European VLBI Network Newsletter

Number 34

January 2013

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1) Message from the EVN chairman

Dear Colleagues,

The highlight of the EVN calendar has to be the EVN Symposium and the meeting organised by Patrick Charlot, Geraldine Bourda and colleagues in Bordeaux last October was a truly splendid event, held in delightful surroundings, and with a fantastic range of talks showcasing the very best of VLBI science in general and EVN results in particular. Thanks again to Patrick and all his colleages.

The growing capabilities of VLBI which were demonstrated included new telescopes, new correlators, longer baselines, shorter wavelengths, more bandwidth, better astrometry, wider fields and improved imaging and calibration.

The meeting included much new science being done by a growing VLBI community which is developing stronger links with many other communities at other wavelengths and in other disciplines. That growing community is strongly supported by RadioNet, which is vital for building, training and educating the VLBI community.

The astrometric potential of VLBI in the Gaia era was convincingly demonstrated by a number of talks; the importance of high resolution radio observations for attacking the 'big question' of the evolution of star-formation and the role of AGN feedback was shown in a range of talks covering nearby and distant star-forming galaxies; and even the more traditional themes of VLBI such as parsec-scale jets were shown to be areas of vigorous research where real progress is being made.

Attending a meeting like this shows that high resolution radio astronomy hits almost all the 'big questions' of any national astronomy roadmap, with unique capabilities. It's up to all of us to spread that news.

Simon Garrington

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2) Call for EVN Proposals

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European VLBI Network

Call for Proposals

Deadline 1 February 2013

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This call for proposals is also available on the web as text

Observing proposals are invited for the EVN, a VLBI network of radio telescopes spread throughout Europe and beyond, operated by an international Consortium of institutes (http://www.evlbi.org/).

The observations may be conducted with disk recording (standard EVN or in real-time (e-VLBI).

The EVN facility is open to all astronomers. Use of the Network by astronomers not specialized in VLBI techniques is encouraged.

The Joint Institute for VLBI in Europe (JIVE) can provide support and advice on project preparation, scheduling, correlation and analysis. See EVN User Support at http://www.jive.nl

Future Standard EVN Observing Sessions (disk recording)

- 2013 Session 2 May 23 - Jun 13 18/21cm, 6cm ...
- 2013 Session 3 Oct 17 - Nov 07 18/21cm, 6cm ...
- 2014 Session 1 Feb 21 - Mar 14 18/21cm, 6cm .*Provisional*..

Proposals received by 1 February 2013 will be considered for scheduling in Session 2, 2013 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure.

RadioAstron Key Science Proposals requiring EVN co-observing in the AO1 period should be submitted by the 1 February 2013 deadline using the EVN Northstar Proposal Tool. The EVN will endeavour to support a very limited number of RA KSP observations requiring time outside of the normal EVN observing sessions. Priority will be given to highly rated projects which make good use of the full EVN array. Such proposals must include a prioritized list of possible scheduling options for each observation, specifying the year, and exact date and UT start and stop times for each of these options.

Future e-EVN Observing Sessions (real-time correlation)

- 2013 Mar 19 - Mar 20 (start at 13 UTC) 18/21cm, 6cm, 5cm or 1.3cm
- 2013 Apr 16 - Apr 17 (start at 13 UTC) 18/21cm, 6cm, 5cm or 1.3cm
- 2013 May 02 - May 03 (start at 13 UTC) 18/21cm, 6cm, 5cm or 1.3cm
- 2013 Jun 18 - Jun 19 (start at 13 UTC) 18/21cm, 6cm, 5cm or 1.3cm

Please consult the e-EVN web page at http://www.evlbi.org/evlbi/e-vlbi_status.html to check for possible updates, and for the available array.

Successful proposals with an e-VLBI component submitted by the February 1st deadline will be considered for scheduling in the above e-VLBI sessions starting from April 16th 2013.

Note that only one wavelength will be run in each session, depending on proposal priorities.

See http://www.e-merlin.ac.uk/vlbi/evn_docs/guidelines.html for details concerning the e-VLBI observation classes and the observing modes.

Features for the next regular EVN and e-EVN sessions

* The antenna at Torun now has a K-Band receiver with SEFD values of 500Jy or better. It is expected to be available for EVN observations from Session 1, 2013.

