ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS

# How to write a (potentially successful) observing proposal

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- Why do we write proposals?
- The proposal process
- Tips and Tricks

# Why do we write proposals?

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- You have a good scientific question that you want to get answered.
- You need money
  - USA: NASA is the biggest funder of astronomy through research grants related to successful observations
  - Some European countries (e.g., Germany) allow to propose for money only if there is a successful proposal

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*Answer:* Many others also have good scientific questions

$\Longrightarrow$ Strong competition for limited resources

Result: significant oversubscription of available facilities

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Typical numbers:

- small optical telescopes: 0.5. . . 2
- VLA: 2. . . 3
- 8 m type optical telescopes (e.g., VLT), HST: 5. . . 6
- *XMM-Newton*, *Chandra*: 5. . . 6

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**Most proposals will be rejected.**

This means that only the best science (for some definition of “best”) gets done. Others call this a lottery.

# Digression: The Cost of Doing Astronomy

Astronomical instrumentation is expensive.

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Radio:

- Effelsberg: 480 €/hour $\Longrightarrow$ 133 €/ksec
- VLBA: 740 €/hour $\Longrightarrow$ 205 €/ksec

  assuming building cost of $85 Million

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*Examples:*

Optical Observatories:

- DSAZ (Calar Alto Observatory): 2.2 m: 3000 €/Night $\Longrightarrow$ 100 €/ksec
- ESO 2.2 m (La Silla): 7000 €/Night $\Longrightarrow$ 233 €/ksec
- ESO NTT (La Silla): 10000 €/Night $\Longrightarrow$ 330 €/ksec
- ESO VLT (Paranal): 59400 €/Night $\Longrightarrow$ 2000 €/ksec
- HST: $>$11000 €/ksec

Assuming 1 Night = 30 ksec; HST: cost was $9.6 billion between 1990 and 2009.

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*Examples:*

X-rays:

- *RXTE*: 360 €/ksec
- *Swift*: 630 €/ksec
- *XMM-Newton*: 1800 €/ksec

  ESA cost only, does not include spending by member states on hardware teams or support in member states for observers.

- *Chandra*: 7700 €/ksec

  Basis: Annual operating cost $65 million (includes guest observer program), and cost to launch: $2.5 billion depreciated over 15 yr lifetime.

