Name: Name

RA [deg] = RA, DEC [deg] = DEC

Min Zenith [deg] = MinZd, Max Zenith [deg] = MaxZd

Night Sky Background [Moon/Dark/Both] = Dark

Wobbles [Standard/Custom] = Standard Wobble

Observation Time [hrs] = 50 hr

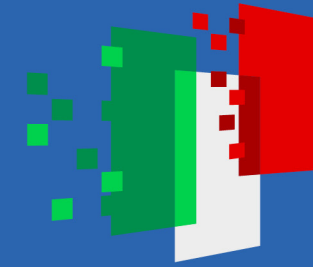
Observation Type = Fast ToO – Slow ToO – Periodic – Joint MWL – None



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School session: How to estimate an exposure time request

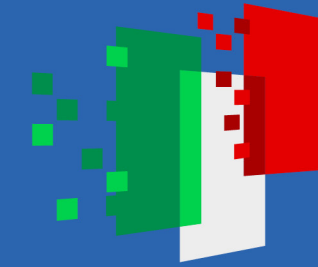
- Later this week, before the start of the actual proposal writing sessions, Dr Alison Mitchell will guide you through a hands-on session on how to address the so-called “Feasibility” of a proposal, which is, at its core, answering to the question “how much observing time do I need to achieve my scientific goal?”, and more in generale addressing the points we saw in the previous slide.
- This will be a hands-on tutorial, so bring your laptop and have Gammapy installed.



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Writing an LST-1 proposal: scientific rationale

1. SCIENTIFIC RATIONALE

Discuss the scientific background and aims of the proposal and why you want to make these observations. This section should not exceed 500 words. Figures and graphics can be included, or appended in Section 5.

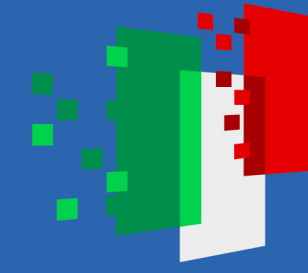
- Scientific rationale provides a (brief, but effective) summary of the current state of research in the field related to your proposed observation. By reading the scientific rationale the person in charge for the evaluation should:



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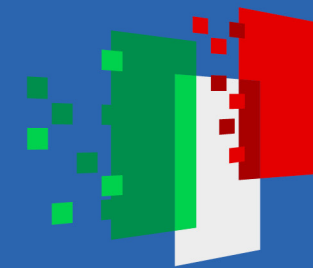
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 1. Get a general understanding of the topic and of the open questions.



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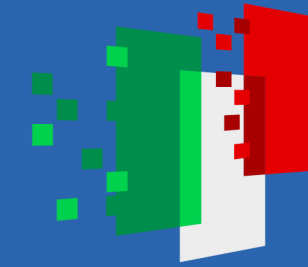
- Scientific rationale provides a (brief, but effective) summary of the current state of research in the field related to your proposed observation. By reading the scientific rationale the person in charge for the evaluation should:
 1. Get a general understanding of the topic and of the open questions.
 2. Within this framework, be convinced that the proposed observation would represent a significant step forward in our understanding of the phenomenon (for example by confirming or rejecting at a certain significance level a theoretical prediction, or by complementing already existing observations providing details that would otherwise be missed...)



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Writing an LST-1 proposal: scientific rationale

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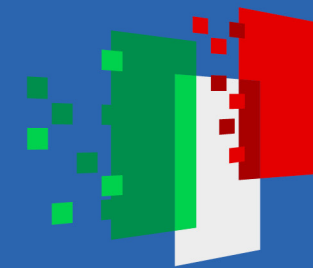
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- Note that concision is a must! 500 words are not a lot.



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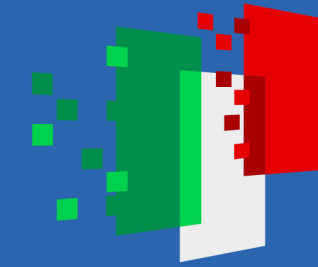
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- Note that concision is a must! 500 words are not a lot.
- Plots are key in helping you drive home your main points, in terms of both existing information and expected outcome.



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Writing an LST-1 proposal: publications plans

2. PUBLICATION PLANS

Present the plan of how you will use the data you will gather to achieve the science goals set out above. Additional information about the target journal and the timeline is very useful. This section should not exceed 100 words.

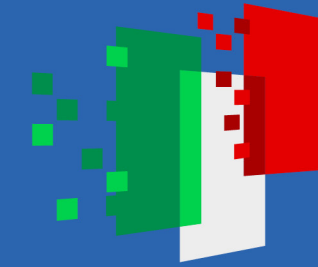
- Explain (once again briefly) how the LST-1 data you are proposing for will be instrumental to address the scientific goals presented in the Scientific Justification.



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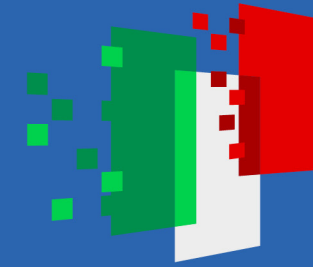
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- This is a good section to briefly report on the outcome of simulations, if they were performed to get an understanding on how the proposed observations would look like (more on this in a moment).



