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**European VLBI Network**  
**Call for Proposals**  
**Deadline: 1 June 2020 23:59:59 UTC**  
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Observing proposals are invited for the European VLBI Network (EVN). The EVN facility is open to all astronomers. Astronomers with limited or no VLBI experience are particularly encouraged to apply for observing time. Student proposals are judged favorably.

Support with proposal preparation, scheduling, correlation, data reduction and analysis can be requested from the [Joint Institute for VLBI ERIC \(JIVE\)](#).

The EVN is a Very Long Baseline Interferometry (VLBI) network of radio telescopes operated by an international consortium of institutes. It is located primarily in Europe and Asia, with



Artist impression of the transient AT2018cow as a newly formed magnetar, as revealed by multi-epoch 5 GHz EVN observations (Mohan, An & Yang, 2020, ApJL, 888, L24).

additional antennas in South Africa and Puerto Rico. The EVN provides very high sensitivity images at angular scales of (sub-)milliarcseconds in the radio domain. EVN proposals may also request **joint e-MERLIN and EVN observations** for an improved uv-coverage at short spacings, significantly increasing the largest detectable angular size to arcsecond scales. Further improvement of the uv-coverage may be achieved in **global VLBI observations** when the EVN observes jointly with NRAO/GBO telescopes or with the Long Baseline Array.

EVN observations may be conducted with disk recording (standard) or in **real-time correlation (e-VLBI), which guarantees a rapid turnaround**. Standard EVN observations are available at wavelengths of 92, 50, 30, 21/18, 13, 6, 5, 3.6, 1.3 and 0.7 cm. e-VLBI observations can be performed at 21/18, 6, 5, and 1.3 cm. e-MERLIN can be combined with the EVN in both standard and e-VLBI observations. Global observations are performed only with standard observations. Every year standard EVN observations occur during three sessions of approximately 21 days each and ten separate days are available for e-VLBI observations.

Proposals can be submitted for the following main classes of observations:

- **Regular proposals:** standard EVN (disk recording), e-VLBI, trigger and Out-of-Session observations, which may include large proposals, trigger proposals, global proposals, and proposals with the inclusion of additional EVN/non-EVN antennas (including integrated e-MERLIN observations), and correlator-only proposals

- **Target of Opportunity (ToO) proposals**
- **Short Observation proposals**

The deadlines for proposal submission are on 1 February, 1 June and 1 October each year, except for ToO and Short Observation proposals, which can be submitted any time. More information regarding the EVN capabilities, observing sessions, proposal guidelines, and user support can be found at [www.evlbi.org](http://www.evlbi.org).

Large EVN observation proposals (>48 hrs) are encouraged by the EVN Programme Committee (PC). These will be subject to more detailed scrutiny on the feasibility of the proposal: the EVN PC may, in some cases, grant the observing time in tranches or attach conditions on the release of the data. There is no upper limit on the amount of time that may be requested by an EVN large proposal and projects of more than one hundred hours have been granted. Large proposals can also be proposed as global programmes (although note the different availability levels of VLBA, versus VLA and GBT, see 'Global VLBI proposals' below) and with the integration of e-MERLIN. Large projects involving several observing epochs will be asked for progress reports by the PC.

### **Proposal guidelines**

All regular proposals should be submitted through the [Northstar submission tool](#).

Proposals must include a Science & Technical justification, and optionally, figures, tables and references. These sections shall be submitted as a single PDF document. The total length of this document is limited to 4 pages (A4 or US Letter format), with a font size no smaller than 11 points. Proposers are free to adjust the length of the various proposal sections within this overall length limit.

The strongly recommended breakdown, however, is 2 pages for the Science & Technical justification and 2 pages for figures, tables and references. Figures and tables may be interleaved with the science justification, so that e.g. figures appear close to the location in the text where references are made to them.

Guidelines for ToO and Short Observations proposals can be found [here](#).

Questions regarding the proposal preparation can be sent to Zsolt Paragi (zparagi@jive.eu). If you need assistance, please indicate that well in advance of the deadline.

