A Beginner's Guide to Writing ALMA Proposals

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Helpful talks and references

- EU ARC I-train talk # 13; Guidance_and_Tips_for_writing_ALMA_proposal by Violette Impellizzeri (JAO)
  - https://almascience.eso.org/tools/eu-arc-network/i-train
- Previous KASI ALMA proposal workshop 2024, 25
  - talks by Seokho, Bumhyun, Yusuke, Jongho https://alma.kasi.re.kr/
- EA ARC proposal workshop; tips by Patricio Sanhueza & Nick Indrioro,
  - https://www2.nao.ac.jp/~eaarc/Meetings/ALMA_PPM2020_stop/ProgramPPW8.html
- Writing ALMA Proposals by Chin-Fei Lee (ASIAA)
- ALMA Science Portal; https://almascience.nao.ac.jp/proposing/learn-more

Identify what to propose & Get excited

- **Is the idea clear to you?** What is the question you will address? What will you learn? Why should others care? Is your idea new, interesting, and important for the community?
- Think about the idea early enough, Read references,
- and Discuss it with your colleagues.
- If needed, read through the titles and abstracts in the previous accepted proposals in your related field to have a sense of the current unsolved problems.

Highest Priority Projects

Clicking on ALMA "Project Code" will spawn an A e, then no archived data exists). Clicking on the "Abstracts" or "CoIs" links will open additional fields in the table with the correspondir

Cycle 12 DDTs

Cycle 12

The table below lists ALMA Cycle 12 projects with p led proposals with archived observations. The public metadata includes the ALMA Project Code, program title and abstract, investigator names and i Europe, NA=North America, or OTHER), and the proposal science category (Category 10=Cosmology and the high redshift universe; Cate and astrochemistry; Category 41=Circumstellar disks, exoplanets and the solar system; Category 50=Stellar evolution and the Sun).

Project Code	Title (Abstracts)	PI (COIs)	Exec	Category
2025.1.00009.S	Optically thin isotopologue line diagnostic of luminous buried AGNs in merging ultraluminous infrared galaxies	Masatoshi Imanishi	EA	20
2025.1.00013.S	Inheritance or reset: the origin of water in protoplanetary disk gas	Margot Leemker	EU	41
2025.1.00021.S	Resolving an extremely broad-lined source in the Galactic Center	Adam Ginsburg	NA	31
2025.1.00034.S	Cold Gas in Cosmic Giants?: Molecular Gas Survey for Giant Radio Galaxies	Hiroshi Nagai	EA	20

Understand the review criteria

ALMA Proposals' guide

- Each proposal must describe the **scientific importance** of the proposed project and include a **clear statement of its immediate observing goals**, including the **suitability of the observations** to achieve the scientific goals (see Section 5.7.2 and guidelines for reviewers).

- How your proposal is ranked & How you would rank others'
- Scientific Merit(과학적 가치): Is the question important? Will it lead to a breakthrough?
- Feasibility(실현가능성): Can the data achieve the goal?
- Suitability(적합성): Is ALMA the right instrument? Is the target justified?

Review Criteria 1: Scientific Merits (과학적 가치)

- Does the proposal clearly indicate which important, outstanding questions will be addressed?
- What are the open questions (three at most) in this field? Why are they important?
- Will the proposed observations have a high scientific impact on this particular field and address the specific science goals of the proposal?
- Why does your project matter?
- Why is this proposal more important than the other proposals?
- Is it leading a breakthrough or just being incremental?
- Is it testing the problem or challenging the previous understanding from a new aspect?

Review Criteria 2: Feasibility (실현 가능성)

- Does the proposal clearly describe how the data will be analyzed in order to achieve the science goal?
- What analyses will be done once you get the data?
- Compare with any models/simulations?
- Use any dedicated tools? Are assumptions valid?
- How to deal with null results? / What can be done in the case of negative results?

Review Criteria 3: Suitability (적 합성)

- Is the choice of target (or targets) clearly described and well justified?
- How are the targets selected? Is the sample size big enough?
- Are the requested SNR, angular resolution, largest angular scale, and the spectral setup sufficient to achieve the science goals and well justified?
- Why did you choose these values?
- Does the proposal justify why new observations are needed to achieve the science goals?
- Why is ALMA needed?

