European VLBI Network Newsletter

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Contents

Edited by Michael Lindqvist, EVN Secretary (Onsala Space Observatory, Sweden; Michael.Lindqvist@chalmers.se)

Message from the Chairman of the EVN Board of Directors

Dear Colleagues in the European VLBI Network, Dear Users of the EVN,

Welcome to the latest edition of the EVN newsletter. I would like to thank all the contributors for all their efforts in developing the EVN and for taking time to describe their progress. This edition of the newsletter again shows advances on many different fronts, from news of potential new telescopes for the EVN, to describing new advanced correlator and wide-band feed technology. The overall goal of these technical developments is of course the astronomical results that the EVN produces. Two featured science results in this edition describe Space VLBI results resolving laterally the jet in 3C84 and astrometry results on the star AM Herculis. Results such as these are only made possible by the combination of the technology developed by engineers, exciting observations proposed and reduced by astronomers, and all those involved in the operations of the EVN, from the Programme Committee and Technical Operation Group, to the station friends and correlator staff.

As well as delivering science today the EVN is also planning its future science vision as described on p. 7, in a process supported by WP7 of the EU project JUMPING JIVE. I was able to attend the first face-to-face meeting of the Science Vision working group in Zaandam at the end of February, and can report that there were a number of truly inspiring talks on how the future EVN can contribute to resolving critical astronomical questions. This was followed by a well attended EVN session at EWASS in Liverpool, again with uniformly excellent and exciting talks (see p. 15). The next step in the process of developing the EVN science vision will be a progress report/chance for community input at the EVN symposium/Users meeting in Granada, October 8th-11th (see p. 18). The deadline for registration and submitting abstracts (25th May) is rapidly approaching, please register as soon as possible to ensure your attendance at what promises to be an exciting meeting in the beautiful city of Granada. Another approaching deadline is of course on June 1st for EVN proposals with details given on p. 3.

John Conway,

Chairman, EVN Consortium Board of Directors

Call for EVN proposals

The next deadline for submitting EVN proposal is ***June 1, 2018***. The details of the call can be found here.

New features in the June 1 Call for Proposals include:

- The Sardinia Radio Telescope is again available for VLBI operations scheduled in Session 3/2018 and beyond.

- The Arecibo Observatory is again available for VLBI observations. However, severe flooding following Hurricane Maria, has caused a deformation of a localised area of the dish affecting its exact sphericality. This has resulted in a drop of Arecibo's high-frequency gain that can be quantified at 18 cm as an SEFD of ~3.1-3.5 Jy (cf. an SEFD of ~2.2-2.5 Jy normally expected for zenith angles less than 16 deg) and at 6 cm as an of ~7.3 Jy (cf. an expected SEFD of ~3.5 Jy between zenith angles 3 and 15 deg). The dish deformation is presently being surveyed, and will then be corrected to return the surface to be truly spherical. A date for this readjustment has not yet been set.

Further information on EVN, EVN+MERLIN, Global VLBI and e-VLBI observations, and guidelines for proposal submission are available at: http://www.jive.eu/jivewiki/doku.php?id=evn:guidelines

Antonis Polatidis, ASTRON, EVN PC Chairman

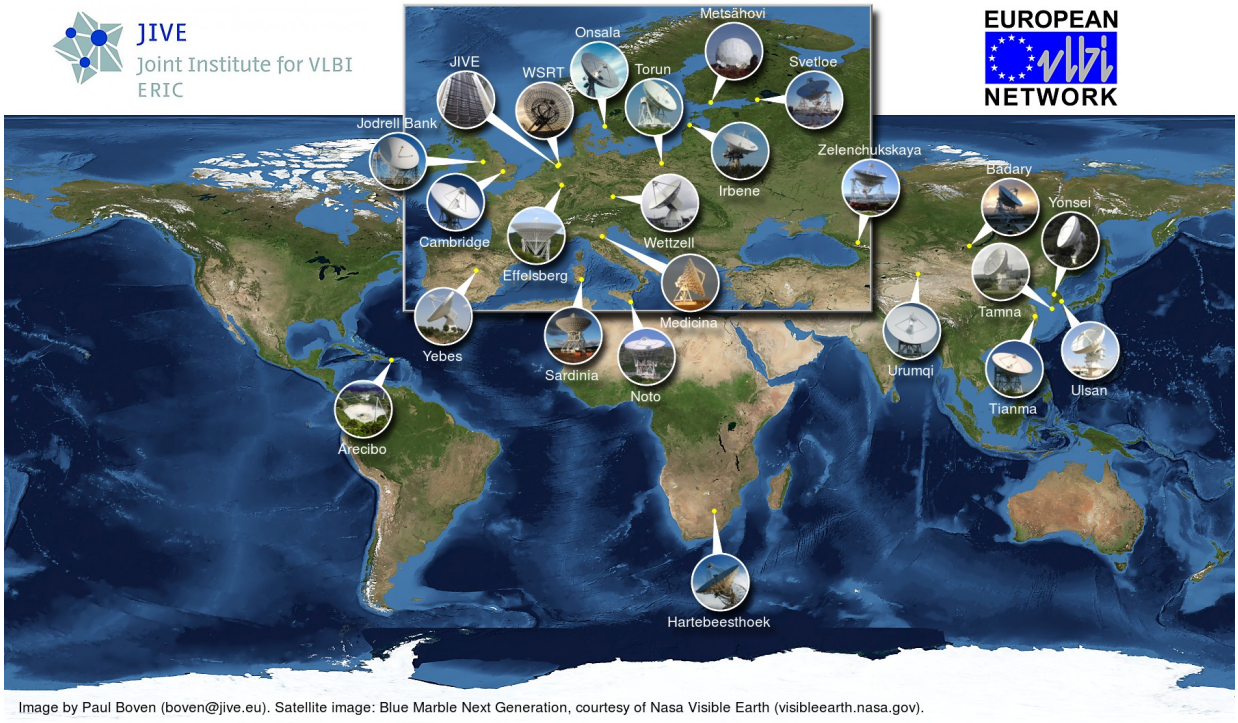


Image by Paul Boven (boven@jive.eu). Satellite image: Blue Marble Next Generation, courtesy of Nasa Visible Earth (visibleearth.nasa.gov).

EVN science highlights

Space-VLBI observations resolve the edge-brightened jet in 3C 84 (NGC1275) at 30 microarcseconds from the core

An international team of researchers from eight different countries has imaged with unprecedented accuracy the newly forming jets of plasma from the core of NGC1275, the central galaxy of the Perseus cluster, identified with radio source 3C 84. Radio images made with an array including the RadioAstron Space Radio Telescope (SRT) and a global array of ground radio telescopes resolve the jet structure ten times closer to the central engine than what has been possible in previous ground-based observations.

These space-VLBI observations were obtained within the RadioAstron Nearby AGN Key Science Project coordinated by Tuomas Savolainen. 3C 84 was observed on September 21-22, 2013. In addition to SRT, more than two dozen ground radio telescopes, including the EVN, the KVN, Kalyazin and the NRAO VLBA, GBT and the phased JVLA participated in the experiment. First results are now published in Giovannini et al. (2018).