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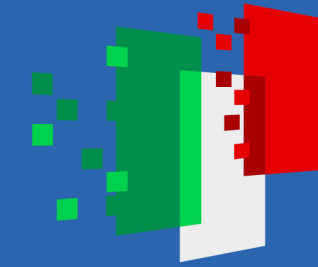
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- This is a good section to briefly report on the outcome of simulations, if they were performed to get an understanding on how the proposed observations would look like (more on this in a moment).
- One final sentence can contain some estimate on the expected timeline, from data analysis to publication.



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Writing an LST-1 proposal: technical justification

3. TECHNICAL JUSTIFICATION

This section should not exceed 100 words. It needs to describe the overall observing strategy and to demonstrate that you understand the overheads involved in the observations and hence a justification of the total time requested.

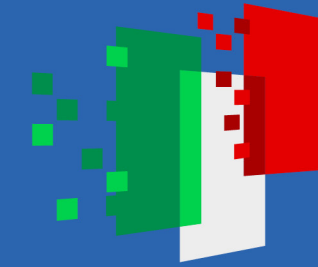
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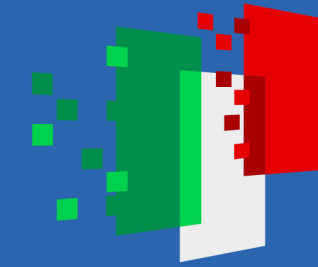
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- In practice, Feasibility tools like those that will be presented by Dr Alison Mitchell will give you the numbers that you need to include in this section.



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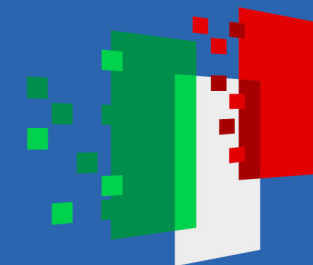
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- Plots to support the claim might be helpful as well (e.g., simulated spectrum with exposure equal to the requested one).



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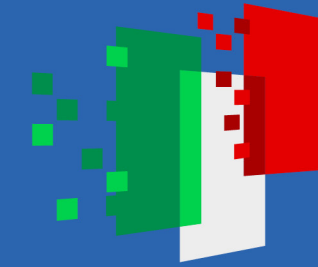
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- Plots to support the claim might be helpful as well (e.g., simulated spectrum with exposure equal to the requested one).
- You will learn more about this later in the week, but the take home message here is the following: one needs first to quantify what they need to achieve a scientific meaningful result (e.g., detection at NNN sigma; spectral parameters constrained with NNN accuracy); then, they should tools to convert these numbers in an exposure time (which should be reasonable: if your goal can be achieved with 500 hours of LST-1 time, it might be the best idea ever, but it will be extremely difficult to convince the panel to give you the time).



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Writing an LST-1 proposal: previous observations

4. PREVIOUS OBSERVATIONS

This section should not exceed 250 words. List any previous proposals on this source and current results, including multiwavelength information if relevant. Figures related to previous observations should be included here.

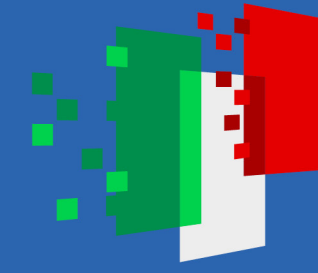
- This section allows one to elaborate a bit more in detail on what is already known on the proposed target (note that this section is thus more specific than the Scientific Justification, since in the SJ one should give a more comprehensive review of the topic of interest).



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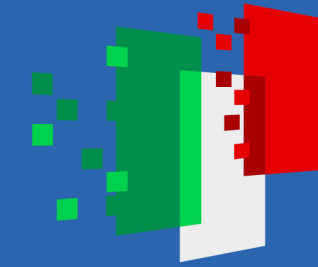
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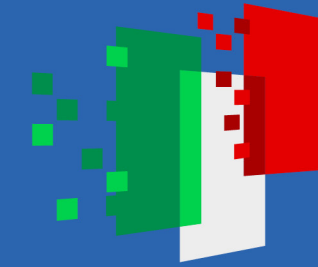
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- Figures from already published papers on the source can (and should) also be included.



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Dual Anonymous Peer Review (DAPR): the increasingly common standard in proposal writing

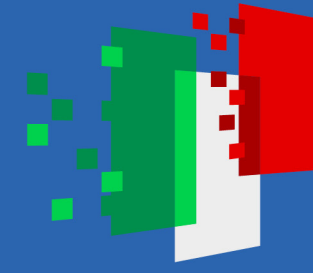
- In the last ~10 years, the vast majority of observatories and facilities have switched to a Dual Anonymous Peer Review (DAPR) system.
- Dual Anonymous: the person that writes the proposal does not know who's judging it (same as for papers) AND the panel in charge of the evaluation do not know who wrote the proposal.
- Goal: removing biases (explicit or implicit) and focus on the validity of the science.
- Evidence shows this as effective (e.g., in NASA Archival Data Analysis Proposals the number of proposals granted to women PI is increased; similar trends are observed in favor of early career PIs...)