Proposal components

- Abstracts
- Science Justification
- Technical Justification (by Seokho tomorrow)

Abstract

- The abstract should offer a concise, clear and coherent narrative that will excite the reviewers about your project.
- The abstract will give the first impression to the reviewer.
- Ideally short, including all contents necessary content (big picture, the problem, the goals of the proposal, observations proposed, and scientific implication).
- Some people rank proposals based on the abstract only for the 1st triage.

Abstracts

- Briefly and powerfully convey the big picture, the problem, the goals of the proposal, observations proposed, and scientific implication.
- Water is essential for the formation of planets and their habitability. It enhances grain growth and is an efficient solvent for molecules needed for life. Despite its importance, following water through the phases of star and planet formation is extremely challenging due to a lack of detections during crucial parts along this journey, in particular in protoplanetary disk gas from which giant planets accrete their atmospheres. Therefore, it is unclear if water in (exo-)planets and comets is inherited from the earliest phases of star and planet formation or if it is reprocessed. A sensitive tracer to distinguish these scenarios is the HDO/H2O ratio. We propose to observe HDO and H_2^18O in the only disk with a detection of three spatially resolved H2O lines with ALMA. These observations will answer the question if gas-phase water in planet forming disks is inherited or reprocessed along the way of star and planet formation and will fill this missing piece in the water trail. (2025.1.00013.S, Margot Leemker)

Scientific Justification Outline

- Max 4 pages for regular proposal; 2 for text +2 for figures/tables/references
- Introduction (0.5-1 page) :
  - Big picture, Specific problem, Previous work & unsolved issues, Summary of what you propose.
- Methodology (1 pages):
  - What will you observe and why? What data do you need? Analytic techniques/tools? Plan for interpreting results & expected impact.
- Description of observations (0.5 page):
  - Key points only. Refer to technical justification for details.

Introduction

- Introduction Start with the "Big Picture" and why it is important.
- Why should a non-expert care about this topic?
  - Reviewers are experts in the field, but they might not be experts in your specific topic.
  - Therefore, the Scientific Justification (especially Introduction) should be written for a knowledgeable but broad-based audience.
- Narrow down to the "Specific Problem" quickly. What are the open questions? (Limit to 2-3 questions).
- Why haven't previous observations solved this?

Introduction

Summary of what you propose

- State your Objective clearly. (Summary of your proposal)
  - ”We propose to measure X to determine Y.”
  - Reviewers need this to find the proposed program fast during the review.
- Ex: We propose to observe the HH 212 jet at 5 au (corresponding to 0.013” here) resolution and 1 km/s velocity resolution for 3 hrs in SiO J=8-7 to resolve the velocity gradient across the jet axis at more than 5 sigma detections to have the first reliable measurement of jet rotation. (C.F. Lee)

Introduction

- State the primary goal of your proposal on the first page, preferably in the top half.
- If the reviewer is not excited by your proposal after this first page, it is not likely ranked highly.

Methodology

- What exactly will be done to answer the questions mentioned in the introduction.
- How will you analyze the data? Describe the analysis techniques/models, not just say “We will analyze the data”
- Justify targets
  - Why is this the BEST source(s) to observe to achieve the science goals? Closest, biggest structure to provide the best spatial resolution? Brightest, to provide the best SNR? Unique? A vast amount of complementary data (multi-wavelength)

Methodology

- Justify # of targets (multiple or surveys)
  - One target? why one is enough? why 20? Survey? Clearly state the number of targets. Justify why the selected sources and why the number of sources.
  - List clear, explicit selection criteria. (Ex. We select all sources in Taurus brighter than .., or all sources closer than 5 kph in ... catalogue. Samples that extend the previous observation by 10 times..)

