

# NRAO Call for Proposals: Semester 2019B

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4 January 2019



The National Radio Astronomy Observatory (NRAO) invites scientists to participate in the Semester 2019B Call for Proposals for the Karl G. Jansky Very Large Array (VLA) and the Very Long Baseline Array (VLBA), High Sensitivity Array (HSA), and Global 3mm VLBI Array (GMVA).

**The submission deadline for Semester 2019B proposals is Friday, 1 February 2019, at 17:00 EST (22:00 UTC).**

The NRAO especially wishes to highlight a new opportunity with the **XMM-Newton Telescope** and continuing opportunities for joint observations with the **Chandra X-ray Observatory**, the **Hubble Space Telescope**, and the **Swift Gamma-Ray Burst Mission**.

Proposal preparation and submission are handled via the NRAO Proposal Submission Tool (PST) available at [NRAO Interactive Services \(http://my.nrao.edu/\)](http://my.nrao.edu/). Proposers who need assistance with proposal preparation or have questions regarding the Call for Proposals or NRAO telescope capabilities should contact Observatory staff via the NRAO [Helpdesk \(https://help.nrao.edu/\)](https://help.nrao.edu/). Note that using these tools (both the PST and the Helpdesk) requires registration.

## News & Opportunities

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### Joint NRAO and GBO Telescope Time Allocation Process

Proposals to the National Radio Astronomy Observatory ([NRAO \(https://science.nrao.edu/observing/\)](https://science.nrao.edu/observing/)) and the Green Bank Observatory ([GBO \(http://greenbankobservatory.org/\)](http://greenbankobservatory.org/)) for the scientific use of its telescopes are evaluated on the basis of scientific merit and technical feasibility using a [panel-based proposal review system \(https://science.nrao.edu/observing/proposal-types/proposal-review-system\)](https://science.nrao.edu/observing/proposal-types/proposal-review-system). This joint process is run by the NRAO in accordance with its [policy of non-discrimination and inclusion. \(https://info.nrao.edu/do/odi/nrao-diversity\)](https://info.nrao.edu/do/odi/nrao-diversity)

The NRAO 2019B Call for Proposals is for observations with the VLA and VLBA/HSA/GMVA; the corresponding call for the GBT can be found at the [GBO Call for Proposals \(http://greenbankobservatory.org/gbt-observers/proposals/2019b-call-for-proposals/\)](http://greenbankobservatory.org/gbt-observers/proposals/2019b-call-for-proposals/).

### Change to the Science Categories

The ETP science category will be split into two in order to manage the increasing number of proposals received in this science area. The new categories will be:

**GWT** – Gravitational Waves and Energetic Transients: supernovae, gravitational wave sources, gamma-ray bursts, tidal disruption events, fast radio bursts, exotic/unknown transients.

**PCO** – Pulsars and Compact Objects: millisecond pulsars, cataclysmic variables, black hole and/or neutron star x-ray binaries, pulsar timing, pulsar proper motion.

All proposals submitted on or after 4 January 2019 will need to specify one of the following nine [science categories \(https://science.nrao.edu/observing/proposal-types/proposalsciencecategories\)](https://science.nrao.edu/observing/proposal-types/proposalsciencecategories): SSP, GWT, PCO, SFM, ISM, NGA, EGS, AGN or HIZ.

### New Opportunities

#### Joint Observations with XMM-Newton Project

By agreement with the NRAO and GBO 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 open skies observing time. Similarly the NRAO/GBO Time Allocation Committee may award up to 150 ks of XMM-Newton time per year. See the [Joint Observations with XMM-Newton \(https://science.nrao.edu/observing/call-for-proposals/2019b/new-opportunity-joint-observations-with-xmm-newton\)](https://science.nrao.edu/observing/call-for-proposals/2019b/new-opportunity-joint-observations-with-xmm-newton) page for details.

### Continuing Opportunities

Access to the Joint Observing program will continue for the VLA, VLBA and GBT for semester 19B.

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

The community has the opportunity to propose for observing time on NRAO facilities through a joint program with the Chandra X-ray Observatory. Proposers to the NRAO have the opportunity to request time on Chandra, to be awarded on the recommendation of the NRAO Telescope Allocation Committee (TAC) and approved by the NRAO Director. Up to 120 ksec will be made available to NRAO proposers annually. See the [Joint Observations with Chandra \(https://science.nrao.edu/observing/call-for-proposals/2019b/chandra\)](https://science.nrao.edu/observing/call-for-proposals/2019b/chandra) page for details.