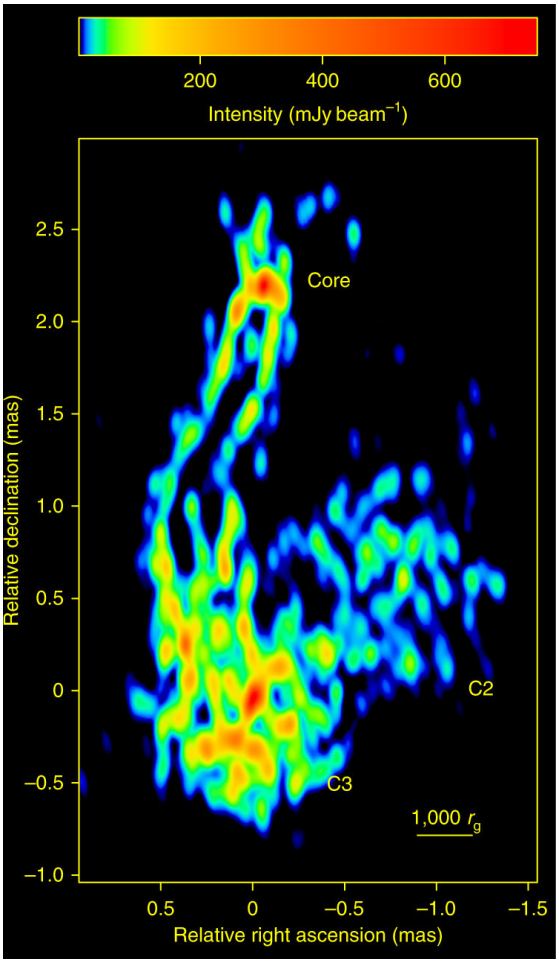


Figure 1. *Radio image at 22 GHz of the central parsec in 3C 84 obtained with the space-VLBI array. The half-power-beam-width (HPBW) is 0.10 x 0.05 mas at PA 0º. The noise level is 1.4 mJy/beam and the peak intensity is 0.75 Jy/beam. The radio core and emission features C2 and C3 are indicated in the image.*

The 22 GHz space-VLBI image shows that the edge-brightened jet in 3C 84 is surprisingly wide, with a transverse radius greater than 250 gravitational radii at a de-projected distance of 350 gravitational radii from the core, Fig. 1. If the bright outer jet layer is launched by the black hole ergosphere, it has to rapidly expand laterally closer to the central engine. If this is not the case, then this jet sheath is likely launched from the accretion disk.

Another major result discussed in the paper is that the previously known, almost cylindrical jet collimation profile on the scales larger than a few thousand gravitational radii extends down to a scale of a few hundred gravitational radii. It indicates a flat density profile of the external confining medium. This result is in contrast with the M87 jet collimation profile. One obvious difference between M87 and 3C 84 jets is the young age of the latter. The dynamical age of the C3 feature (the head of the restarted jet in 3C 84) at the time of the space VLBI observation is only about 10 years. The dynamical age of the jet is less than what is likely needed for the relaxation of the system, and we may not be seeing the final structure of the jet.

Published in: G. Giovannini et al.:**A wide and collimated radio jet in 3C84 on the scale of a few hundred gravitational radii**, Nature Astronomy (see also aXiv:1804.02198).

Gabriele Giovannini, Dipartimento di Fisica e Astronomia, Universitá di Bologna, Bologna, Italy

Another look at AM Herculis

Precise estimation of annual parallaxes for selected targets with the use of independent techniques are essential in the GAIA era. VLBI astrometry seems to be a perfect choice as a reference for the GAIA measurements. Recently, Gawronski et al. (2018) reported EVN astrometric campaign performed in the e-VLBI mode at 6 cm, dedicated to AM Herculis. Using six astrometric measurements it was possible to estimate the annual parallax for this star with the sub-mas accuracy (π=11.29±0.08 mas, d=88.8±0.6 pc), Fig 2. (left).

AM Herculis is a prototype of so-called polars, active compact binary systems. In polars, very strong magnetic field of the primary white dwarf (10–250 MG) prevents the creation of an accretion disc and the matter transferred from the secondary follows the magnetic field lines and falls onto the magnetic pole/poles of the primary. The accretion is occasionally ceased in these systems and during these episodes polars fall into the quiescent phase with decreased optical brightness. e-EVN observations were conducted during the long AM Her quiescent phase. It allowed to study the radio flux evolution at the time of small activity of AM Her, Fig 2. (right). Gawronski et al. (2018) showed that AM Her radio flux is likely modulated with the orbital phase, and this could be explained if the secondary red dwarf is also magnetically active. In this picture the gyrosynchrotron emission arises between the secondary surface and L1 point. The magnetic activity of the secondary could explain the puzzle of AM Her as a persisted radio source. This attribute also most likely distinguish AM Her from other polars.

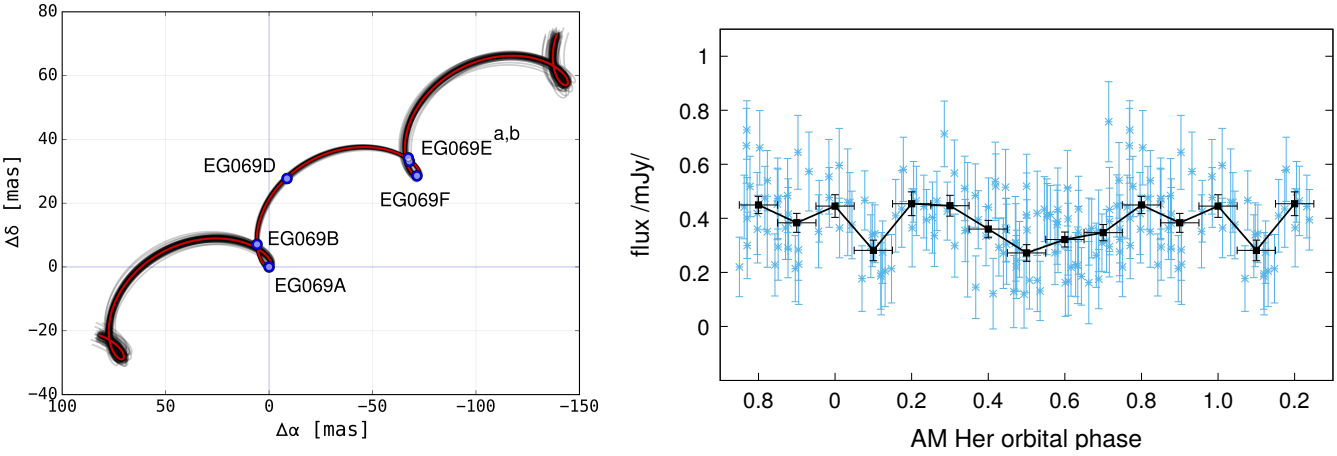


Figure 2. (Left) *Sky-projected parallactic motion of Am Her for all e-EVN observations .Red curve is for nominal solutions. Thin grey curves are for 100 randomly selected samples from the MCMC-derived posterior (see Gawronski et al. for details). (Right) AM Her quiescent radio flux at 5 GHz phased with the orbital motion of the system. Cyan points represent measurements based on individual scans and black points binned values.*

Published in: Gawroński et al. (2018): **Another look at AM Herculis-radio-astrometric campaign with the e-EVN at 6 cm**, MNRAS.