Methodology

- Expected results & impacts
  - What are the physical parameters that can be immediately derived from the observations.
  - These physical parameters allow us to discriminate between competing models or understand a phenomenon...
  - Ex: We will get this and that jet parameters. The measured jet rotation will allow us to discriminate between the two competing models, namely, x-wind model and disk-wind model. (C.F.Lee)
  - Ex; By performing X observations, we will achieve Y." By answering question X, we will gain a better understanding of process Y, which has important implications for subjects A, B, and C."

Description of Observations

(0.5 page)

- Provide **brief summary** of the observational setup. Refer reader to the Technical Justification for the details.
- Convince the reviewer that the technical set up:
  - It can achieve the scientific goals of the proposal, is the best setup to achieve the science goals, use ALMA time in the most efficient way.

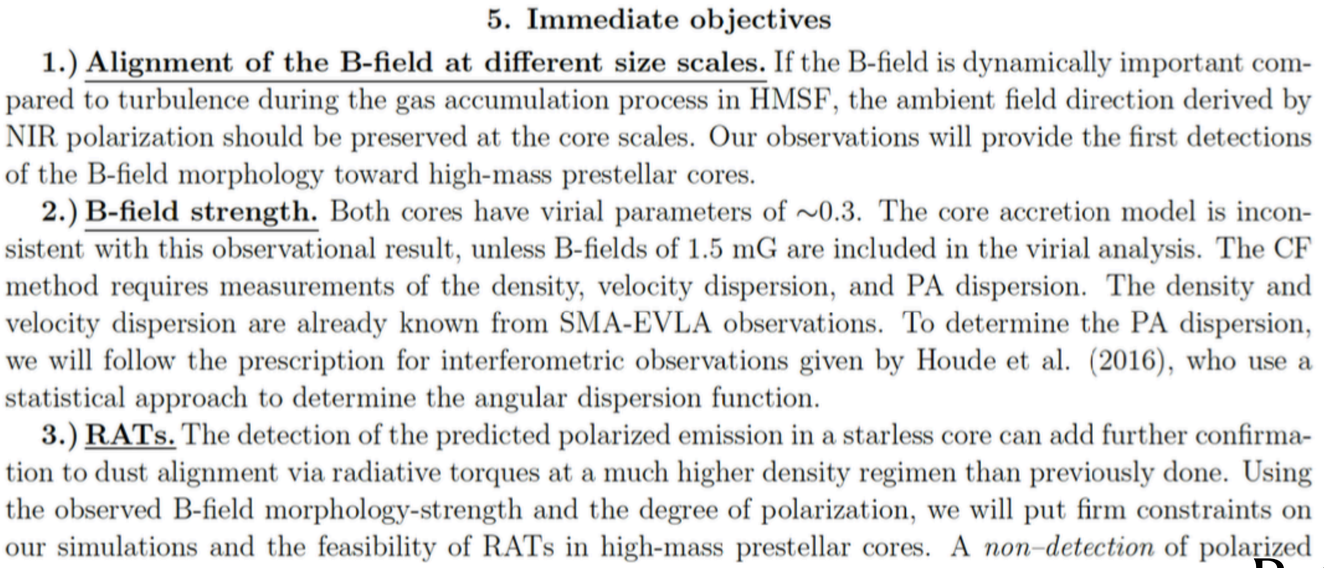
Description of Observations

(0.5 page)

- Justify every proposed parameter.
  - Angular resolution, (We need 0.1 arcsec to resolve the disk gap in 5 AU scale)
  - largest angular scale, (to study the extended structure of 500au scale filaments)
  - sensitivity (5sigma detection of .. line)
  - frequency setup (continuum & lines, to HCO+line at 0.2km/s resolution to resolve the 3km/s rotation structure..)
  - mosaic,
  - ACA (7m+TP), why ALMA
- Not justified? + one weakness bullet. May not promote your proposal but can degrade it.

Proposal Style

- Formatting & Highlights: Make it readable. Use bold or italics for key sentences (Scientific Goal, Importance), but use sparingly. Limit emphasized text to 2-3 sentences per page.
- Structure matters: Use clear section headings. Number your scientific questions (Q1, Q2...).