* Both Jb1 and Jb2 will be available for EVN recording, as will simultaneous EVN+e-MERLIN operations with home-station EVN recording. For such simultaneous EVN+e-MERLIN operations, VLBI data from Cm will be made available at up to 512Mbps (e.g. 64MHz in both hands of circular polarization) on a best efforts basis. For updated information please consult the web at: http://www.e-merlin.ac.uk/vlbi/

* Please consult http://www.evlbi.org/evlbi/e-vlbi_status.html and the EVN User Guide for updates on the current EVN and e-EVN array; availability of different stations per observing band and for the dates of the e-EVN observing sessions.

Large EVN projects

Most proposals request 12-48hrs observing time. The EVN Program Committee (PC) also encourages larger projects (>48 hrs); these will be subject to more detailed scrutiny, and the EVN PC may, in some cases, attach conditions on the release of the data.

How to submit

All EVN, Global and e-VLBI proposals (except ToO proposals) must be submitted using the NorthStar on-line proposal submission tool. Global proposals will be forwarded to NRAO automatically and should not be submitted to NRAO separately. New proposers should register at http://proposal.jive.nl

The SCIENTIFIC JUSTIFICATION MUST BE LIMITED TO 2 PAGES in length. Up to 2 additional pages with diagrams may be included.

The deadline for submission is 23:59:59 UTC on 1 February 2013.

Additional information

Further information on Global VLBI, EVN+MERLIN and e-EVN observations, and guidelines for proposal submission are available at: http://www.e-merlin.ac.uk/vlbi/evn_docs/guidelines.html

The EVN User Guide describes the network and provides general information on its capabilities.

The current antenna capabilities can be found in the status tables. For the standard EVN see http://www.evlbi.org/user_guide/EVNstatus.txt.

For the e-EVN array see http://www.evlbi.org/evlbi/e-vlbi_status.html.

The On-line VLBI catalogue lists sources observed by the EVN and Global VLBI.

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3) EVN Science Highlights

a) Black holes - no place left to hide!

Very sensitive, wide-field observations with a worldwide network of radio telescopes have uncovered black holes residing in the centre of dust obscured galaxies. In some cases, the amount of dust is so large that even x-rays from the accreting black holes are absorbed in these systems. This is the result of research done by astronomers Chi, Barthel and Garrett from Groningen and Dwingeloo, and is set to appear in an upcoming issue of Astronomy & Astrophysics.

Also in apparently normal galaxies, it seems black holes grow steadily by devouring matter. The bright, exotic radiation, usually the result of these so-called accretion processes, seems to be completely obscured in some galaxies. Only a network of highly sensitive radio telescopes can detect these processes is the conclusion of the Dutch astronomers. The suspicion that the faint radio waves, emitted by many galaxies in the distant early universe is the result of accretion by their black holes, has now been proven.