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

By agreement between the NRAO and the Space Telescope Science Institute, STScI can award up to 3% of the available time on NRAO's North American facilities to highly ranked proposals that request time on both HST and NRAO telescopes. In return, STScI has offered 30 orbits of HST time for allocation by the NRAO TAC per year. See the [Joint Observations with HST \(https://science.nrao.edu/observing/call-for-proposals/2019b/hubble-space-telescope\)](https://science.nrao.edu/observing/call-for-proposals/2019b/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 NRAO to award up to 300 kiloseconds of Swift observing time per year. Similarly, NRAO permits the Swift Guest Investigator (GI) Program to award NRAO observing time. See the [Joint Observations with Swift \(https://science.nrao.edu/observing/call-for-proposals/2019b/swift\)](https://science.nrao.edu/observing/call-for-proposals/2019b/swift) page for details.

## **Joint Observations with Fermi Gamma-ray Space Telescope**

It is possible to propose for observing time on NRAO facilities through the Fermi Gamma-ray Space Telescope Joint Proposal Opportunity or the Cooperative Proposal Opportunity. See the [Joint Observations with Fermi \(https://science.nrao.edu/observing/call-for-proposals/2019b/fermi\)](https://science.nrao.edu/observing/call-for-proposals/2019b/fermi) page for details.

## **Joint Proposals Between the VLA, GBT, and VLBA**

Observing programs that require combinations of the GBT, VLBA, and/or the VLA should submit a proposal for each of the requested telescopes, with a clear justification for each, as has been the case to date. The proposals will be reviewed and considered jointly by the Time Allocation Committee. VLBI proposals which request the GBT or VLA (or any other HSA telescope) as elements of the VLBI array do not need separate proposals---those telescopes can be selected as separate VLBI stations from a VLBA/HSA proposal.

## **Director's Discretionary Time Including Education and Public Outreach**

Proposals for Director's Discretionary Time (DDT) may be submitted at any time. They must be submitted through the [PST \(https://my.nrao.edu/\)](https://my.nrao.edu/). DDT proposals are intended to address [targets of opportunity \(https://science.nrao.edu/observing/proposal-types/too\)](https://science.nrao.edu/observing/proposal-types/too), high-risk/high-return [exploratory time \(https://science.nrao.edu/observing/proposal-types/exploratoryproposals\)](https://science.nrao.edu/observing/proposal-types/exploratoryproposals), or other science opportunities deemed sufficiently urgent to justify prompt action.

DDT proposals may also be submitted for the purpose of education and public outreach - for example, to image an iconic source or to support an educational opportunity for students. Such proposals should clearly justify the requirements for the requested time allocation and observing mode on any given instrument, and should describe the anticipated impact of the observation.

While there is not an *a priori* limit to time that can be requested via DDT, it is expected that no more than 5% of the observing time on each telescope will be allocated for this purpose.

## **Other Proposal Opportunities**

The NRAO would like to make users aware that there are additional proposal opportunities as follows:

- **High Risk Proposals:** As a means of maximizing its scientific impact through cutting-edge observations, the Observatory encourages the submission of high-risk/high-reward proposals.
- **Commensal Observing:** NRAO telescopes and backends are sufficiently flexible in many cases to allow two experiments to run commensally. To the degree that this enhances science return from the telescopes, NRAO wishes to support commensal projects subject to resource and scheduling constraints.
- **Filler Programs:** Some programs are not time critical, strongly dependent on array configuration, or require highly subscribed LST ranges. Such programs may be able to take advantage of "filler" time.

Further information about each of these programs can be found on the [Proposal Opportunities](https://science.nrao.edu/observing/proposal-types/proposal-opportunities) (<https://science.nrao.edu/observing/proposal-types/proposal-opportunities>) page.

