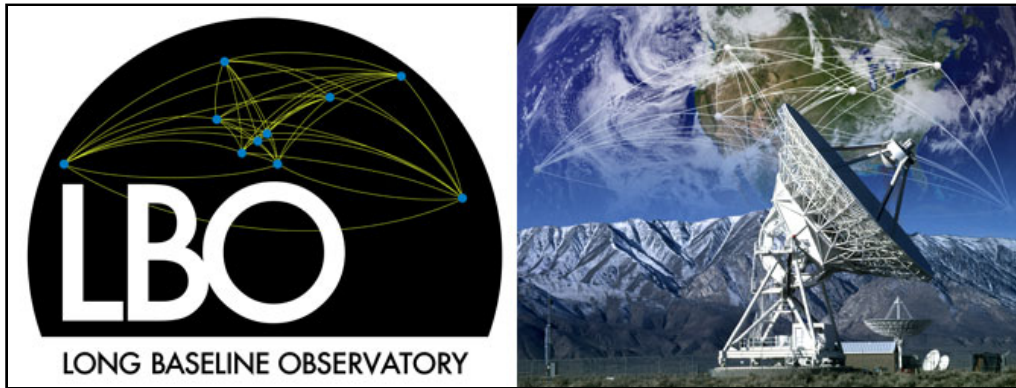


# LBO Call for Proposals: Semester 2019A

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29 June 2018



The Long Baseline Observatory (LBO) invites scientists to participate in the LBO's Semester 2019A Call for Proposals for the Very Long Baseline Array (VLBA), the High Sensitivity Array (HSA), and the Global 3mm VLBI Array (GMVA).

**The submission deadline for Semester 2019A proposals is Wednesday, 1 August 2018, at 17:00 EDT (21:00 UTC).**

The LBO strongly encourages proposers to read through the "[News and Opportunities](https://science.lbo.us/observing/call-for-proposals/2019a/news-oprtn) (<https://science.lbo.us/observing/call-for-proposals/2019a/news-oprtn>)" page carefully as there are changes throughout the call for proposals.

Proposal preparation and submission remain via the **NRAO** Proposal Submission Tool (PST) available at [NRAO Interactive Services](http://my.nrao.edu/) (<http://my.nrao.edu/>). Note that PST use requires registration.

Proposers who need assistance with proposal preparation or have questions regarding the Call or VLBA capabilities should submit help requests via the NRAO [Helpdesk](https://help.nrao.edu/) (<https://help.nrao.edu/>). We especially urge proposers new to proposing for the VLBA/HSA or even those who have less experience in VLBI to use the [Helpdesk](https://help.nrao.edu/) (<https://help.nrao.edu/>) in a timely fashion in advance of the proposal deadline to understand the technical use of the VLBA/HSA.

Approximately 1000 to 1200 hours of VLBA observing time are expected to be available for Open Skies in observing semester 2019A.

## News & Opportunities

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### Time Allocation Under the Long Baseline Observatory (LBO)

Because of the reorganization among NRAO, the LBO, and the Green Bank Observatory (GBO), **this** 2019A Call for Proposals is only for observations with the VLBA/HSA and the GMVA ; the call for the GBT and the VLA can be found at the [GBO Call for Proposals](http://greenbankobservatory.org/gbt-observers/proposals/2019a-call-for-proposals) (<http://greenbankobservatory.org/gbt-observers/proposals/2019a-call-for-proposals>) and the [NRAO Call for Proposals](https://science.nrao.edu/observing/call-for-proposals/2019a/) (<https://science.nrao.edu/observing/call-for-proposals/2019a/>), respectively. For the meantime the LBO, GBO, and NRAO will continue to run a single, joint proposal review and time allocation process, as described [here](https://science.nrao.edu/observing/proposal-types/peta) (<https://science.nrao.edu/observing/proposal-types/peta>).