# The Proposal Process

# $T = -$few months

$T = -$few months: Agency or observatory sends out a call for proposals

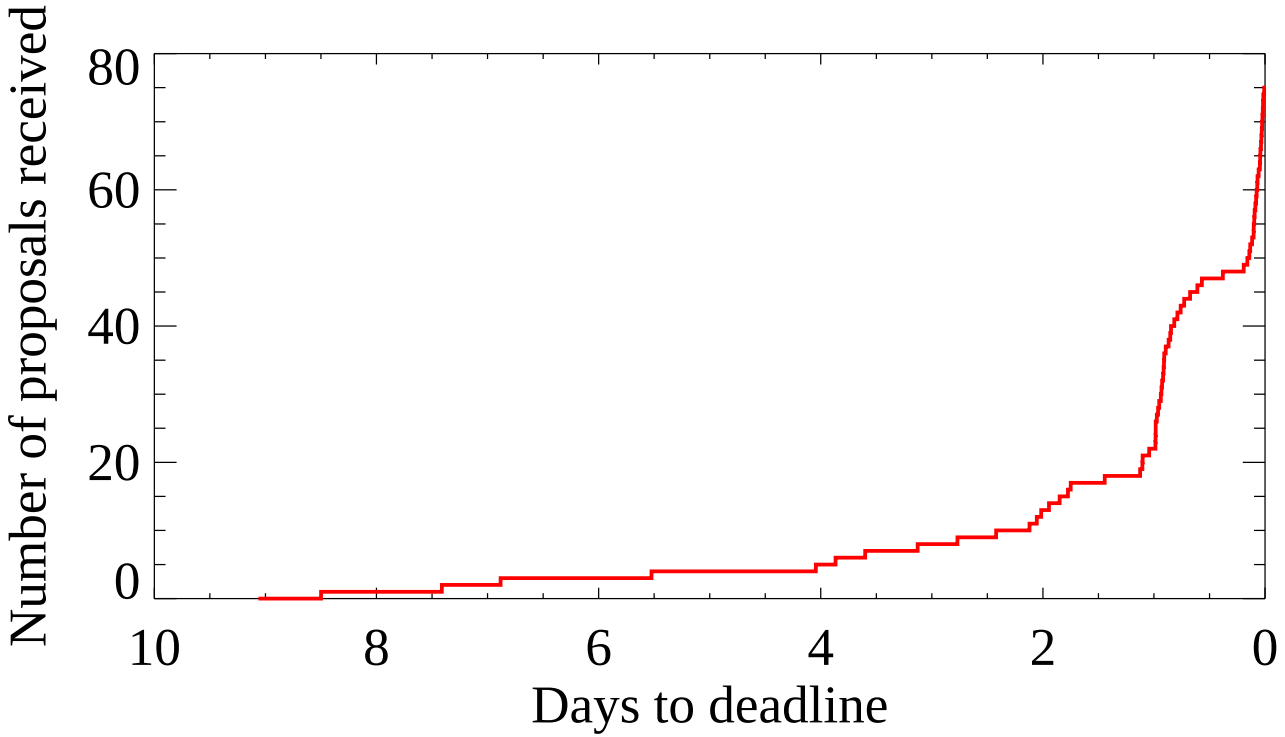
Often called "Announcement of Opportunity" (AO)

- X-rays: typically once per year for $\sim$the following year
  - *Chandra*, *INTEGRAL*: Spring
  - *XMM-Newton*: Fall
  - *Suzaku*: $\sim$December
- optical: typically $2\times$ per year
  - e.g., ESO: 1. April for the period 1. October – 31. March
- radio: often trimesters

$\Longrightarrow$ multiwavelength campaigns require *significant* planning

$\Longrightarrow$ you can spend / waste all of your time writing proposals

# $T = 0$: Proposal Submission




Arrival of proposals for *INTEGRAL* AO7 KP deadline ($T = 0$ was on 3 July, 12 UT)

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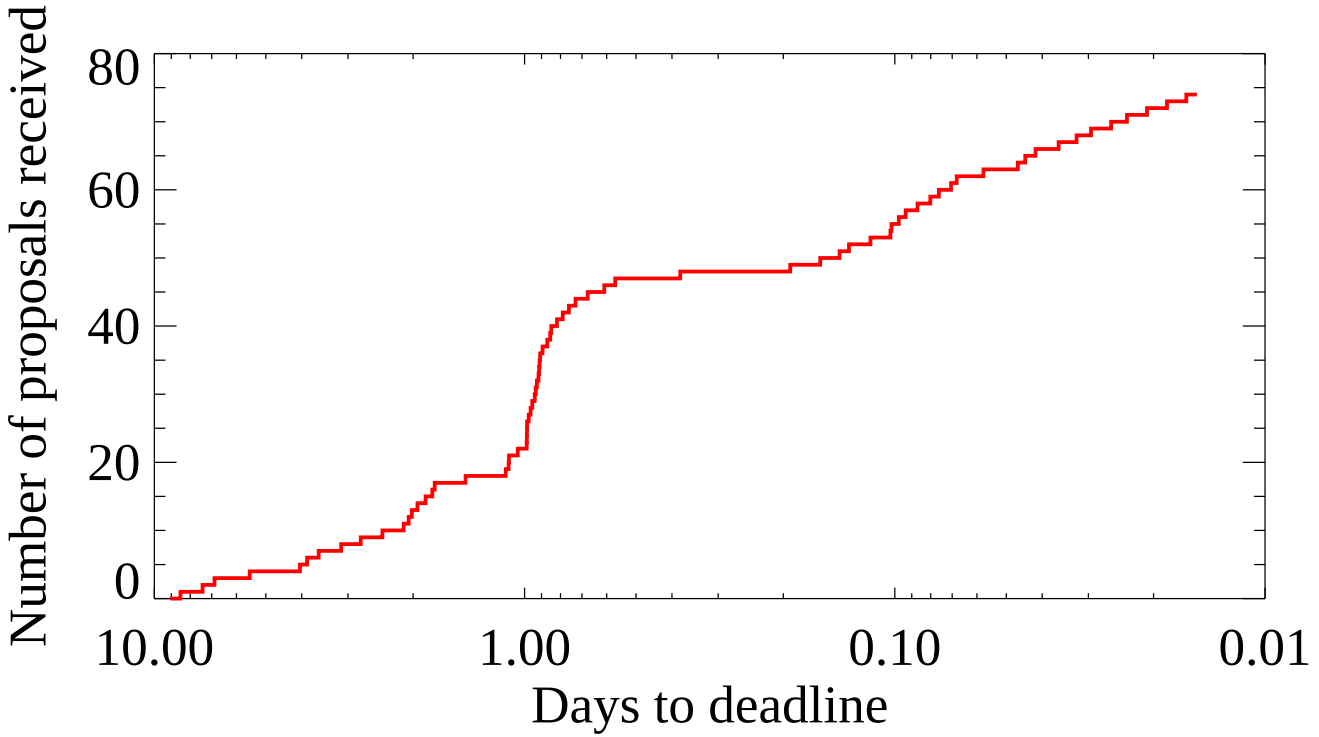