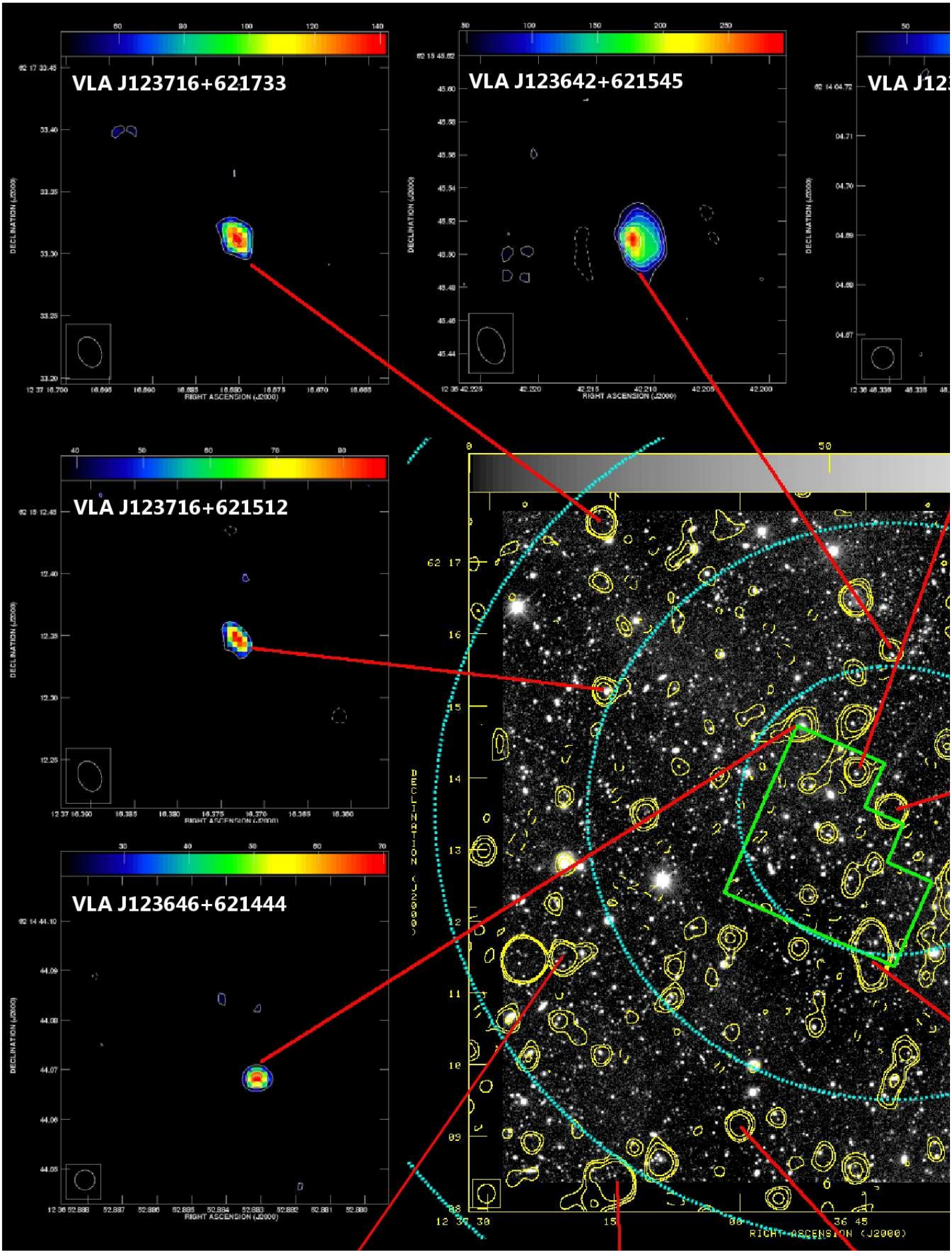
Traditional radio telescopes, such as the Westerbork Synthesis Radio Telescope (WSRT), cannot determine the exact nature of the radio emission. The technique of Very Long Baseline Interferometry (VLBI) is necessary, in which a network of radio telescopes in different countries or continents observe the same object. The many gigabytes of data of the individual telescopes are then combined. This method digitally simulates a radio telescope of thousands of kilometers in diameter, and as a consequence with a very high resolution and sensitivity.