### VLBA Shared Risk Observing

In 2019A, the LBO will offer the use of **all VLBA stations** (N.B.: **not** the HSA) with a maximum recording rate of 4096 Mbps. This resource will be offered as Shared Risk Observing. This means that if there is a problem with using this resource, we will not automatically re-observe a given project. During semester 19A we expect to be able to support 4096 Mbps recording for ~15% of the open-skies observing time. Therefore we will only allocate 4096 Mbps to the most highly-ranked proposals that request it. Your proposal should indicate whether it could be considered for allocation at 2048 Mbps, perhaps with an increased time request, or dropped from consideration altogether.

For further details on this new capability and others in the Shared Risk Observing program, visit the [VLBA SRO web page \(https://science.lbo.us/facilities/vlba/proposing/sro\)](https://science.lbo.us/facilities/vlba/proposing/sro).

## Joint Observations with XMM-Newton Project

By agreement with the NRAO/GBO/LBO Observatories, detailed in a [Memorandum of Understanding \(https://science.nrao.edu/observing/call-for-proposals/nrao-gbo-lbo-xmm-newton-mou\)](https://science.nrao.edu/observing/call-for-proposals/nrao-gbo-lbo-xmm-newton-mou), the XMM-Newton Project may award up to 3% of NRAO/GBO/LBO open skies observing time. Similarly the NRAO/GBO/LBO Time Allocation Committee may award up to 150 ks of XMM-Newton time per year. See the [Joint Observations with XMM-Newton \(https://science.nrao.edu/observing/call-for-proposals/2019a/new-opportunity-joint-observations-with-xmm-newton\)](https://science.nrao.edu/observing/call-for-proposals/2019a/new-opportunity-joint-observations-with-xmm-newton) page for details.

## Large Proposals

The VLBA continues to encourage Large proposals (those requesting 200 hours or more). **VLBA proposers are urged to submit their Large proposals for this Call, or to submit relevant pilot projects that will be useful in preparing for a future Large proposal.**

## VLBA Resident Shared Risk Observing Program

The VLBA Resident Shared Risk Observing (RSRO) program provides users with early access to new capabilities in exchange for a period of residency in Socorro to help commission those capabilities. For example, the phased-VLA system was developed through RSRO programs. **Users are encouraged to conceive and propose innovative ideas for new VLBA capabilities.** Some staff suggestions are included at the [VLBA RSRO program \(https://science.lbo.us/facilities/vlba/proposing/rsro\)](https://science.lbo.us/facilities/vlba/proposing/rsro) page, along with details for submitting RSRO proposals.

Proposers should be aware that RSRO capabilities are generally not approved at priority A, owing to the level of risk associated with these observations.

## Other Proposal Opportunities

Proposers should keep in mind that the following classes of observations are very welcome, as well as Large Proposals (see above):

- **Director's Discretionary Time Proposals:** Proposals for Director's Discretionary Time (DDT) may be submitted at any time. They must be submitted through the Proposal Submission Tool, and are intended to address targets of opportunity, high-risk/high-return exploratory time, or other science opportunities deemed sufficiently urgent to justify prompt action. For pre-planned observations of possible transient events, whose event times are unknown **a priori**, a **Triggered** proposal submitted at a regular deadline is preferred over a DDT. See the [Proposal Types \(https://science.lbo.us/observing/proposal-types/proposalatypes\)](https://science.lbo.us/observing/proposal-types/proposalatypes) web page for further details.

- **Filler Programs:** Some programs are not time critical, do not require highly subscribed GST ranges, or can usefully observe in multiple brief, randomly-timed sessions. Such programs may be able to take advantage of "filler" time, and are **strongly** encouraged. Types of projects that might be suitable for VLBA filler time include: surveys of many sources, deep integrations spread over many sessions, and long term monitoring. It is rare for fewer than 6 antennas to be functional and have good observing conditions as well; high frequency projects that can use a reduced array are therefore viable. To be eligible for FILLER status the project should be flexible enough to be scheduled:

- with non-ideal weather conditions;
- with less than the full complement of antennas;
- with a target list of source positions around the sky; and
- with short duration or variable length scheduling blocks.