Marcin Gawronski, Centre for Astronomy, Torun, Poland

News from JUMPING JIVE

The first few months of 2018 have been busy as well as exciting for the EC H2020 JUMPING JIVE collaboration ("*Joining up Users for Maximizing the Profile, the Innovation and Necessary Globalization of JIVE*"). Overall, the project has been active in promoting the excellence of VLBI. New countries and new audiences have been approached in the effort of strengthening the current community and building new fruitful collaborations.

The *Management* of the project (**WP1**) continues to follow the progress of JUMPING JIVE by gathering information on the status of the various deliverables and by assisting the other WPs with their activities, for example with the logistic preparation of meetings. We are also reaching the important milestone of the mid-term review of the project. In agreement with the EC Project Officer and with the JUMPING JIVE Executive Board, we set the date and location of the review: 12 October 2018 in Granada, Spain, just after the EVN symposium.

WP2 ("*Outreach and advocacy*") has created a brochure for a non-VLBI audience of astronomers, to attract new users, Fig. 3. We have distributed the brochure at EWASS 2018 in Liverpool. The EWASS has also been our first big outreach event. We have shared part of the booth with e-MERLIN, where we showed our banners and offered the brochure and other promotional material about JIVE and the EVN (pens, stickers, ...). These materials will be available for all EVN institutes to use, check the JJ WP2 wiki page for details. Additionally, expert VLBI users were showing good success examples and including information on JIVE and EVN in their presentations, in a variety of symposia and special sessions.

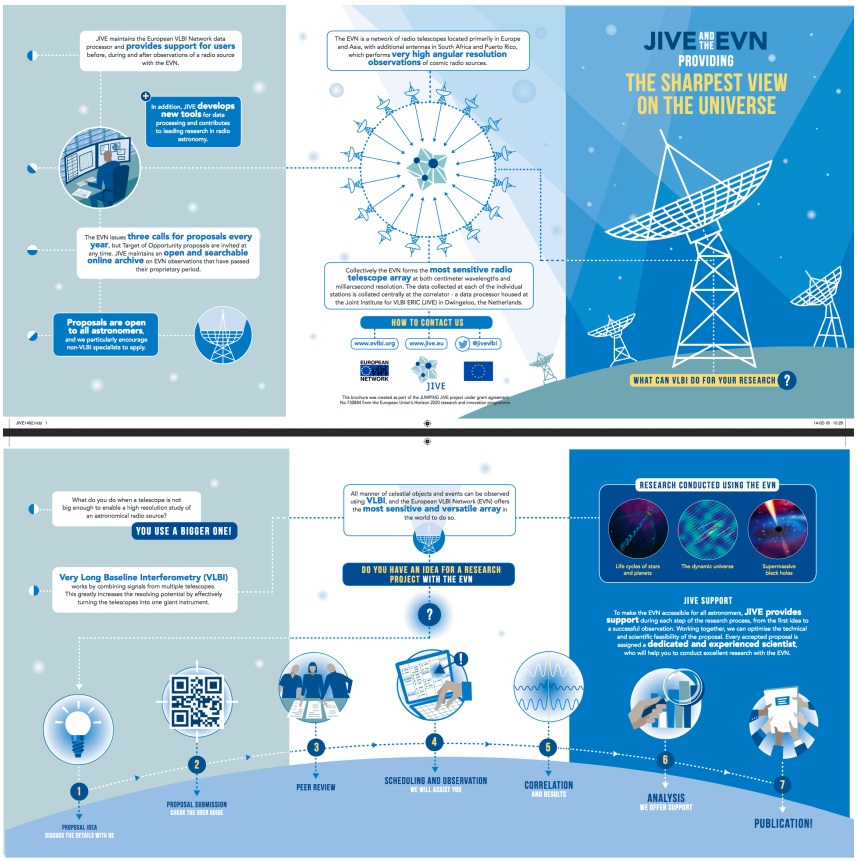


Figure 3. *The new JIVE/EVN brochure, a high resolution version can be found here.*

The effort in "*Building new partnerships*" (**WP3**) has brought Leonid Gurvits (leader of the WP) to different parts of the globe. Many countries have shown interest in cooperating with JIVE and the EVN. In particular, the interest to resurrect the 54 m fixed spherical radio telescope has been expressed in Armenia in order to upgrade it to EVN-compatible standards. Possible science tasks, including VLBI, for a new prospective combined deep space communication and radio astronomy facility in United Arab Emirates have been discussed at an international workshop held in Abu Dhabi in March 2018.

A number of meetings and online questionnaires have been the focus of **WP4**. The goal is to find common challenges and possible synergies between JIVE and the International LOFAR Telescope.

WP5 works on *"Integrating new elements"*. An exciting result coming from this WP, in collaboration with other parts of the project and the EVN, was the inclusion of the Ghana radio telescope in a standard NME experiment (at 6 cm) during the first EVN session of 2018. Work has progressed in getting successful fringes with RAEGE Santa Maria station in the Azores (see separate news item below). Stay tuned for more exciting fringes news in the next EVN newsletter.

We are also working on exploring the "*Geodetic capabilities*" (**WP6**) of the EVN. A proposal was submitted to the EVN for the February 1st 2018 deadline to repeat the TP001 experiment that first measured positions for the non-geodetic EVN stations in 2000. The proposal requests 24 hours of EVN observing time at K band and will be scheduled in geodetic-style mode. All EVN telescopes with observing capability at K band are requested, including also the e-MERLIN out-stations (after successful were fringes detected to Cambridge and Darnhall in the session 1/2018 K-band NME ftp fringe-tests).

Figure 4. *Participants in the WP7 meeting held in Zaandam, The Netherlands.*

JUMPING JIVE has a full work package (**WP7**) dedicated to *"The Future of VLBI"***.** A face-to-face meeting of VLBI expert was held in Zaandam (NL) on from 28/02 to 01/03 2018, Fig. 4. The meeting has been extremely successful. The need for a new scientific roadmap for the EVN has been further highlighted, and it clear that such document is a necessity for the scientists and the directors of the EVN observatories. Each presentation has been followed by constructive discussion, where the necessary developments have been underlined. At the end of the meeting, "chapter coordinators", i.e. the experts leading the effort in each individual part of the document, have been identified. Their mandate is to start gathering the scientific input for inclusion in the document. **WP7** has also organised a special session about VLBI at the EWASS 2018 in Liverpool (see separate news item below).

With regard to "*Global VLBI interfaces*", **WP8** works on tools for astronomers such as a more modern SCHED, for scheduling VLBI observations. Furthermore, some progress has been made on an integrated system for completely autonomous observations of a radio telescope.