### **Recording capabilities for the next standard EVN and e-VLBI Sessions**

Disk recording at 2 Gbps is available at 6, 3.6, 1.3 and 0.7 cm on the majority of EVN telescopes. The remaining telescopes will record at 1 Gbps or the highest possible bit-rate (mixed mode observation). The current status is given [here](#).

e-VLBI at 2 Gbps is available at 6 cm and 1.3 cm on the majority of EVN telescopes. The remaining telescopes will observe at 1 Gbps or the highest possible bit-rate (mixed mode observation). The current status is given in the 'operational modes' section on <http://www.evlbi.org/capabilities>.

The choice of data rate should be clearly justified in the proposal.

### **Proposing for standard EVN observing sessions (disk recording)**

Proposals received by 1 June 2020 will be considered for scheduling in Session 3, 2020 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure and grade.

Upcoming standard EVN Sessions

Year	Session	Dates
2020	Session 3	15 Oct - 05 Nov
2021	Session 1	Feb/Mar

### **Proposing for e-VLBI observing days (real-time correlation)**

e-VLBI experiments are carried out in 10 days spread over the year, outside of the regular EVN sessions. The correlation is done real-time, and the data are delivered to the proposers rapidly, which may be an advantage for rapid response science or science with temporal constraints (e.g., transients, astrometry). Also projects that can justify the need for rapid data delivery, e.g., student projects, are eligible.

e-VLBI projects are centrally scheduled (using inputs from the PI) because several projects may be observed in a single session. This advanced user support makes e-VLBI ideal for less experienced users. Note that some observing modes, such as multi-phase centre observing and multi-pass correlation are not available in e-VLBI. Please contact the [JIVE User Support](#) if you are planning a non-standard observing mode.

The request for e-VLBI should be clearly justified in the proposal and, if multi-epoch e-VLBI is requested, proposals should also indicate the range of temporal cadence the proposal could sustain. Please consult the 'operational modes' section on <http://www.evlbi.org/capabilities> to check for possible updates, and for the available array.

Successful proposals with an e-VLBI component submitted by the June 1 deadline will be considered for scheduling on the e-VLBI days starting from September 2020. Note that e-VLBI days are limited to a single observing frequency which will be based on the *highest graded proposal*. The schedule (including the frequency and the participating antennas) can be modified up to 08:00 UT on the day before the e-VLBI run starts.

### Upcoming e-VLBI days

Year	Begin Science Time 13:00 UTC	End Science Time 13:00 UTC
2020	15 Sep	16 Sep
2020	06 Oct	07 Oct
2020	17 Nov	18 Nov
2020	01 Dec	02 Dec

### **Out-of-Session Observing**

Out-of-Session observing time on user specified dates (up to a maximum of 144 hours/year), is available for both disk recording and e-VLBI modes. Proposals requesting Out-of-Session observing time must provide full scientific (and technical if appropriate) justification as to why observations must be made outside standard sessions.

Out-of-session observing will be scheduled in blocks of no less than 12 hours in duration (although proposals may request shorter observations), and occur no more than 10 times per year. Proposals should specify which dates/GST ranges are being requested and indicate the minimum requirement in terms of numbers of telescopes (and any particular telescopes).

Proposals will only be considered for dates occurring after the regular EVN session that follows the EVN proposal review.

**Urgent observations requiring much shorter lead times should be submitted as "[Target-of-Opportunity](#)" (ToO) proposals.**

### **Availability of EVN Antennas**

The latest status of the EVN antennas can be found [here](#).

The three **Quasar** antennas of the Russian VLBI Network (Badary, Svetloe and Zelenchukskaya) are now available for e-VLBI. Their participation is planned for the 2020 e-VLBI days in: Mar, Apr, Sep, Nov and Dec.

The **Kunming 40 m telescope**, operated by the Yunnan Astronomical Observatory, became a regular EVN station and can be requested for EVN disk-recording observations at 13, 6, 5 and 3.6 cm wavelengths.



Image by Paul Boven (boven@jive.eu). Satellite image: Blue Marble Next Generation, courtesy of Nasa Visible Earth (visibleearth.nasa.gov).