**Proposals for filler projects must include the word "filler" in the proposal title.** Teams must provide tools that allow VLBA operations, with minimal effort, to create schedules for arbitrary blocks of time of one hour or longer when such time becomes available during dynamic scheduling. Large VLBA filler proposals (i.e. combining Filler and Large proposal types), and multi-semester proposals, are also welcomed.

- **High Risk Proposals:** As a means of maximizing its scientific impact through cutting-edge observations, the Observatory **strongly** encourages the submission of high-risk/high-reward proposals.
- **Commensal Observing:** The VLBA has some innate ability to support commensal observing either through clever use of existing infrastructure or through operation of user-supplied capabilities. It is recommended that interested proposers discuss their ideas with VLBA staff prior to submission in order to develop a plausible program. Such observations will be subject to resource constraints.

Further information about each of these programs can be found [here \(https://science.lbo.us/observing/proposal-types/proposal-opportunities\)](https://science.lbo.us/observing/proposal-types/proposal-opportunities). If, after reading pertinent documentation, there are still questions, please submit the questions to the [NRAO helpdesk \(http://help.nrao.edu/\)](http://help.nrao.edu/).

## **Very Long Baseline Array (VLBA), High Sensitivity Array (HSA) & Global mm VLBI Array (GMVA) Proposals**

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### **Calls for Proposals**

**Proposals are due by 2018 August 1, 17:00 US EDT (21:00 UT).**

This deadline applies to the following proposal types:

- [Very Long Baseline Array \(https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-vlba\)](https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-vlba) (VLBA) and [High Sensitivity Array \(https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-hsa\)](https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-hsa) (HSA) proposals requesting time in Semester 2019A (2019 February 1 - 2019 July 31) or multi-semester proposals.
- [Global mm VLBI Array \(https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-gmva\)](https://science.lbo.us/observing/call-for-proposals/2019a/vlba-and-extd#prop-gmva) (GMVA) proposals for 2019 Session I (Apr 04 - Apr 09), or later sessions.

Required proposal submission mechanisms are detailed in individual sections below.

### **VLBA Proposals**

The VLBA provides ultra-high angular resolution for astrophysical studies including:

- Non-thermal continuum emission, including polarimetry, from active galactic nuclei (AGN), Galactic microquasars, pulsars, and other sources.
- Maser emission lines of OH (1.7 and 6.0 GHz), CH<sub>3</sub>OH (6.7 and 12.2 GHz), H<sub>2</sub>O (22 GHz), SiO (43 and 86 GHz) and other molecules, and numerous thermal absorption lines, in a variety of Galactic and extragalactic circumstances.
- Multiple-phase-center surveys across the primary beam.
- Parallax and proper motion via differential astrometry of a variety of stars, star-forming regions, and nearby extragalactic objects, at accuracies as good as 10 microarcsec.
- Absolute astrometry at accuracies of ~200 microarcsec to expand the International Celestial Reference Frame.

Overall information about the VLBA is available in the [VLBA Observational Status Summary](https://science.lbo.us/facilities/vlba/docs/manuals/oss/) (<https://science.lbo.us/facilities/vlba/docs/manuals/oss/>) (OSS); specific sections relevant to various proposal types are linked below.

The VLBA operates two data systems, a Polyphase Filterbank (PFB), and a Digital Downconverter (DDC). These are described in detail in [Section 5.4](https://science.lbo.us/facilities/vlba/docs/manuals/oss/sig-proc/rdbe/) (<https://science.lbo.us/facilities/vlba/docs/manuals/oss/sig-proc/rdbe/>) of the VLBA OSS, which also includes suggestions for selecting the optimal observing system for various scientific goals.

For Semester 2019A, we expect no significant pressure in specific GST ranges for available VLBA observing time.