Exploring the "*Capacity for VLBI in Africa*" (**WP9**) is a key topic for JUMPING JIVE. Two candidates from Africa have been selected for the ASTRON/JIVE Traineeship program. With regard to other training activities in Africa, Development in Africa via Radio Astronomy (DARA, a UK STFC Newton funded project) has created (with JUMPING JIVE contributions) a consolidated set of teaching materials. This is designed to minimise the workload on individual trainers/lecturers.

Looking towards the future and the possibility of "*VLBI with the SKA*" (**WP10**), Cristina Garcia Miro, SKA-VLBI Scientist, is doing an excellent job in making sure that the SKA pays particular attention to its VLBI capabilities at all stages of developments.

All in all, JUMPING JIVE is a collaboration full of exciting activities. As a project, it is very healthy with high-quality work going on in all its components. The community of people working on JUMPING JIVE has also been very active and successful, reflecting the excellence and the spirit of collaboration of the whole EVN community.

Giuseppe Cimó (JUMPING JIVE Project Manager), The Netherlands

EVN/JIVE Technical Developments

BRAND: First feed prototype being manufactured – a frequency decade of bandwidth 1.5-15.5 GHz

The BRoad-bAND (BRAND) RadioNet (see EVN Newsletter 48) project is moving into the first prototype phase of a 1.5–15.5 GHz astronomical receiver (more than 10:1 frequency bandwidth). Onsala Space Observatory, Sweden (OSO) is leading the feed design where the first prototype is optimised for the prime-focus geometry of the Effelsberg 100 m telescope. Current Quad-Ridge Flared Horn (QRFH) design shows in simulation, input reflection less than -10 dB across the band with an average of 50 % aperture efficiency for the Effelsberg telescope. Using available state of the art cryogenic Low Noise Amplifier (LNA) data, calculation gives an effective SEFD of 20-40 Jy, comparable to current narrowband feeds. The design (see Fig. 5) was presented by Flygare et al. during the 12th European Conference on Antennas and Propagation (EuCAP2018) in London, April, 2018. Currently, the feed is being manufactured and schedule for tests in the summer of 2018. In parallel, high performance LNAs have been designed and manufactured by the Yebes observatory (IGN), Spain. The LNAs will be integrated together with the feed in the receiver cryostat. The BRAND EVN partners include Germany (MPIfR), Italy (INAF), Sweden (OSO), Spain (IGN), The Netherlands (ASTRON), and Latvia (VIRAC).

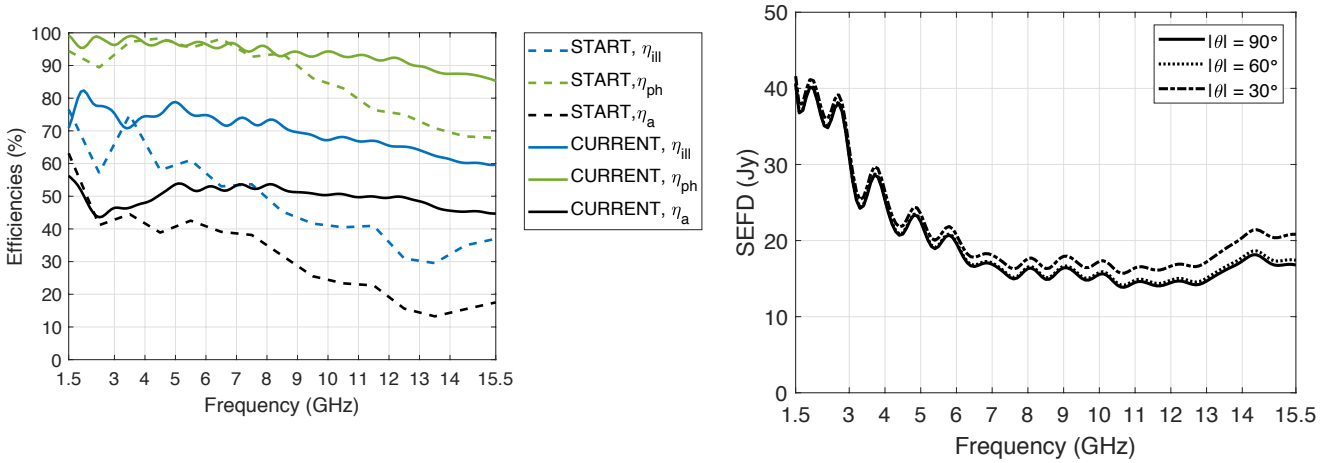


Figure 5. *(Left) Evolution through stochastic optimization of the BRAND QRFH feed shown as efficiencies in the Effelsberg reflector at prime focus, solid lines show current model. η_{ill} denotes the illumination efficiency and η_{ph} the phase efficiency (consistency in location of the phase center relative the telescope focal point). Total aperture efficiency showed as the black curve η_a. (Right) Estimated SEFD over 3 elevation angles for the BRAND feed simulated in Effelsberg reflector at prime focus (surrounding horizon effects of mountains not accounted for in the low elevation).*

Jonas Flygare, Onsala Space Observatory, Sweden

Real-time fringes with the UniBoard VLBI Correlator

The JIVE UniBoard FPGA based VLBI correlator ("JUC") always correlates all baselines and polarisation products at the same speed: slightly faster than real-time. It does this irrespective of number of stations or input data rate – up to the capacity it was built for. For the first generation of UniBoards this capacity is 32 stations x 512 Mbps / station or, when trading in stations for bandwidth, 16 stations x 1024 Mbps per single UniBoard. This faster than real-time, always-on, independent of data rate or number of stations mode of operation is an ideal solution for real-time VLBI correlation. In fact, the investment in the DBBC2 and FiLa10G hardware at the European VLBI Network stations gives another boost: this equipment can output reliable, very stable streams of up to 4 Gbps onto the international networks. The replacement with hardware of sending software at the stations as well as receiving software at the correlator allows for stable real-time correlation at low power consumption. Once set up correctly the hardware never stalls, never runs into memory leaks and never crashes.

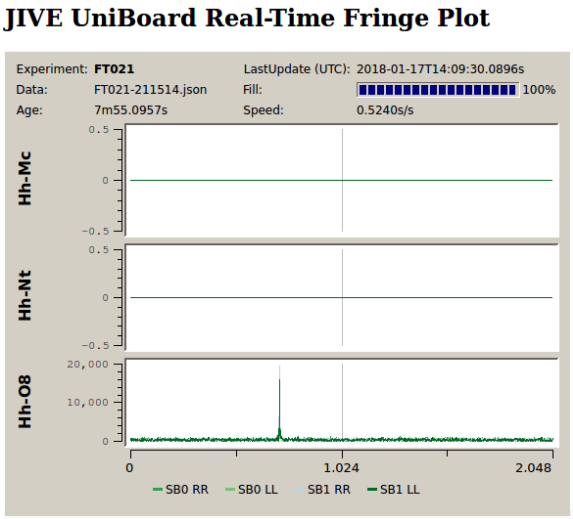


Figure 6. *First real-time fringes with the UniBoard correlator.*

The JUC has proven fringe-capable for disk-based correlation before. On January the 17th 2018, following the regular EVN e-VLBI session, a few stations continued observing. This time, however, the correlation was performed by the JUC. By the end of the test time its first real-time fringe was observed on the baseline between Hartebeesthoek and Onsala, as can be seen in the screen shot of the real-time fringe plot which is always published on the web during e-VLBI runs, Fig. 6. The lack of fringes on the two remaining baselines (to Medicina and Noto - the other participants had had to stop by then) were due to the fact that the data path from Italy to the second UniBoard was firewalled at JIVE. Unfortunately this was only found out after the test time expired, but fixed readily.