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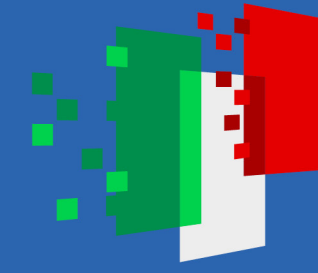
- Let's see a list of suggestions from <https://science.nasa.gov/researchers/dual-anonymous-peer-review/>



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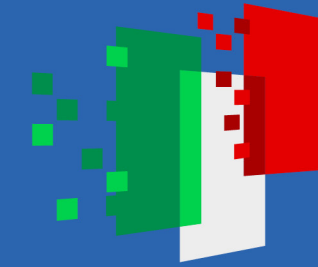
Proposers are required to write the Scientific/Technical/Management (i.e., science justification) section of the proposal in an anonymized format, i.e., in a manner that does not explicitly identify the names of the team members or their institutions. Some specific points follow:



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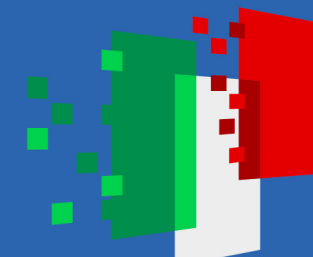
- 1 Do not claim ownership of past work, e.g., "my previously funded work..." or "Our prior analysis demonstrates that..."
- 2 Do not include the names of the personnel associated with the proposal or their organizational affiliations. This includes but is not limited to, page headers, footers, diagrams, figures, watermarks, or PDF bookmarks. This does not include references to past work, which should be included whenever relevant (see below).
- 3 Do not associate personnel with named teams or collaborations, e.g., "the PI is a member of the EAGLE collaboration."



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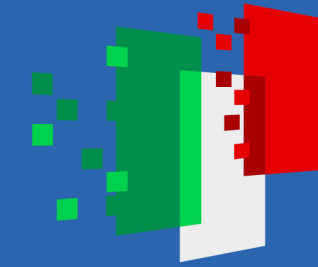
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 - 4 References must be written in the form of a number in a square bracket, e.g. [1], which will then correspond to the full citation in the reference list.
 - 5 When citing references, use third person neutral wording. This especially applies to self-referencing. For example, replace phrases like "as we have shown in our previous work [17], ..." with "as previously shown [17], ..."



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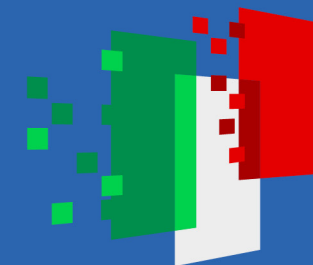
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 - 6 Depending on the program element, it may be occasionally important to cite exclusive access datasets, non-public software, unpublished data, or findings that have been presented in public before but are not citable. Each of these may reveal (or strongly imply) the investigators on the proposal. In these instances, proposers must use language such "obtained in private communication" or "from private consultation" when referring to such potentially identifying work. If proposers include this type of citation, do not include with whom the personal communication took place, i.e., do not refer to the names or roles of individuals or provide a description of a team or group.
 - 7 As always, the reviewers expect proposers to describe the past work in the field to put the proposed work into context and how the proposed work would improve, build-upon, complement, contradict, or complete that past work. Using the above guidelines, proposers should be able to successfully accomplish this in an anonymized manner.



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An example (from the Hubble Space Telescope DAPR webpage)

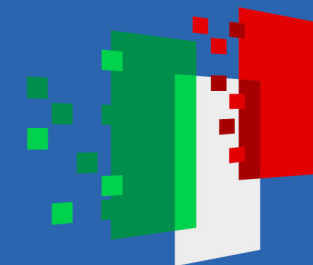
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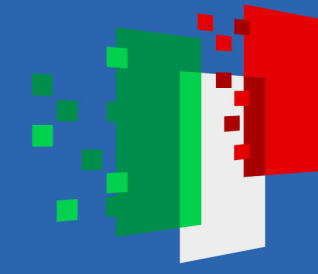
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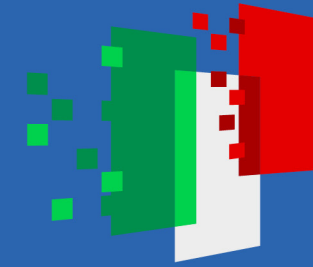
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Summary

- Writing proposals is a key skill for astronomers.
- During this week you will work in groups of three to write an LST-1 proposal on a topic of your choice.
- The proposals will then be evaluated by a panel, and feedback will be provided.
- Before the proposal writing sessions, you will learn about dealing with catalogs and datasets, and to estimate how much time is needed to fulfil your scientific requirements.
- Use these first days of school to divide yourselves in groups, and to think about a scientific case you deem interesting!