The **Arecibo Observatory** is available for VLBI observations. However, severe flooding following Hurricane Maria, has caused a deformation of a localised area of the dish affecting its exact sphericity. This has resulted in a drop of Arecibo's high-frequency gain that can be quantified at 18 cm as an SEFD of  $\sim 3.1\text{-}3.5$  Jy (cf. an SEFD of  $\sim 2.2\text{-}2.5$  Jy normally expected for zenith angles less than 16 deg) and at 6 cm as an SEFD of  $\sim 7.3$  Jy (cf. an expected SEFD of  $\sim 3.5$  Jy between zenith angles 3 and 15 deg). Until readjustment of the dish surface will be realised, proposers should take the above SEFD values into account when writing a proposal.

The **Tianma 65m telescope** (Tm65) is located about 6 km away from the 25 m Seshan telescope (Sh). The 2-letter abbreviation for Tm65 telescope is T6. Both of these telescopes can observe at 18, 13, 6, 5 and 3.6 cm. Tm65 can also observe at 21, 1.3 and 0.7 cm. Tm65 is the default telescope; Sh will be used if Tm65 is not available for some reason. If you select both, you should also discuss the motivation for the very short baseline in the proposal.

The **Korean VLBI Network** (KVN) is an Associate Member of the EVN. KVN telescopes may be requested for EVN observations at 1.3 cm and 7 mm wavelengths. For more details regarding the KVN, see: [http://radio.kasi.re.kr/kvn/main\\_kvn.php](http://radio.kasi.re.kr/kvn/main_kvn.php)

### **Integration of e-MERLIN Telescopes into the EVN**

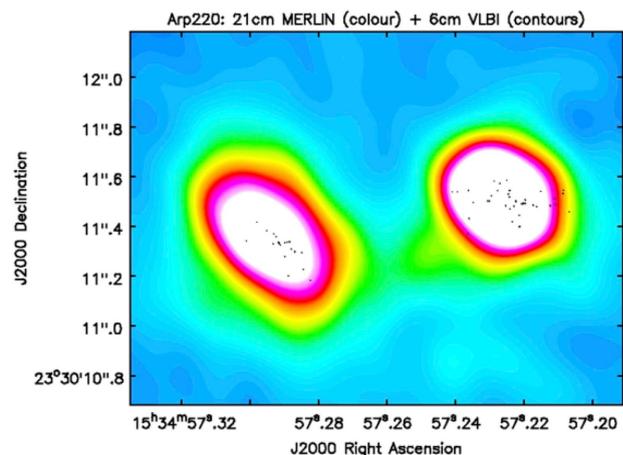
Integrated **e-MERLIN + EVN** observations are now available using up to 5 e-MERLIN outstations at 512 Mbps; in addition to the selected Jodrell Bank Observatory (JBO) home station. This additional capability provides short-spacing coverage between 11 and 220 km within e-MERLIN, together with intermediate and long baselines between e-MERLIN and EVN antennas in both disk-recording and e-VLBI mode. Principal Investigators (PIs) can request

multiple e-MERLIN outstation antennas (all, or a subset of Pi, Da, Kn, De, Cm) in addition to an EVN homestation antenna at JBO (Jb1 or Jb2).

It is essential that e-MERLIN+EVN proposals **provide clear scientific/technical justification for the inclusion of e-MERLIN outstation telescopes**, including why e-MERLIN outstation antennas are required for the delivery of the scientific goal. This is because in addition to EVN PC approval, the e-MERLIN outstation contribution has to be approved by the e-MERLIN Time Allocation Group (TAG). For e-MERLIN TAG approved projects e-MERLIN outstation data will then be available for full correlation with other EVN antennas at JIVE. Note that EVN proposals requesting only Jb1 or Jb2 are still considered as standard EVN proposals and will only require approval by the EVN PC.

For e-MERLIN outstations correlated within the EVN, the maximum bitrate available for each outstation correlation at JIVE (both disk and e-VLBI) is 512 Mbps – equivalent to 2 polarizations at 64 MHz bandwidth. Thus, the PI may request up to 5 outstation telescopes in dual polarization mode with a bandwidth of 64 MHz per polarization in addition to the e-MERLIN home station antenna at up to 1 Gbps depending on the observing wavelength (2 polarizations at 128 MHz bandwidth).