# VLA Proposal Guide

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## VLA Configuration Plans and Science Time Available

The 1 February 2019 deadline covers the observing period 20 November 2019 through 10 February 2020 (Semester 2019B), corresponding to the D configuration of the VLA. Multi-configuration proposals that include this configuration may also be submitted. Additionally, proposals requesting only configurations that will fall in semester 2020A (or later) may be submitted if the Principal Investigator is a graduate student. NRAO offers this service to provide scientific and technical feedback for students, and to provide them with an opportunity to re-submit their proposals for their principal semester with this information in hand. Students should ensure that their status is up to date and correct in the NRAO User Database. Please refer to the [VLA Configuration Plans \(http://go.nrao.edu/vla-plan\)](http://go.nrao.edu/vla-plan) for details and availability of upcoming configurations.

A plot of estimated available observing hours as a function of LST and weather conditions for the D configuration in semester 2019B is below. In this plot, engineering, maintenance, and testing cause the solid (upper) line to be less than the total number of LST days in the configuration; such activities occur predominantly during daytime.



Estimated science time available per LST hour is shown by the solid (upper) black line for all frequencies, the dashed (middle) line for K-band conditions, and dotted (lower) line for Q-band conditions. The colored bars show time already committed in previous proposal rounds, where green represents priority A, yellow priority B, and red priority C. For the net available time in either configuration per LST hour subtract the bars of the pre-committed time from the black curve.

## Observing Capabilities for Semester 2019B

For the 2019B observing semester, we have added the following capabilities to our General Observing (GO) program: frequency averaging, and phase-binned pulsar observations. Details are given in the [Offered VLA Capabilities during the Next Semester \(http://go.nrao.edu/vla-capabilities\)](http://go.nrao.edu/vla-capabilities) section of the [Observational Status Summary \(http://go.nrao.edu/vla-oss\)](http://go.nrao.edu/vla-oss) (OSS) and are summarized in the following table. Several additional capabilities are available to proposers through the Shared Risk Observing (SRO) and Resident Shared Risk Observing (RSRO) programs, as described below.

Capability	Description
8-bit samplers	<p>Standard default setups for:</p> <ul style="list-style-type: none"> <li>• 2 GHz bandwidth continuum observations at S/C/X/Ku/K/Ka/Q bands (16 × 128 MHz subbands)</li> <li>• 1 GHz bandwidth continuum observations at L-band (16 × 64 MHz subbands)</li> <li>• 256 MHz bandwidth continuum observations at P-band (16 × 16 MHz subbands)</li> </ul> <p>Flexible setups for spectroscopy, using two, independently tunable, 1 GHz baseband pairs, each of which can be split into up to 16 flexibly tunable subbands</p> <p>Single, dual, and full polarization products</p>
3-bit samplers	<p>Standard default setups for:</p> <ul style="list-style-type: none"> <li>• 8 GHz bandwidth continuum observations at K/Ka/Q-bands</li> <li>• 6 GHz bandwidth at Ku-band</li> <li>• 4 GHz bandwidth at C/X-bands</li> </ul> <p>Flexible setups for spectroscopy, using four, independently tunable, 2 GHz baseband pairs, each of which can be split into up to 16 flexibly tunable subbands</p> <p>Single, dual, and full polarization products</p>
Mixed 3-bit and 8-bit samplers	Allows more flexibility for simultaneous continuum and high-resolution spectral line observing
Subarrays	Up to 3 independent subarrays using standard 8-bit continuum setups
Phased array for VLBI	See <a href="https://science.nrao.edu/observing/call-for-proposals/2019b/vlba-proposal-guide">VLBA Call for Proposals (https://science.nrao.edu/observing/call-for-proposals/2019b/vlba-proposal-guide)</a>
Solar observing	All solar observing except the L-band reverse-coupled system
On-The-Fly Mosaicing (OTF)	P-, L-, S-, and C-bands only; no subarrays
Pulsar	Phase-binned pulsar observing
Frequency averaging	Frequency averaging in the correlator by a factor of two or four (only available for single subarray and non-OTF observations)

Both single pointing and mosaics with discrete, multiple field centers will be supported. Data rates up to 25 MB/s (90 GB/hour) will be available to all users and, with additional justification, data rates up to 60 MB/s (216 GB/hour) will be available. [Correlator integration time limits per band and per array configuration \(http://go.nrao.edu/tim-res\)](http://go.nrao.edu/tim-res) also apply as described in the OSS. The data rate and total data volume required by a proposal will be a consideration in its technical evaluation.