VLBA proposals must be prepared and submitted using the NRAO Proposal Submission Tool (PST), accessible via [NRAO Interactive Services](http://my.nrao.edu/) (<http://my.nrao.edu/>). Use of the PST requires registration by all proposers, including co-investigators, in the NRAO User Database.

Proposals requiring significant additional correlator resources, such as multiple phase centers per field or multiple pulsar phase bins, should consider mechanisms to support the correlation without adversely affecting the throughput of other projects. These should be entered in the technical justification section of the proposal.

## High Sensitivity Array (HSA)

The [HSA](https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/hsa/) (<https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/hsa/>) comprises the VLBA, phased VLA, GBT, Effelsberg, and Arecibo telescopes. We fully expect normal scientific observations, including HSA VLBI observations, to be available at Arecibo for semester 2019A. All of the HSA stations are equipped with instrumentation compatible with the VLBA observing capabilities described in [Section 5.4](https://science.lbo.us/facilities/vlba/docs/manuals/oss/sig-proc/rdbe/) (<https://science.lbo.us/facilities/vlba/docs/manuals/oss/sig-proc/rdbe/>) of the VLBA OSS. Ongoing special considerations for the HSA telescopes are documented in [OSS Section 14.2](https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/hsa/) (<https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/hsa/>); new features and special cases are cited here.

**VLBI observations** combining the VLBA with any one or more of the other four HSA stations can be requested in a single HSA proposal. However, separate proposals must be submitted for any **non-VLBI use** of any requested telescopes.

HSA proposals must be prepared and submitted using the NRAO Proposal Submission Tool (PST), accessible via [NRAO Interactive Services](http://my.nrao.edu/) (<http://my.nrao.edu/>). Use of the PST requires registration by all proposers,

including co-investigators, in the NRAO User Database. The inclusion of HSA stations should be quantitatively justified in the proposal.

- **The phased Very Large Array (Y27)** will be available for HSA observing in Semester 2019A, in the **B** and **A** configurations. High frequencies (at receiver bands 22 GHz and above) have better phasing in the more compact configurations (**C** and **D**).

Observing with a single VLA antenna (Y1) in conjunction with the VLBA will only be available through the [VLBA Resident Shared Risk Observing \(https://science.lbo.us/facilities/vlba/proposing/rsro\)](https://science.lbo.us/facilities/vlba/proposing/rsro) program.

- **The Green Bank Telescope, like the VLBA, has transitioned into a new partnership arrangement, the Green Bank Observatory (GBO).** Time available for VLBI on the GBT will be reduced compared to earlier years, and only the most highly rated proposals across all GBT observation types will be awarded time. Additionally, proposers should be aware that long scheduling blocks (more than 6 hours) will be very difficult to schedule owing to constraints coming from non-NSF [GBO \(http://www.greenbankobservatory.org/\)](http://www.greenbankobservatory.org/) partners. Proposers are encouraged to make clear in the technical justification section any constraints about how observing time could be broken into smaller pieces without adversely affecting the proposed science; include information as relevant regarding maximum elapsed time of a split schedule and minimum scheduling block lengths.

Observations using the GBT 6-cm receiver as part of the HSA must be taken, correlated, and calibrated in full Stokes mode. Due to the large cross talk between polarizations, only total intensity (Stokes I) data will be usable.

- **The Effelsberg telescope** supports both the PFB and DDC observing systems available on the VLBA.
- **The Arecibo 305-m telescope** is currently available only with the PFB observing system. An RSRO project is encouraged to help qualify the 4-channel DDC observing system at Arecibo.

## **Global 3mm VLBI Array (GMVA)**

GMVA proposals submitted by the 2018 August 1 deadline will be considered for scheduling in 2019 Session I (Apr 04 - Apr 09), or later sessions.

Complete information on the GMVA is available at the [GMVA website \(http://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/\)](http://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/). Ongoing special considerations for the GMVA are documented in [Section 14.3 \(https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/gmva\)](https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/gmva) of the VLBA OSS; new features and/or special cases are cited here.