The road from disk-based- to real-time fringes was long. In principle, from a JUC control software perspective, real-time VLBI with the FiLa10G is easier than disk-based correlation. This is somewhat counterbalanced by having to control more equipment, the fact that JUC needs a different input data format than what the FiLa10G could yield at the time as well as that in real-time observing mode everything has to work correctly at the same time.

Thanks to a continued, combined and coordinated effort of individuals at the MPIfR/Bonn (DBBC/FiLa10G firmware), at the EVN stations (testing and verifying alternate firmwares and equipment setups) and at JIVE (JUC firmware, control software) this result was made possible. With all technicalities now removed and its soon-to-be-installed four UniBoards, the JUC will be capable of handling real-time VLBI correlation for up to 16 EVN stations at up to 4 Gbps / station (or 32 stations at up to 2 Gbps / station). It should be realised, though, that many other bottlenecks exist in the EVN which will need to be resolved before this will become a viable observing mode.

On behalf of the JUC group at JIVE, The Netherlands,
Jonathan Hargreaves, Des Small, Benito Marcote, Arpad Szomoru and Harro Verkouter

First VLBI fringes with the RAEGE in Santa Maria (Azores, Portugal)

The 'Colombo' radio telescope in Azores (Portugal) participated, for the first time, in a geodetic Very Long Baseline Interferometry (VLBI) experiment on 21st February 2018, together with the 40 m radio telescope at the Yebes Observatory (Spain) of the Spanish National Geographic Institute (IGN). The successful observations in S (2 GHz) and X (8 GHz) bands were confirmed after data recorded by both telescopes was sent to JIVE for further analysis and correlation, Fig. 7.

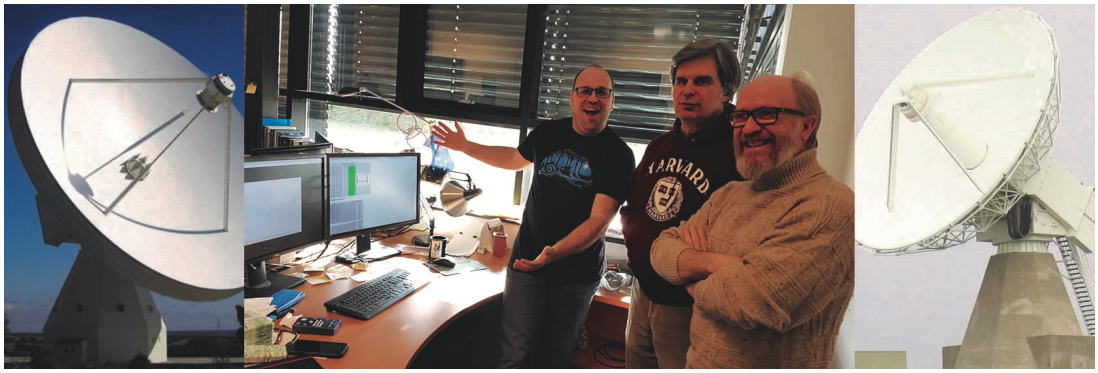


Figure 7. *Left: Yebes 40 m telescope in Spain. Middle: J. Blanchard, B. Campbell and F. Colomer celebrating the fringes at JIVE. Right: The 'Colombo' radio telescope in Azores, Portugal.*

Colombo is a 13.2m radio telescope at the RAEGE station in Santa Maria (Azores), the second telescope that will constitute the Spanish-Portuguese Atlantic Network of Geodynamic and Space Stations (RAEGE). This telescope is available for observations with the EVN at X band, until the new broadband receiver and VGOS operations are started in 2019.

RAEGE is a project of the IGN and the Regional Government of the Azores consisting of a network of 4 Fundamental Geodetic Stations located in Yebes (Guadalajara, Spain), the Azores Islands (Santa Maria and Flores, Portugal) and the Canary Islands (Gran Canaria, Spain), It is integrated into the International VLBI Service for Geodesy and Astrometry (IVS), which, among other objectives, measures the movements of terrestrial tectonic plates, the Earth Orientation Parameters (EOP), the length of day (LoD), and constructs the International Celestial Reference Frame (ICRF). For more information see www.raege.net.

Paco Colomer, JIVE Director, The Netherlands

The advent of the Hellenic radio telescope

The scientific adventure of converting a 30m telecommunication antenna to a radio telescope is going to materialize within a decade in Greece. The conversion we are planning to undertake is not attempted for the first time (e.g., Woodburn, et al., 2015, Wild, 2017).The aim is to build a fully professional instrument capable of observing, both as a stand-alone single dish and as a VLBI antenna (e.g. in the EVN and the IVS). The antenna will also participate in SETI searches in collaboration with the Break Through Listen Research Laboratory, Department of Astronomy, UC Berkeley. The project's national impact expected, apart from popularization and educational activities to act as an inspirational drive for new scientists, includes the opening of new fields of applications which could contribute to the development of the Hellenic Industry.

The project is the result of the scientific collaboration between the School of Sciences and Technology (SST) of the Hellenic Open University (HOU) and the Telecommunication Systems & Applications Research Laboratory (TSARL) of the Department of Electronics Engineering of the Technological Educational Institute (TEI) of Sterea Ellada. A Memorandum of Understanding has been signed between the owner of the antenna, the Hellenic Telecommunication Company (OTE), and SST-HOU /TSARL-TEI. OTE has granted the Institutes the use of the equipment and to convert it to a professional radio telescope of international standards. OTE also supports the project fully with electricity costs and some pre- and after- maintenance. The antenna is located in Thermopile Telecommunication Station at the south-eastern point of Europe in the region of Skarfeia, Lokrida, Fig. 8.