There are some [limitations on frequency settings and tuning ranges \(http://go.nrao.edu/vla-frq\)](http://go.nrao.edu/vla-frq), especially at Ka-band; please consult the OSS for further details. Additionally, the [Exposure Calculator \(http://go.nrao.edu/ect\)](http://go.nrao.edu/ect) has been updated and other special tools are available to assist users with the development of correlator setups for the proposal deadline (see [VLA Proposal Submission Guidelines \(http://go.nrao.edu/vla-steps\)](http://go.nrao.edu/vla-steps)). All antennas employ electronics and receiver systems that provide continuous frequency coverage from 1–50 GHz in the following observing bands: 1–2 GHz (L-band); 2–4 GHz (S-band); 4–8 GHz (C-band); 8–12 GHz (X-band); 12–18 GHz (Ku-band); 18–26.5 GHz (K-band); 26.5–40 GHz (Ka-band); and 40–50 GHz (Q-band). In

addition to these, all VLA antennas are equipped with 224-480 MHz (P-band) and 54-86 (4-band) receivers near the prime focus. For details see the Low Frequency Observing section below.

We continue to offer shared risk programs to our user community for those who would like to push the capabilities of the VLA beyond those offered for general use.

## VLA Shared Risk Observing

The VLA Shared Risk Observing (SRO) program allows users access to capabilities that can be set up via the Observation Preparation Tool (OPT) and run through the dynamic scheduler without intervention, but are not well tested. The following capabilities are offered under the SRO program in Semester 2019B:

- On-the-Fly (OTF) mosaicing for X-, Ku-, K-, Ka-, and Q-bands (used when each pointing on the sky is no more than a few seconds), but not using subarrays; and
- 32 subbands per baseband with the 8-bit samplers.

See the [VLA Proposal Submission Guidelines \(http://go.nrao.edu/vla-steps\)](http://go.nrao.edu/vla-steps) web page for information about tools and other advice on proposing for Shared Risk observing capabilities.

## VLA Resident Shared Risk Observing

The VLA Resident Shared Risk Observing (RSRO) program provides access to extended capabilities of the VLA that require additional testing. This access is provided in exchange for a period of residence to help commission those capabilities. Examples of capabilities that would fall under the RSRO program in Semester 2019B include:

- correlator dump times shorter than 50 msec, including integration times as short as 5 msec for transient detection;
- pulsar observations using the YUPPI system;
- data rates above 60 MB/s;
- recirculation beyond a factor of 64 in the correlator;
- P-band system (224–480 MHz) polarimetry;
- 4-band system (54–86 MHz; see Low Frequency Observing section below);
- more than 3 subarrays, or subarrays with the 3-bit system;
- complex phased array observations (e.g., pulsar and complex VLBI observing modes);
- Frequency averaging by more than a factor of 4.

A detailed description of the VLA RSRO program for semester 2019B and beyond is available at the [VLA Proposal Submission Guidelines \(http://go.nrao.edu/vla-steps\)](http://go.nrao.edu/vla-steps) web page.

## Low Frequency Observing

The new low frequency receiver system developed in collaboration with the Naval Research Laboratory is available for observations at P-band (224–480 MHz) through the GO and SRO programs. Use of the P-band system for polarimetry is through the RSRO Program. The new receivers also work at 4-band (54–86 MHz), and new feeds will have been deployed on all VLA antennas by the time of the 2019B semester. Both 4-band and P-band can be observed simultaneously, but access to the 4-band system is only available through the RSRO program.

## Commensal Observing Systems at the VLA

There are two commensal systems on the VLA that may take data at the same time as your proposed observation. The first is the [VLITE \(http://vlite.nrao.edu/\)](http://vlite.nrao.edu/) system, which will take data at P-band during regular observations that use bands other than P-band. The VLITE system is deployed on fifteen VLA antennas.

Observers wishing to gain access to the commensal VLITE data taken during their VLA observations should follow the instructions on the [VLITE \(http://vlite.nrao.edu/\)](http://vlite.nrao.edu/) web page for doing so. The second is the [realfast \(http://realfast.io/\)](http://realfast.io/) system, which takes data at very fast dump rates in an effort to detect Fast Radio Bursts (FRBs). This system is still in development, but we expect it to be observing during the 2019B semester.