For further enquiries regarding e-MERLIN + EVN observations please see the [e-MERLIN Contact Webpage](#), or alternatively email: [vlbi@jb.man.ac.uk](mailto:vlbi@jb.man.ac.uk)



Radio emission from the starburst galaxy Arp 220, illustrating the angular scales covered by EVN+eMERLIN observations, showing the two nuclei of Arp220, dominated by star formation, (e-MERLIN) and the large population of supernovae and supernovae remnants (VLBI). This e-MERLIN (colour), with a resolution of 0.2 arcseconds, and VLBI (contours, visible as dots) at ~1.5 milliarcsecond resolution overlay image shows data presented by Varenius et al., 2014, A&A 593 and Varenius et al., 2019, A&A 632, respectively.

### **Global VLBI Proposals**

Global VLBI proposals can be proposed for a data rate of up to 2 Gbps including VLBA, JVLA and the GBT. Global proposals will be forwarded to the NRAO and GBO Time Allocation Committees automatically and should not be submitted to NRAO and GBO separately.

Proposers are asked to **clearly justify the need for and illustrate the plan of use for the NRAO/GBO antennas**, in particular for the GBT and JVLA due to their limited availability.

The **Green Bank Telescope** (GBT) is operated by the Green Bank Observatory (GBO). Time available for global VLBI on the GBT is small (VLBI typically accounts for 10% of Open Skies observing), 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 (>6 hours) will be very difficult to schedule owing to constraints coming from non-NSF GBO partners. In the Technical Justification, proposers are encouraged to clarify any constraints about how observing time could be broken into smaller pieces without adversely affecting

the proposed science and include relevant information regarding maximum elapsed time of a split schedule and minimum scheduling block lengths.

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

The NRAO's **Very Long Baseline Array** (VLBA) has no limit to hours spent performing global VLBI. Use of VLBA for Open Skies observing is guided by the scientific merit of the proposal.

The NRAO's **Karl G. Jansky Very Large Array** (JVLA) follows the same observing model as the VLBA, in that there are no restrictions on total hours of joint observing time but telescope time access is quite competitive so a strong justification for its use is required. Note that phasing of the array at high frequencies ( $\leq 1.3$  cm) is done only in the compact antenna configurations (C and D) of the JVLA.

Some modes may require different bandwidth channels at different telescopes, which can be handled by the software correlator (SFXC). JIVE support staff will work with Socorro to assist you during the scheduling process of such observations. Global observations will be correlated at the SFXC correlator at JIVE (default) or at the DiFX correlator in Bonn or at the DiFX correlator in Socorro (if appropriate justification is given in the proposal).

For further inquiries regarding the GBT, VLBA and JVLA in global observations please contact the [JIVE User Support](#).

### **Use of Australian VLBI Network Antennas**

Some Australian **Long Baseline Array** (LBA) time will be made available for simultaneous scheduling with the EVN, thus enabling the possibility of joint LBA/EVN observations. The easternmost stations of the EVN are in a similar longitude range to the LBA telescopes, and for sources in equatorial regions, baselines to western European stations are also achievable for a brief period of time. Joint LBA time is likely to be heavily oversubscribed, and authors are requested to note whether they are prepared to accept scheduling without LBA antennas being present. EVN+LBA observations should be possible at all principal EVN wavebands from 21 cm to 1.3 cm. When specifying requested antennas from the LBA in the Northstar Proposal tool, please specify 'LBA' under the "other" row in the telescope-selection box - this selects all antennas that are available for joint observations.

Any proposals for joint EVN+LBA observations submitted to the EVN by its 1 June 2020 deadline should also be submitted to the LBA by their (provisional) 15 June 2020 deadline and will first be eligible for scheduling in EVN Session 3/2020. For more details regarding proposing time on the LBA, see: <https://www.atnf.csiro.au/observers/index.html>

### **Joint observations with other facilities**

For joint observations with other facilities, e.g., EVN+XMM, separate proposals should be submitted to the EVN and to the other facility. Such proposals will be considered by the EVN PC on a case-by-case basis.