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# $T = 1$ month

$T = 1$ month: Preparation for review

1. Formal checks of proposals (100–800 depending on facility) are done at the agency:
   - Does proposal obey the rules and regulations?
     - page or word limit correct?
     - are you allowed to propose for your object?

       e.g., *INTEGRAL* doesn't allow you to propose for the next nearby SN
   - is your proposal technically feasible?

     Information will be forwarded to the reviewers
   - is a similar observation already available in the archives?

     Information will be forwarded to the reviewers
2. Proposal assigned to one of a few subject areas

   e.g., stars, X-ray binaries, galaxies and AGN, deep fields
3. Proposal is sent to the subject area specific review panel

# $T = 2$ months

$T = 2$ months: Proposals are read by the subject area specific panel

Good numbers to keep in mind:

- 50–80 proposals per panel
- 5–8 reviewers per panel

Reviewers are specialists in the general subject area, but *not* in the subject of your proposal!

In preparation for review:

- All reviewers are supposed to read all proposals
- Many facilities adhere to the following procedure:
  - Each reviewer is primary reviewer on $\sim$10–15 proposals
  - Each reviewer is secondary reviewer on another $\sim$10–15 proposals
- Reviewers do initial grading of proposals

# $T = 3$ months

$T = 3$ months: Panel Meeting

X-ray: Depending on satellite done centrally (NASA, *INTEGRAL*) or distributed throughout Europe (*XMM-Newton*).

Optical: most often done centrally (e.g., ESO)

Radio: Often done by telecon or even anonymously

1st day: First panel meeting

- Proposals discussed in panel according to subject area and/or initial ranking
- lowest 25–30% ranked proposals get triaged
- Primary/Secondary reviewer present each proposal
- Proposal is discussed: $\sim$10 minutes per proposal!
- Panel votes to give new grade

At the end of the 1st day, a new priority ordered list of proposals exists, which is already very close to the final list.

$T = 3$ months

2nd day: List of proposals gets looked at again:

- Can constraints of individual proposals be accommodated?
  - Target of Opportunity observations?
  - Duration of observations vs. visiblity of target
  - Time constrained observations

    (e.g., simultaneous X-ray/optical, multi-satellite,. . . )

  If not, even very good proposals have to be killed.
- Is the panel's program balanced?

  e.g., in an X-ray binary panel: BH versus NS binaries versus CVs; this may result in a good but long proposal getting kicked out in order to accommodate a few shorter proposals
- Write up (more or less useful) feedback
- Reviewers fly home (i.e., session ends around 15:00)

Good proposals are discussed for a maximum of 15 Minutes.