## Proposal and Observation Preparation

Proposal preparation and submission are via the Proposal Submission Tool (PST) at [NRAO Interactive Services \(https://my.nrao.edu/\)](https://my.nrao.edu/). Use of the PST requires registration in the NRAO User Database. There are various tools and documentation to help users in this process. Descriptions of all updated documentation and tools, along with an outline of the steps required to write a proposal, are available at the [Guide to Proposing for the VLA \(http://go.nrao.edu/vla-prop\)](http://go.nrao.edu/vla-prop) web page.

When constructing sessions in the PST, proposers should be cognizant of their use by the Time Allocation Committee (TAC). Specifically taking into account the time available as a function of LST, software will assign an initial scheduling priority to each session in each proposal, which can be modified by the TAC if they desire. The assigned scheduling priority will depend on the linear-rank score of the proposal from its scientific review, the LSTs involved in the session (daytime is harder to accommodate than nighttime, for instance), the predicted atmospheric conditions for observing over that LST range at the time of year of the configuration, the total time requested in the session, and the competition from other proposals requesting time at similar LSTs. Please see [this description \(http://go.nrao.edu/obs-session\)](http://go.nrao.edu/obs-session) for guidance on how to set up sessions in the PST, and [this document \(http://www.aoc.nrao.edu/~schedsoc/VLAprioritizerMemo.pdf\)](http://www.aoc.nrao.edu/~schedsoc/VLAprioritizerMemo.pdf) for a complete description of the VLA Prioritizer (the software that generates the initial scheduling priorities for all sessions that are subsequently used by the TAC to derive the final priorities).

All approved VLA observations are set up using the [Observation Preparation Tool \(OPT\) \(http://go.nrao.edu/opt-doc\)](http://go.nrao.edu/opt-doc). Most, if not all, projects will be observed dynamically; users should submit scheduling blocks before the start of the configuration to maximize the opportunity of them being observed. Advice on the optimal length of scheduling blocks and other useful information may be found at the [Observing FAQ \(http://go.nrao.edu/vla-obsfaq\)](http://go.nrao.edu/vla-obsfaq) web page.

Information about VLA capabilities, proposal preparation and submission, observing strategies, and calibration overhead can be found in the [VLA Observational Status Summary \(http://go.nrao.edu/vla-oss\)](http://go.nrao.edu/vla-oss), at the [Guide to Proposing for the VLA \(http://go.nrao.edu/vla-prop\)](http://go.nrao.edu/vla-prop), and at the [Guide to Observing with the VLA \(http://go.nrao.edu/vla-obs\)](http://go.nrao.edu/vla-obs). Answers to Frequently Asked Questions are contained in these proposing and observing guides. Questions may also be directed to the [NRAO Helpdesk \(http://go.nrao.edu/obshelp\)](http://go.nrao.edu/obshelp).

## VLBA, HSA, and GMVA Proposal Guide

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Proposal submission information for the following three combinations of telescopes are detailed in individual sections below:

- [Very Long Baseline Array](https://science.lbo.us/facilities/vlba/) (VLBA) and [High Sensitivity Array](https://science.lbo.us/facilities/vlba/proposing/HSA/) (HSA) proposals requesting time in Semester 2019B (2019 August 1 - 2020 January 31) or multi-semester proposals.
- [Global mm VLBI Array](https://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/) (GMVA) proposals for 2019 Session II (Oct 03 - Oct 08), or later sessions.

## VLBA Proposals

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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/) (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) of the VLBA OSS, which also includes suggestions for selecting the optimal observing system for various scientific goals.

Approximately 1000 to 1200 hours of VLBA observing time are expected to be available for Open Skies in observing semester 2019B. We expect that this available time will be distributed roughly uniformly with GST.

VLBA proposals must be prepared and submitted using the NRAO Proposal Submission Tool (PST), accessible via [NRAO Interactive Services](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.

## VLBA Shared Risk Observing

In 2019B, the VLBA will again offer the use of all **VLBA** stations (**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 19B we expect to be able to support 4096 Mbps recording for ~40% of the open-skies observing time. Therefore we will 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.

## VLBA Resident Shared Risk Observing

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.