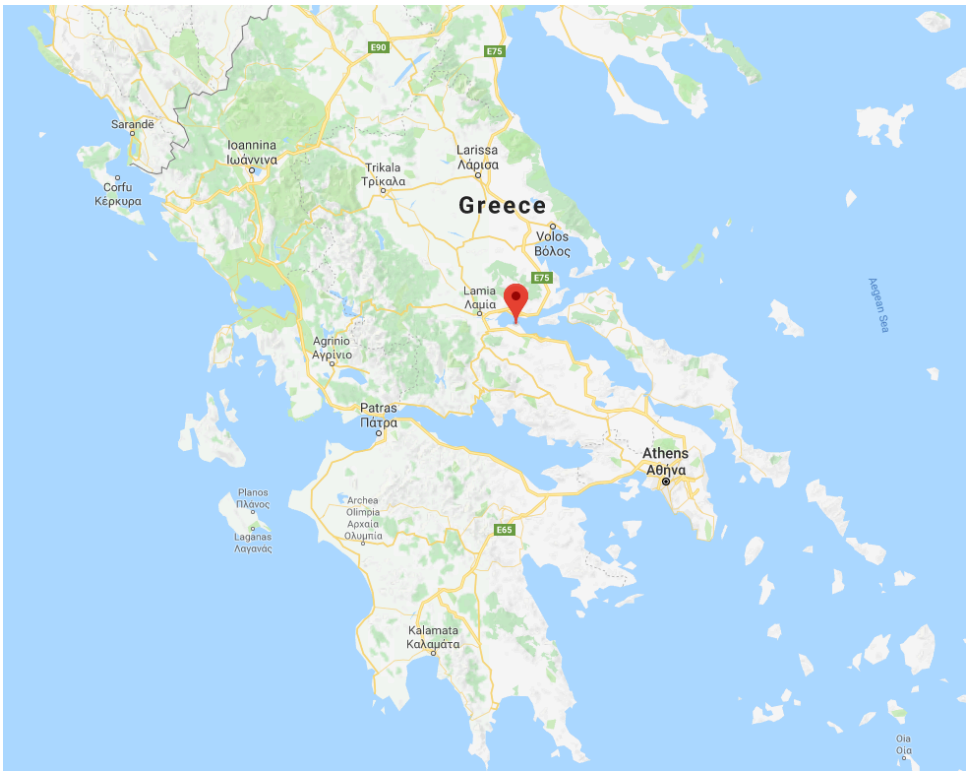


Figure 8. *The location of the Thermopile Telecommunication Station (38°49'20.74"N 22°41'9.51"E) owned by the Hellenic Telecommunication Company OTE.*

Our team will work on both the front- and back-ends of the antenna. The project will be kicked off by using the existing C-band feed system. We will install a 6 GHz dual polarization receiver with low noise amplifiers and making pointing and sensitivity amplitude and phase measurements and adjustments. RFI measurements, in order to characterize the RFI environment at the site, will also be done. After making an evaluation study of the moving and other parts of the dish infrastructure, we will change, accordingly, motors, cables, driving and control systems, and encoders. This will allow the adequate mechanical performance of a fully steerable professional radio telescope. Note, the antenna was manufactured to track geostationary satellites. For the backend we will need to purchase new radio astronomy digitization electronics, such as digital base band converter, a VLBI recorder, a snap board (eg. Casper - UC Berkeley, or CSIRO), etc. Optical fibres will be tested as needed since we need to transmit the data to correlators/processing centres. After acquiring the know-how of the C-band functionality transforming the antenna to a professional instrument, we will work towards operating the antenna at L-band with the vision to go higher (> 10 GHz).

Figure 9. *Photo of the C-band Satellite Telecommunications Antenna (photo credit K. Papathanasopoulos)*

Our project's innovation will be the design and construction of a receiver which will operate in L-band in two different frequency ranges (eg.1200-1450 MHz and 1600-1700 MHz). In general, a dual-band (DB) component is a component accomplishing the same function at two different arbitrary frequencies without the need to design two different mono-band circuits. In our receiver this will be achieved by using the theory and techniques of the Composite right-/left-handed (CRLH) transmission-line (TL) metamaterials. The CRLH TL allows arbitrary dual-band operation as a benefit of its four degrees of freedom. This feature does not exist in conventional transmission lines and thus we cannot design DB components. As a result, our radio telescope will operate as dual band radio telescope with the same receiver.

A short video of the antenna (see Fig. 9) at its location can be found in OTE's youtube channel in the following link: https://www.youtube.com/watch?v=adYggTk7g-E

Nectaria A.B. Gizani, SST/HOU, and Giorgos P. Veldes, TSARL/TEI, PIs of the project on behalf of the Scientific Team.

Reports from Meetings

Outstanding presence of VLBI at the European Week of Astronomy and Space Science

The EC H2020 JUMPING JIVE project organised a strategic presence of VLBI in the 2018 edition of the European Week of Astronomy and Space Science (EWASS), which took place in Liverpool (UK) on April 3-6 2018, Fig. 10. For information see: http://eas.unige.ch/EWASS2018/