About 80% of all proposals are "good".

$T = 3$ months

## 3rd day or separate meeting: chairs meeting

- Panel chairs compare ranked lists, remove duplicates

  Dupe: Same source in two panels $\Longrightarrow$ only one can go

- Haggling on “boundary cases”
- Discussion of Key Programs or Large Programs

  These are very long programs, e.g., deep fields, surveys, which can cost more time than a single panel has available.

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# After the Panel Meeting

Weeks after the panel meeting:

- Agency sends out rejection and acceptance letters
- “observation enhancement”

∼6–18 Months after proposal deadline: Observations are performed. . .

- Grade A: definitively
- Grade B: probably
- Grade C: possibly (“filler target”)

  fillers are needed to optimize observing efficiency

Different grading schemes are possible; I don’t know how the radio people are doing their scheduling.

1 year after data are received by PI: Data become public.

# Tips and Tricks

# Define Observation

Before writing a proposal, you should do your homework:

- read and understand instructions for proposers

  page limit, submission software,. . . – formalities matter!

- test your idea: convince others that your suggested observation is interesting and important.

  This also helps you in formulating the proposal and your scientific questions.

- check archives for same/similar observations

  If these exist, you will have to address this in the proposal!

- understand your instrument

  Do a rough feasibility study, check visibility of source, estimate $S/N$, are there other facilities you could use?. . .

**Read the relevant documentation on the instrument you plan to use.**

# Structure

General structure of a proposal:

1. (Abstract)

   $\Longrightarrow$ The only thing all reviewers will read

2. Introduction (1 p)

   $\Longrightarrow$ Why is this science interesting? What are the open questions? Big picture?

3. Scientific Justification (2 p)

   $\Longrightarrow$ Why is your observation interesting? How will you do the analysis?

4. Technical Feasibility (0.5 p)

   $\Longrightarrow$ Prove that the observation is doable

   E.g., perform $S/N$ estimates, simulate the spectrum or image, estimate required exposure (short is good), show that source is visible, discuss why other facilities couldn't do the science better (e.g., *Chandra* vs. *XMM-Newton*, VLA vs. VLBI...)

Rule of thumb: If the 1st page is not interesting and does not state what you want, your proposal will not get accepted.

# Writing Style

- Proposals will be read by non-specialists

  $\Longrightarrow$ Give your proposal to an astronomer friend
- Proposals will be read in a hurry

  $\Longrightarrow$ Use the KISS-principle

  KISS=Keep it simple, stupid!
- Get to the point immediately
- Be explicit in what you want to do

  $\Longrightarrow$ e.g., sparingly use **boldface** to emphasize an important point
- Avoid jargon, acronyms, or complicated language

  $\Longrightarrow$ and use good english (have native speaker read proposal)

If the referees don't understand what you want, you have lost: Because of oversubscription, panels are looking for arguments to kick you out, not to keep you in!

# Technical Issues

Technical issues to address:

- Be consistent

  $\Longrightarrow$ e.g., use same exposure throughout

- Follow agency/observatory recommendation for estimating count rates / exposure times

  $\Longrightarrow$ or scale from archival observations where available

- Do not forget to check archives and visibility!

For further information on proposals formalities, exposure time estimators, etc., please see the different facility WWW-pages.

# Further Reading

- Fomalont, E.: Preparing a competitive radio proposal (Santa Fe, 2004)

  `http://www.aoc.nrao.edu/events/xraydio`

- Leibundgut, B.: ESO proposals (Prague, 2009)

  `http://www.eso.org/~bleibund/talks/Proposals_Prague09_pub.pdf`

- Seward, F.D.: How to write an X-ray proposal (Santa Fe, 2004)

  `http://www.aoc.nrao.edu/events/xraydio`

Good Luck!