## High Sensitivity Array (HSA) Proposals

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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. All of the HSA stations are equipped with instrumentation compatible with the VLBA observing capabilities described in [Section 5.4 \(https://science.lbo.us/facilities/vlba/docs/manuals/oss/sig-proc/rdb\)](#) of the VLBA OSS. Ongoing special considerations for the HSA telescopes are documented in [OSS Section 14.2 \(https://science.lbo.us/facilities/vlba/docs/manuals/oss/vlba-plus/hsa\)](#); 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 2019B, in the **A** and **D** configurations. High frequencies (at receiver bands 22 GHz and above) have better phasing in the more compact configurations (**C** and **D**). High frequency phasing in the extended configurations in the summer can be quite difficult.

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, 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) Proposals, including Phased ALMA**

GMVA proposals submitted by the 2019 February 1 deadline will be considered for scheduling in 2019 Session II (Oct 03 - Oct 08), 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 the GBT and/or ALMA in a GMVA proposal should be quantitatively justified. ALMA and/or the KVN must be specified by entering "ALMA" or "KVN" as "Other" entries in the PST.

Note that the availability of NOEMA (PLATEAU DE BURE) for GMVA Session II in 2019 and later sessions is currently uncertain.

### **Another opportunity to propose VLBI observations using the phased ALMA telescope will be available at this Call for GMVA proposals:**

It is expected that phased ALMA will participate in some GMVA observations during ALMA Cycle 7 (Oct 2019 - Sept 2020; see the [ALMA Cycle 7 Pre-announcement \(https://almascience.org/news/alma-cycle-7-pre-announcement\)](https://almascience.org/news/alma-cycle-7-pre-announcement)). There are likely to be ~43 ALMA antennas available to the ALMA observation; but the phased sum used for VLBI may be constructed only from those that lie within a circle of radius 0.5 km. GMVA session dates for 2020 are not yet fixed but Session I in 2020, which is traditionally in the period March - May, would provide an opportunity for GMVA + ALMA observing.

*Any GMVA proposal requesting phased ALMA during Cycle 7 must be submitted via the NRAO PST at the February 1, 2019 deadline.*

Proposers should:

- specify "ALMA" in the *Other Stations* text field in the PST
- select the default GMVA 3mm observing mode of 2 Gbps, dual polarization
- specify the amount of time and GST range(s) needed for ALMA *separately*, either in Session Constraints or Comments, or in the Technical Justification.

A separate proposal to ALMA must also be submitted at the deadline for ALMA Cycle 7 proposals on April 17, 2019. For this, all proposers (PI and Co-I's) must be registered ALMA users (see: <http://www.almascience.org> (<http://www.almascience.org/>)).

*Restrictions on GMVA+ALMA proposal in Cycle 7:*

- GMVA observations with ALMA will be limited to a fixed recording mode, which currently provides 2 Gbps on all baselines. The KVN will not be available in this mode. Only VLBA telescopes will be available at 7mm in this mode.
- Due to the need to phase up on science target sources themselves, they will be restricted to those with a flux density  $>0.5$  Jy contained within an unresolved core on ALMA baselines up to 1 km.
- In order to make a clean linear-to-circular polarization transformation of ALMA recordings, any target source must be observed for a duration of at least 3 hours (breaks for calibrators permitted) to sample a range of parallactic angles.
- Large Programs ( $>50$  hours of observing time) are not permitted because phased ALMA is a non-standard mode.
- No long-term programs may be proposed, and no proposals will be carried over into the next cycle.
- There is a cap for VLBI of 5% of ALMA Cycle 7 observing time. As time for GMVA observations will thus be scarce, proposals should include a quantitative justification as to why ALMA is essential for the goals of the project.

*Resubmission of ALMA Cycle 6 proposals:*

The outcome of scheduled GMVA+ALMA Cycle 6 observations scheduled in April 2019 is unlikely to be known until after the ALMA Cycle 7 proposal deadline. If the PI wishes to mitigate against the possibility that these observations are not completed successfully, the proposal must be **resubmitted to ALMA** by the Cycle 7 proposal deadline and undergo a new review. **The proposal does not need to be resubmitted to the GMVA in this case.** Observations in Cycle 7 will only occur if the April 2019 observations are not completed successfully and the ALMA Cycle 7 proposal is ranked high enough for scheduling.