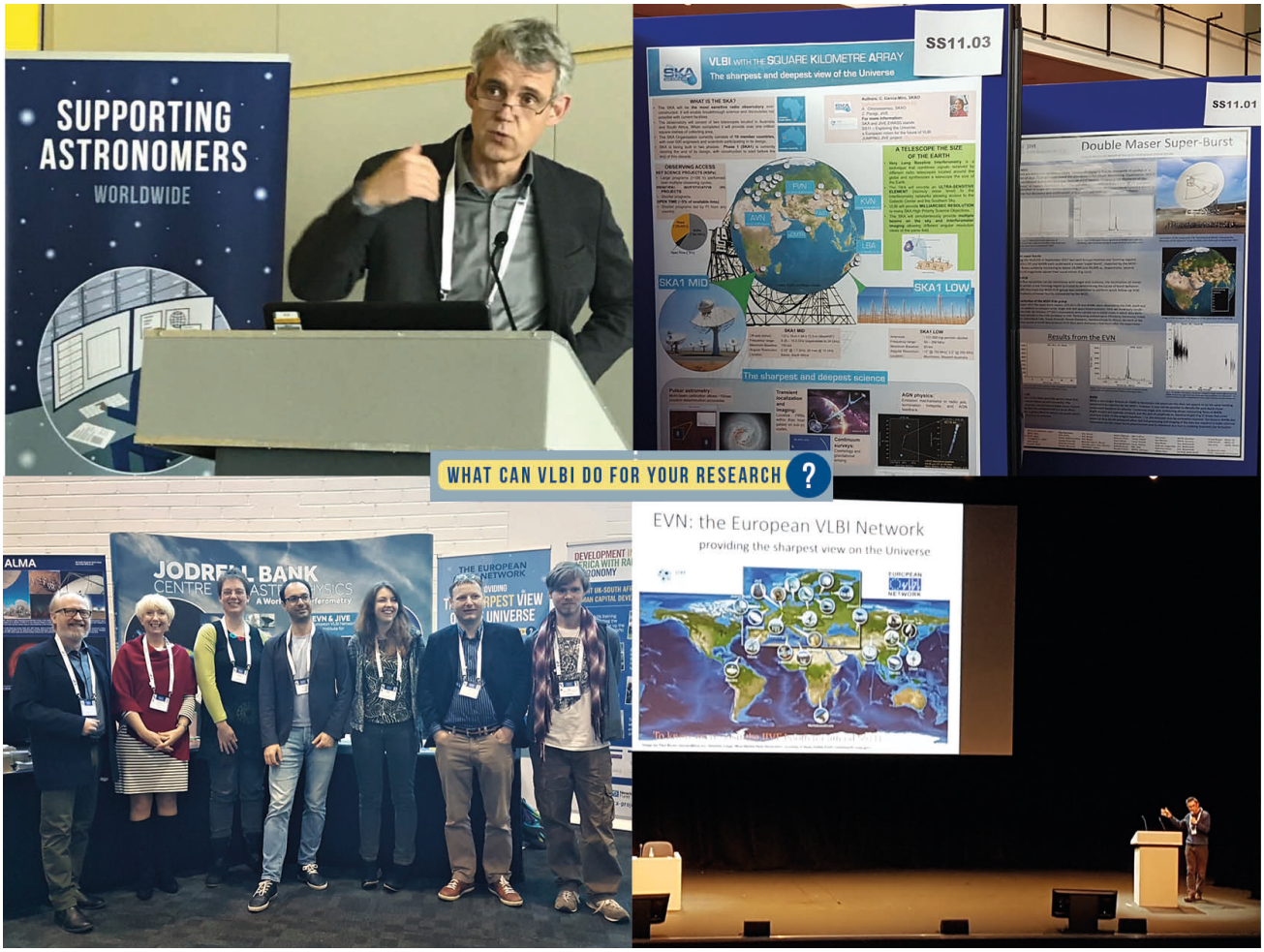


Figure 10. *Photos from the EWASS in Liverpool, April 3-6, 2018.*

The main objective within JUMPING JIVE **WP2** ("*Outreach and advocacy*") was to bring the VLBI technique and unique science conducted to the attention of a broader astronomical audience. To do this, several approaches were adopted. A brochure was widely distributed to conference participants by JIVE's Science Communication Officer's Gina Maffey. The brochure, which caters for an audience of non-VLBI astronomers, explains the EVN and JIVE – including the Call for Proposals and the user support available at JIVE – to potential new users with a simple and attractive design. Presence in the exhibition area was also possible thanks to an agreement with e-MERLIN and DARA to share a booth space, and the courtesy of the SKA to host our SKA-VLBI roll up banner. Thank you!

In addition, expert VLBI users showed their successful research examples and included information on JIVE and the EVN in their presentations across a number of symposia and special sessions. These included Miguel Pérez-Torres, Robert Schulz, Ross Burns, Ilse van Bemmel, Marcello Giroletti, and Tim O´Brien. In this way, VLBI was present in thematic symposia on cosmology, strong gravity, novae, and astrometry, inspiring scientists to incorporate VLBI data into their studies.

The most focused activity was the Special Session "Exploring the Universe: A European vision for the future of VLBI" (SS11) organised by Tiziana Venturi (INAF), Michael Lindqvist (OSO) and Zsolt Paragi (JIVE), in the context of JUMPING JIVE **WP7**. VLBI is currently the only means of achieving sub-milliarsecond scale angular resolution imaging in astronomy. Consequently, the aim of this special session was to discuss the role of VLBI in the context of the challenges and open questions of astrophysics as we approach the next decade. A key component in this was to explore the astrophysical key areas where VLBI will prove to be crucial for majorly improving knowledge and understanding. The organisation of this event was part of an ongoing effort to shape the VLBI roadmap for the next decade. There were eleven invited presentations by a mixed bag of speakers (including both VLBI black belts and also non-VLBI experts) such as Andrew Williamson, Cristiana Spingola, Andrea Merloni, Tom Muxlow, Heino Falcke, Tulia Sbarrato, Jason Hessels, Andreas Brunthaler, and Hans Olofsson. The final presentation of the session was given by the Chair of the EVN CBD John Conway, who shared his view of the possible future technical developments in the EVN.

Finally, VLBI got some more minutes of glory when mentioned by Phil Diamond, SKA Director General, in his plenary talk. Here, he described its importance in the era of the SKA, and the fact that VLBI provides very long baselines to SKA1-MID, source localisation and superb astrometric capabilities – introducing the up and coming generations of astronomers to the benefits of VLBI.

Mission accomplished!

Paco Colomer, JIVE Director, and coordinator of H2020 JUMPING JIVE

EVN Technical Operation Group meeting in Shanghai

The latest Technical and Operations Group (TOG) meeting of the EVN was hosted by Shanghai Astronomical Observatory (SHAO), on the 19th of March 2018. With 45 participants from 17 different institutes it was very well attended, Fig. 11. The meeting covered the usual wide range of topics, from detailed station reports to general calibration issues, the performance of the network, current and future developments and actions to improve the quality of observations at the EVN. The minutes and the presentations can be found here.

Figure 11. *Participants in the EVN TOG in Shanghai, China.*

On the 20th of March the programme featured a set of talks during the morning by TOG members, the EVN Program Committee, SHAO staff and members of the East Asian VLBI Network . The presentations covered scientific achievements, EVN and SHAO technical developments, the Chinese space programme and the status and development of the East Asian VLBI Network. During the afternoon there was a trip to the Sheshan area close to Shanghai which included a visit to the 65 m Tianma telescope (control room and antenna) and to the Sheshan correlator and laboratories.

This meeting demonstrated once again that having the TOG meetings at the different stations helps to establish closer ties amongst the EVN partners and the technical friends from all stations, and that it benefits and eases the operation of the network. In conclusion, this was a very useful and informative meeting and we thank our Chinese colleagues for the excellent organization and their warm hospitality.

RadioNet provided economic support both to SHAO for the organization of the meeting and to some participants subsidizing their travel.

Arpad Szomoru, EVN vice TOG-chair, JIVE, The Netherlands

Upcoming Meetings

The 14th EVN Symposium

Registration and abstract submission are now open
http://EVNSymp2018.iaa.es

The 14th European VLBI Network (EVN) Symposium and Users Meeting will be hosted by the Instituto de Astrofísica de Andalucía-CSIC in Granada (Spain) on behalf of the EVN Consortium Board of Directors. The meeting will take place on October 8-11, 2018 at the main auditorium of the Parque de las Ciencias of Granada, the science museum of the city, within walking distance from the historic areas of Granada. A CASA-VLBI tutorial has been organized by JIVE for the late afternoon of October 11th, 2018 (15:30h to 16:30h). Separate registration will be required soon for interested participants

This biennial meeting is the main forum for discussion of the latest very long baseline interferometric scientific results and technical and technological developments within the EVN member countries. At this meeting there will also be a chance for user input into the future Science Vision for the EVN.