As noted in the HSA section above, GBT time available for VLBI has been reduced due to its new partnership arrangements.

GMVA proposals must be prepared and submitted using the NRAO Proposal Submission Tool (PST), accessible via [NRAO Interactive Services \(http://my.nrao.edu/\)](http://my.nrao.edu/). Use of the PST requires registration by all proposers, including co-investigators, in the NRAO User Database. The inclusion of GMVA stations should be quantitatively justified in the proposal. Proposals requesting the KVN must be specified by entering "KVN" as "Other" entries in the PST.

**This GMVA proposal call will not include phased ALMA.**



## Joint Observations with Space Telescopes

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### Joint Observations with Space Telescopes

The following opportunities are available to combine observations with the VLBA and several space observatories operating at very different wavelengths. (Joint observations combining the VLBA with other ground-based VLBI instruments are embedded in the periodic VLBA Call for Proposals, and described in the VLBA Observational Status Summary.) The following joint observation opportunities with the LBO will continue in semester 2019A via existing arrangements. (For 2019A, the agreement with XMM-Newton is new.)

#### Joint Observations with XMM-Newton Project

By agreement with the NRAO/GBO/LBO Observatories, detailed in a [Memorandum of Understanding \(https://science.nrao.edu/observing/call-for-proposals/nrao-gbo-lbo-xmm-newton-mou\)](https://science.nrao.edu/observing/call-for-proposals/nrao-gbo-lbo-xmm-newton-mou), the XMM-Newton Project may award up to 3% of NRAO/GBO/LBO open skies observing time. Similarly the NRAO/GBO/LBO Time Allocation Committee may award up to 150 ks of XMM-Newton time per year. See the [Joint Observations with XMM-Newton \(https://science.nrao.edu/observing/call-for-proposals/2019a/new-opportunity-joint-observations-with-xmm-newton\)](https://science.nrao.edu/observing/call-for-proposals/2019a/new-opportunity-joint-observations-with-xmm-newton) page for details.

#### Joint Observations with Chandra X-ray Observatory

In previous semesters, the community has had the opportunity to propose for observing time on NRAO facilities through a joint program with the Chandra X-ray Observatory. Beginning in semester 2016A, proposers to the NRAO have had the opportunity to request time on Chandra, to be awarded on the recommendation of the Telescope Allocation Committee (TAC) and approved by the Director. This arrangement now applies to facilities of the LBO. Up to 120 ksec total will be made available for NRAO, LBO, and GBO proposals annually. See the [Joint Observations with Chandra \(https://science.nrao.edu/observing/call-for-proposals/2019a/chandra\)](https://science.nrao.edu/observing/call-for-proposals/2019a/chandra) page for details.

#### Joint Observations with the Hubble Space Telescope (HST)

By agreement between the NRAO and the Space Telescope Science Institute, STScI will be able to award up to 3% of the available time on the VLBA, VLA, and GBT to highly ranked proposals that request time on those telescopes and on HST. In return, STScI has offered 30 orbits of HST time for allocation by the NRAO, LBO, and GBO TACs to proposals submitted for observing semesters 2018B and 2019A. See the [Joint Observations with HST \(https://science.nrao.edu/observing/call-for-proposals/2019a/hubble-space-telescope\)](https://science.nrao.edu/observing/call-for-proposals/2019a/hubble-space-telescope) page for details.

#### Joint Observations with Swift Gamma-Ray Burst Mission

To foster correlative observations, a joint Swift/NRAO observing program has been established, detailed in a [Memorandum of Understanding \(http://swift.gsfc.nasa.gov/proposals/nrao.html\)](http://swift.gsfc.nasa.gov/proposals/nrao.html). By this agreement, the Swift Program permits the NRAO, LBO, and GBO to award up to 300 kiloseconds of Swift observing time per year. Similarly, the Swift Guest Investigator (GI) Program may award observing time on the VLBA, VLA, and GBT. See the [Joint Observations with Swift \(https://science.nrao.edu/observing/call-for-proposals/2019a/swift\)](https://science.nrao.edu/observing/call-for-proposals/2019a/swift) page for details.