However, if the PI wishes to obtain a second epoch of GMVA+ALMA observations, even if the April 2019 observations are successful, a new proposal must be submitted to **both the GMVA and ALMA** by their respective proposal deadlines.

## Alerts & Tips for Proposers

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### Change to the Science Categories

The ETP science category will be split into two in order to manage the increasing number of proposals received in this science area. The new categories will be:

**GWT** – Gravitational Waves and Energetic Transients: supernovae, gravitational wave sources, gamma-ray bursts, tidal disruption events, fast radio bursts, exotic/unknown transients.

**PCO** – Pulsars and Compact Objects: millisecond pulsars, cataclysmic variables, black hole and/or neutron star x-ray binaries, pulsar timing, pulsar proper motion.

All proposals submitted on or after 4 January 2019 will need to specify one of the following nine [science categories](https://science.nrao.edu/observing/proposal-types/proposalsciencecategories) (<https://science.nrao.edu/observing/proposal-types/proposalsciencecategories>): SSP, GWT, PCO, SFM, ISM, NGA, EGS, AGN or HIZ.

### Source Lists

The Observatory requires proposers to specify their source lists in full. This enables the Observatory 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 Observatory.

### Dissertation Plans

Students PROPOSING to use an NRAO telescope for their PhD dissertation MUST submit a "Plan of Dissertation Research" IF THEY CHECK THE THESIS BOX ON THE PST. THE PLAN SHOULD BE no more than 1000 words, AND SUBMITTED with their first proposal. This plan can be referred to in later proposals. **The Plan of Dissertation is important in the proposal review process and should be well written; it is not a placeholder.** At a minimum it should contain:

- A summary of thesis science and goals.
- The role played by NRAO observations being proposed.
- A thesis time line.
- The adviser name and institution.
- An estimate of the total NRAO telescope resources needed.

The plan provides some assurance against a dissertation being impaired by adverse referee comments on one proposal, when the referees do not see the full scope of the project. This requirement applies to all three of the NRAO major instruments: VLA, VLBA and GBT.

The Plan of Dissertation Research can be uploaded either from the Author's page or from the student's user profile at: Profile > My Profile > User Preferences. The Plan of Dissertation Research is associated with an Author which can then be used in one or more proposals. The Plan of Dissertation Research field here is only used to display the current status. For example, if there are no students listed on the proposal who are observing for their thesis the text box will display: Dissertation Research Plan(s) not required"

### Tips for Proposers

The NRAO proposal evaluation and time allocation process is panel based. That is, members of the scientific community are responsible for reviewing proposals based on their scientific merit through the [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 program of 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.

## Useful Resources & Tools

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**Note:** you must be a registered NRAO user to access some of these resources. Please go to [NRAO Interactive Services \(http://my.nrao.edu/\)](http://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.

### Very Large Array (VLA)

- [VLA Observational Status Summary \(http://go.nrao.edu/vla-oss\)](http://go.nrao.edu/vla-oss)
- [Guide to Proposing for the VLA \(http://go.nrao.edu/vla-prop\)](http://go.nrao.edu/vla-prop)
- [Guide to Observing with the VLA \(http://go.nrao.edu/vla-obs\)](http://go.nrao.edu/vla-obs)
- [VLA Configuration Plans and Science Time Available \(http://go.nrao.edu/vla-plan\)](http://go.nrao.edu/vla-plan)
- [VLA Exposure Calculator \(http://go.nrao.edu/ect\)](http://go.nrao.edu/ect)

### Very Long Baseline Array (VLBA)

- [VLBA Observational Status Summary \(https://science.lbo.us/facilities/vlba/docs/manuals/oss\)](https://science.lbo.us/facilities/vlba/docs/manuals/oss)
- 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 \(http://www.gb.nrao.edu/~fghigo/gbt/vlbinfo.html\)](http://www.gb.nrao.edu/~fghigo/gbt/vlbinfo.html)
- [VLBA/HSA Sensitivity \(via EVN Sensitivity Calculator\) \(http://www.evlbi.org/cgi-bin/EVNcalc\)](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/)

### NRAO Helpdesk

For help on any aspect of proposing or observing not found in our documentation, please file a ticket with the [NRAO helpdesk \(https://help.nrao.edu/\)](https://help.nrao.edu/).



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