Topics to be discussed include:

- Powerful AGN science
- Starburst galaxies, extragalactic masers, and supernovae
- Stellar evolution and stellar masers
- Transient sources and pulsars
- Astrometric, geodetic & space applications
- VLBI technology developments
- Users feedback
- Current and future VLBI facilities and international cooperation

Moreover, **the meeting will also focus on** the role of EVN on:

- Very high-sensitivity VLBI with SKA
- Future multi wavelength and multi messenger astronomy including high angular-resolution astronomy at other wavelengths

Confirmed invited speakers include:

- Anna Bartkiewicz (Stellar evolution and stellar masers)
- Marica Branchesi (Multi messenger astronomy)
- Heino Falcke (The Event Horizon Telescope)
- Cristina Garcia-Miro (Very-high sensitivity VLBI with SKA)
- Jose-Luis Gomez (Powerful AGN science)
- Jose-Carlos Guirado (Synergies with high-resolution IR-optical interferometry)
- Benito Marcote (Fast radio bursts)
- Monica Orienti (Synergies between VLBI and CTA)
- Maria Rioja (Techniques and applications of high accuracy astrometry)
- Eskil Varenius (Starburst galaxies, extragalactic masers and supernovae)

The next **relevant dates** regarding the Symposium are:

- Deadline for abstract submission: **May 25th, 2018**
- Deadline for reduced registration fee: **August 1st, 2018**

The **reduced conference fee (290€)** includes admission to all scientific sessions and conference materials, welcome reception, coffee breaks and lunches during the meeting (Monday to Thursday), and conference dinner.

If needed, **funding support** from RadioNet can be requested through the registration form to get part of the traveling and/or accommodation expenses reimbursed. The SOC will decide about the distribution of the funding among the applicants proposing a contribution. Application by early-stage researchers is encouraged.

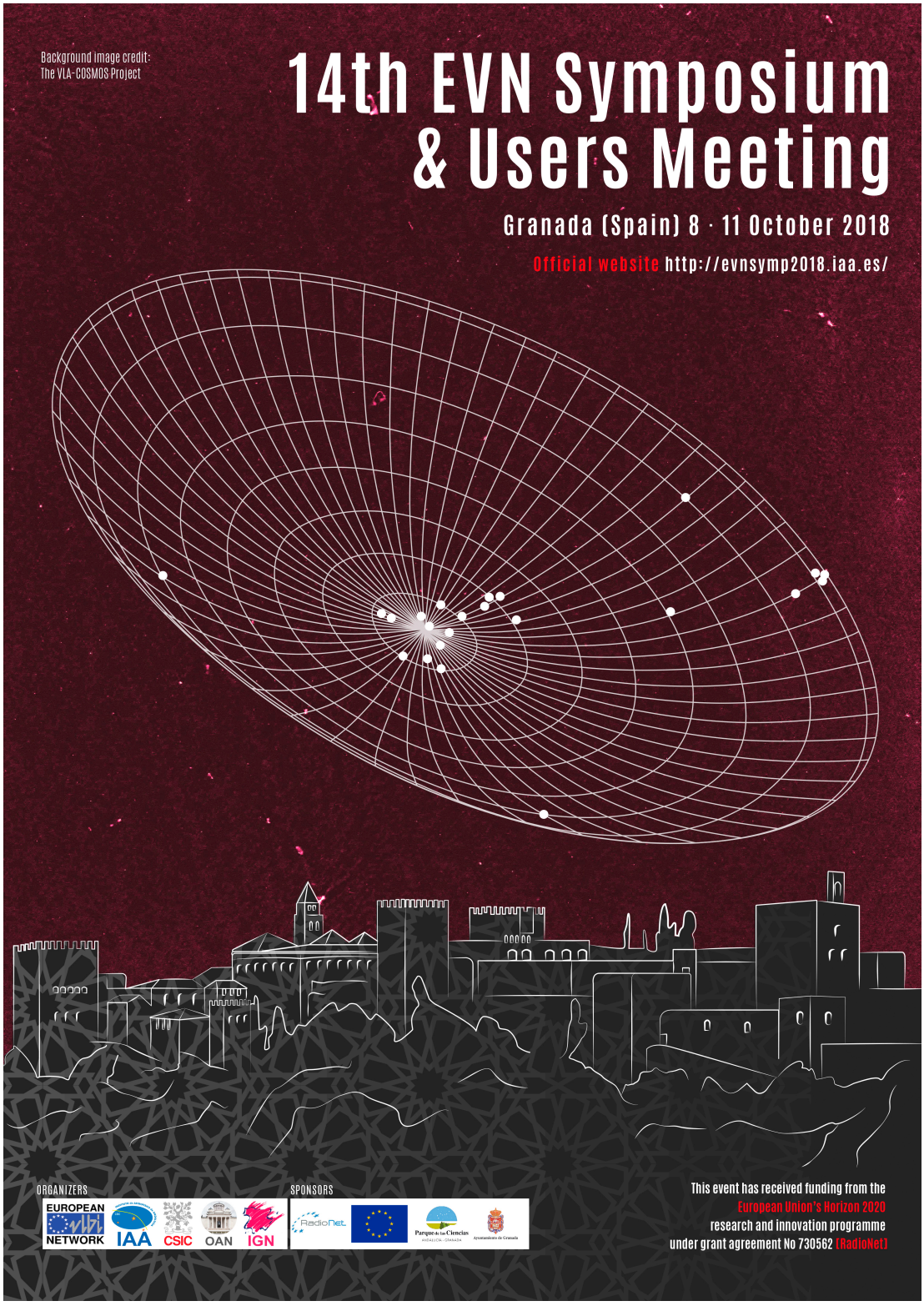
The weather and the city environment in Granada is typically excellent for the period selected for the conference. A number of social activities have been organized, including (among others) a welcome reception at Nazari Palace "Cuarto Real de Santo Domingo" (October 7th, evening), a visit to the historic Alhambra palaces and gardens (October 9th, evening), a visit to the IRAM 30m millimeter Radiotelescope (October 10th, afternoon; if weather allows), and the conference dinner in the historic rooms of Santa Paula Palace (October 10th, evening).

Further information regarding the meeting and details about committees, relevant dates, the venue, accommodation, and travelling to Granada is available on the conference web site at:

http://EVNSymp2018.iaa.es

Contact: EVN2018@iaa.es

This event has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 730562 [RadioNet URL: www.radionet-org.eu]).



P.S.: **A copy of the EVN Symposium 2018 advertisement poster** (see above) can be found here. Thanks for helping us to advertise the meeting by printing, and placing in your bulletin board.

Ivan Agudo on behalf of the SOC and the LOC

The 7th International VLBI Technology Workshop

The Seventh International VLBI Technology Workshop will be hosted by NARIT, the National Astronomical Research Institute of Thailand. It will take place from November 12 to 15, 2018, at Aonang Villa Resort, Krabi, Thailand. The details can be found here:

http://www.narit.or.th/en/index.php/ivtw2018

NARIT is in the process of establishing the Thai Radio Astronomy Observatory (TNRO) in Chiang Mai, which will host a new 40 m Radio Telescope and a 13.2 m VGOS station on the same site, expected to see first light in early 2020.

The International VLBI Technology Workshops have evolved from the highly successful 10 year series of International e-VLBI workshops. The scope of the technology workshops aims to encompass all areas of hardware and software development relevant to VLBI.

The Seventh workshop in this series will feature (but not be limited to) traditional VLBI topics, such as receivers, backends, recording equipment, and e-transport. One day will be dedicated to correlators, for which we will also invite a number of experts from non-VLBI fields.