#### Joint Observations with Fermi Gamma-Ray Space Telescope

We remind the community that it is possible to propose for observing time on LBO facilities through the Fermi Gamma-ray Space Telescope Joint Proposal Opportunity or the Cooperative Proposal Opportunity. See the [Joint Observations with Fermi](https://science.nrao.edu/observing/call-for-proposals/2019a/fermi) (<https://science.nrao.edu/observing/call-for-proposals/2019a/fermi>) page for details.

## Alerts & Tips for Proposers

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### Director's Discretionary Time vs. Triggered Proposals

In general, and when practical, the LBO encourages submission of Triggered proposals at a Regular proposal deadline, in lieu of submitting Director's Discretionary Time (DDT) proposals. Submitting Regular, Triggered proposals allows such proposals to be evaluated by the Science Review Panel / Telescope Allocation Committee along with possible competing proposals, and to be more rigorously reviewed for their science justification. In addition, having an approved Triggered proposal for specified types of events bypasses the delay in writing and obtaining approval for a DDT proposal, and thus expedites rapid availability of observing time on the VLBA. Finally, approved Triggered proposals will generally have priority over DDT requests in cases where the two are competing for equivalent science.

### Source Lists

LBO requires proposers to specify their source lists in full. This enables the LBO to identify potential conflicts between observing programs and to better understand scheduling pressure on the instruments it operates. It may be the case that the final target list has not been selected at the time a proposal is submitted. In such cases, all potential targets and fields should be listed. The only exceptions to this requirement are for Triggered proposals to observe targets that are unknown a priori. Proposal source lists are not made public by the LBO.

### Dissertation Plans

Students planning to use the VLBA for their PhD dissertation must submit a "Plan of Dissertation Research" of no more than 1000 words with their first proposal. This plan must be referred to in later proposals for time allocations relevant to the thesis work described in the plan. It is the responsibility of the student to ensure that the information contained in the plan is up-to-date at the time a given proposal is submitted. By the same token, a proposal for work that is relevant to a student thesis should refer to the plan and clearly state the relevance of the proposal to the plan. At a minimum the plan should contain:

1. An overview of the research program
2. The thesis timeline, including the expected date of completion
3. An estimate of the VLBA resources needed to complete the program of research
4. Clear statements about the importance of each proposal to the thesis as a whole.

The plan provides some assurance against a dissertation being impaired by an adverse review of a proposal when the full scope of the thesis is not seen. The plan can be submitted via [NRAO Interactive Services](http://my.nrao.edu/) (<http://my.nrao.edu/>). Students are reminded to submit their plan comfortably in advance of the proposal deadline. Thesis plans must be in pdf format so science reviewers can easily access the plans. Students who have not yet graduated but have active plans on file should update those plans to a pdf format if they are not already in that form.

### Advertised Capabilities

Proposers that request VLBA capabilities that are not advertised in this [Call for Proposals](https://science.lbo.us/observing/call-for-proposals/2019a/introduction) (<https://science.lbo.us/observing/call-for-proposals/2019a/introduction>) or the [Observational Status Summary](https://science.nrao.edu/facilities/vlba/docs/manuals/oss) (<https://science.nrao.edu/facilities/vlba/docs/manuals/oss>) should first discuss such proposals with the VLBA staff

by using the [helpdesk \(https://help.nrao.edu/\)](https://help.nrao.edu/) (this means beginning such discussions well in advance of the proposal deadline). In addition, such requests should be clearly stated and justified in the Technical Justification of the proposal. Technical reviewers will determine the effect such requests may have on operational readiness of the VLBA. If it is found that those requests are detrimental to normal operations, they will not be approved, or be approved only on a "best effort" basis. Some capabilities that are not advertised may be good candidates for the [VLBA RSRO program. \(https://science.lbo.us/facilities/vlba/proposing/rsro\)](https://science.lbo.us/facilities/vlba/proposing/rsro)