5. Immediate objectives

1.) Alignment of the B-field at different size scales. If the B-field is dynamically important compared to turbulence during the gas accumulation process in HMSF, the ambient field direction derived by NIR polarization should be preserved at the core scales. Our observations will provide the first detections of the B-field morphology toward high-mass prestellar cores.

2.) B-field strength. Both cores have virial parameters of ∼0.3. The core accretion model is inconsistent with this observational result, unless B-fields of 1.5 mG are included in the virial analysis. The CF method requires measurements of the density, velocity dispersion, and PA dispersion. The density and velocity dispersion are already known from SMA-EVLA observations. To determine the PA dispersion, we will follow the prescription for interferometric observations given by Houde et al. (2016), who use a statistical approach to determine the angular dispersion function.

3.) RATs. The detection of the predicted polarized emission in a starless core can add further confirmation to dust alignment via radiative torques at a much higher density regimen than previously done. Using the observed B-field morphology-strength and the degree of polarization, we will put firm constraints on our simulations and the feasibility of RATs in high-mass prestellar cores. A *non–detection* of polarized

Patricio

Figures

- Figures should be simple and clearly convey a single significant point.
- Figure can better deliver the message than the dense text.
- Reviewers will look at the figures (and abstract) to refresh their memory of a proposal, should be easily readable (avoid small fonts or dense spacing)
- Tell the reviewer what is the point of the figure, and **specify the take away message**.

Appendix A Definition of a Duplicate Observation

A proposed observation is considered a duplicate of another observation if *all* of the following conditions are met:

Target field location

- For single-field interferometry, the proposed position coincides within the half-power beam width of the other observation. Moving objects (e.g., Solar System objects) will be identified by name.
- For mosaic observations, more than 50% of the proposed pointings are within the half power beam width area covered by the other observation.

Angular Resolution

- The proposed angular resolution differs by a factor of ≤2 from the other observation.

Spectral windows

- Continuum: The requested sensitivity (rms) for the aggregate bandwidth is better by a factor of ≤ 2 from the other observation and the requested frequency is within a factor of 1.3.

  – or –

- Spectral line: If the central frequency in any requested correlator window observed in Frequency Division Mode (FDM) mode is encompassed by the other observation observed in FDM mode and the sensitivity per spectral channel, after smoothing to the same spectral resolution, is better by a factor of ≤ 2.

To be considered a “continuum” observation, the proposed correlator setup must contain 2 or more windows with a bandwidth > 1.8 GHz.

Solar observations will not be checked for duplications.

5.3.1 Page limits, formatting, and fonts

The formatting requirements for ALMA proposals are presented below. Proposals that do not follow these requirements may be disqualified. Users are encouraged to prepare their Scientific Justifications using the LaTeX template available on the Science Portal.

Page layout and font sizes:

- Page format: A4 or US Letter.

- Text area: No larger than 247 mm by 180 mm.
  - For A4 paper this corresponds to top/bottom margins of 25 mm and left/right margins of 15 mm.
  - For US letter paper this corresponds to top/bottom margins of 16 mm (0.62 inches) and left/right margins of 18 mm (0.71 inches).
- Font size: Minimum 12 points, including the main text, figure captions, tables, and references.
- Line spacing: single line spacing (14.4 points) for all content.

Page limits:

- Regular, ToO, VLBI, Phased Array, and DDT proposals
  - 4 pages maximum.
  - The recommended breakdown is two pages for the science case and two pages for figures, tables, and references, but proposers are free to adjust these numbers within the overall page limit.

Final Checklist

- [ ] Did I check the Archive?
- [ ] Is the abstract self-contained and exciting?
- [ ] Clear and self-explanatory images.
- [ ] Did I justifد why I need this specific setup?
- [ ] Did I address "What if we see nothing?"

Take away message

- **Be excited**. If you are not excited by your idea & proposal, neither is the reviewer. (Viollette)
- **Be ambitious**. Proposal writing is ambitious. You are exploring the unknown and are going to answer outstanding questions, unlike a conservative paper writing (Nick)
- **Be direct**. Reviewers need to read, evaluate, and write comments about 10+proposals in limited time. If you were the reviewer, what would you do? (C.F. Lee)