## Tips for Proposers

LBO will use the panel-based NRAO proposal evaluation and time allocation infrastructure. That is, members of the scientific community are responsible for reviewing proposals based on their scientific merit through eight [Science Review Panels \(https://science.nrao.edu/observing/proposal-types/proposal-review-system\)](https://science.nrao.edu/observing/proposal-types/proposal-review-system). As a means of broadening the scientific perspective of its reviewers, and of increasing the participation of the wider astronomy and astrophysics community in the science programs of LBO, GBO and NRAO facilities, SRP membership is deliberately selected to include some colleagues that are not necessarily experts in radio observational techniques. This being the case, we encourage proposers to consider the following when preparing their proposals:

1. Avoid the use of radio astronomy jargon
2. Do not assume the reader is familiar with a particular observing technique - explain it briefly
3. Do not assume the reader is familiar with an earlier rationale for a developing line of research - provide adequate historical context and connect the dots as necessary
4. Describe previous observations and publications relevant to the proposed observations
5. If a particular point source or brightness temperature sensitivity is required, justify it.
6. In many imaging observations the time required to accumulate sufficient UV coverage will exceed the amount of time required to reach the required sensitivity. Make sure to request sufficient time to meet the needs of the observation.

## Useful Resources & Tools

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The LBO currently uses the NRAO Proposal Submission Tool and other proposal tools (such as the Proposal Finder Tool), and the NRAO Helpdesk to manage proposal submission and user support. Proposers must therefore be registered in the NRAO User Database, available via [NRAO Interactive Services. \(https://my.nrao.edu/\)](https://my.nrao.edu/). If you are already a registered user, you are encouraged to update your profile.

### Proposal Submission Tool

The Proposal Submission Tool and associated documentation is accessed through [NRAO Interactive Services \(http://my.nrao.edu/\)](http://my.nrao.edu/).

### Proposal Finder Tool

The [Proposal Finder Tool \(http://library.nrao.edu/proposals\)](http://library.nrao.edu/proposals) (PFT) may be used to search cover sheets of proposals approved for time on NRAO telescopes. The PFT returns the proposal's authors, title, abstract, and, if available, approved hours.

### Links to VLBA Documentation



## General

- [VLBA Observational Status Summary \(https://science.lbo.us/facilities/vlba/docs/manuals/oss\)](https://science.lbo.us/facilities/vlba/docs/manuals/oss)
- [NRAO Helpdesk \(https://help.nrao.edu/\)](https://help.nrao.edu/)

## High Sensitivity Array

- [VLBA+ Observing \(https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus\)](https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus)
- [Observing with the High Sensitivity Array \(https://science.lbo.us/facilities/vlba/proposing/HSA-Tips\)](https://science.lbo.us/facilities/vlba/proposing/HSA-Tips)
- [VLBI at the VLA \(https://science.lbo.us/facilities/vla/docs/manuals/obsguide/modes/vlbi\)](https://science.lbo.us/facilities/vla/docs/manuals/obsguide/modes/vlbi)
- [VLBI on the GBT \(http://www.gb.nrao.edu/~fghigo/gbt/doc/vlbinfo.html\)](http://www.gb.nrao.edu/~fghigo/gbt/doc/vlbinfo.html)

## Proposing

- [EVN Sensitivity Calculator \(http://www.evlbi.org/cgi-bin/EVNcalc\)](http://www.evlbi.org/cgi-bin/EVNcalc)

## Observing

- [SCHED User Manual \(http://www.aoc.nrao.edu/software/sched\)](http://www.aoc.nrao.edu/software/sched)
- [VLBA Calibrator Search Tool \(https://www.lbo.us/vlba/astro/calib/\)](https://www.lbo.us/vlba/astro/calib/)

## Analysis

- [NRAO Data Archive \(https://archive.nrao.edu/archive\)](https://archive.nrao.edu/archive)