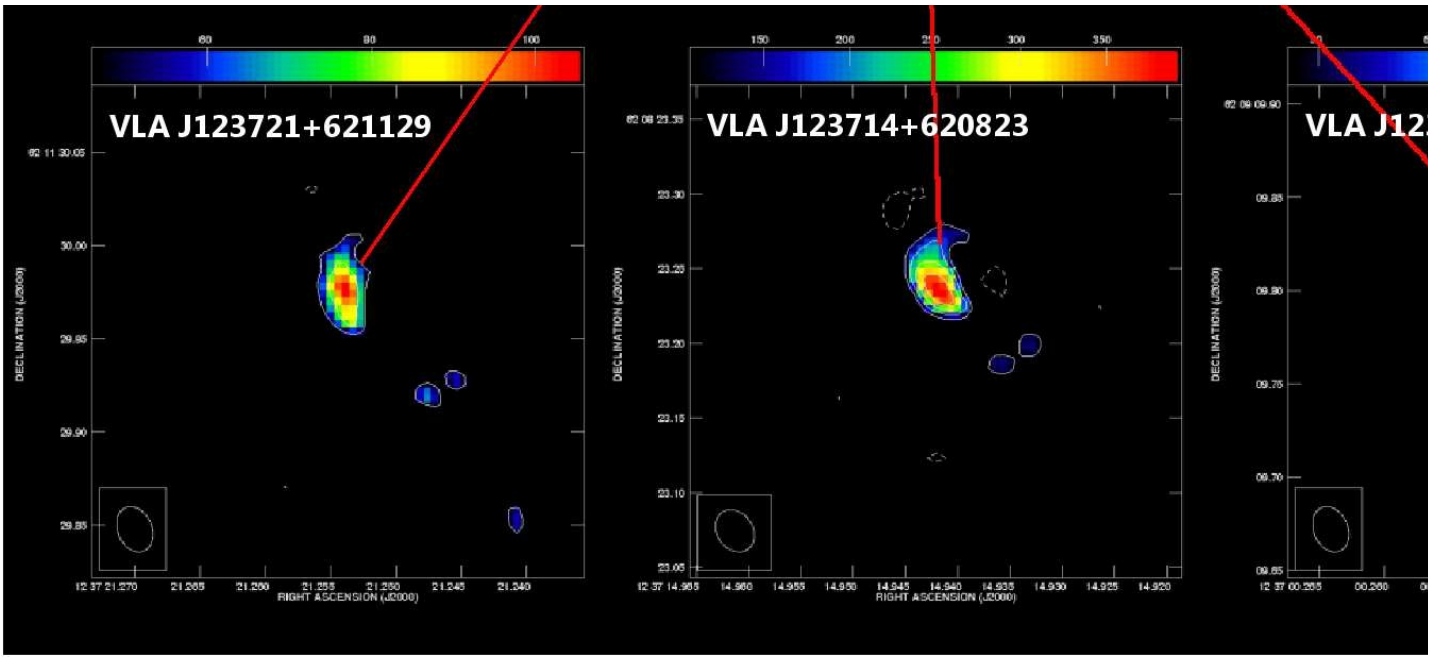
Using such a VLBI-network of sixteen radio telescopes on two continents (Europe and the United States), a so far unimaginable record sensitivity and resolution could be reached, undoubtedly proving the accretion activity of the distant galaxies.

'We know many galaxies have black holes. Of course these need to grow to what they are now and it seems that, thanks to these VLBI-observations of the galaxies in the Northern Hubble Deep Field, we can now really observe this growth', say prof. Peter Barthel of the Kapteyn Institute of the University of Gronignen and prof. Michael Garrett of ASTRON, the Netherlands Institute for Radio Astronomy in Dwingeloo.

Barthel adds: 'We are proud of these results, but what is mostly in our minds is the fact that the one who had the largest part in this study is no longer with us.' Doctoral student Seungyoup Chi, from South-Korea, died from a serious illness in the year he would obtain his PhD doctorate in Groningen. 'This publication appears posthumous, also in his memory', say Barthel and Garrett, at the time supervisors of Chi.

Reference: Chi, Barthel and Garrett, 2013 A&A in press (astro-ph/1301.1253)





Black holes - no place to hide. Composite image of the radio (WSRT 1.4GHz)-optical image of the HDF-N and HFF, surrounded by postage stap images of the twelve compact VLBI-detected radio sources.

b) Probing the nature of compact ultra-steep spectrum radio sources with the e-EVN and e-MERLIN

Ultra-steep spectrum (USS) sources are those with a radio spectral index of <-1.4. The subset of such sources which are compact on arcsecond scales have not been well-studied, and clues as to their nature are few. Suggestions which have been put forward include radio galaxies located near the epoch of re-ionisation, young obscured radio galaxies, steep-spectrum core AGN, and Galactic pulsars. In an attempt to narrow down the possibilities we have observed a small sample of such objects, selected for spectral index by comparing the VLSS and WENSS catalogues, and for arcsecond-scale compactness from the flux ratio between the NVSS and FIRST surveys. Our observational results, accepted for publication in MNRAS Letters, show that these sources are a diverse group.

From the original sample of USS sources, five were selected for an exploratory VLBI survey. These sources were observed at 1.6 GHz with ten stations of the EVN in e-VLBI mode in June 2010 (programme EP070). At the same time, synthesis array data were recorded at Westerbork enabling an investigation of the compactness of the objects. Despite some rather large (for VLBI) pointing offsets, three of the USS sources were detected in the EVN observations recovering between 20 and 94% of the Westerbork-only flux densities. In March 2011, e-MERLIN commissioning observations of two of the sources were also carried out, using the available five stations equipped with the new C-band system.

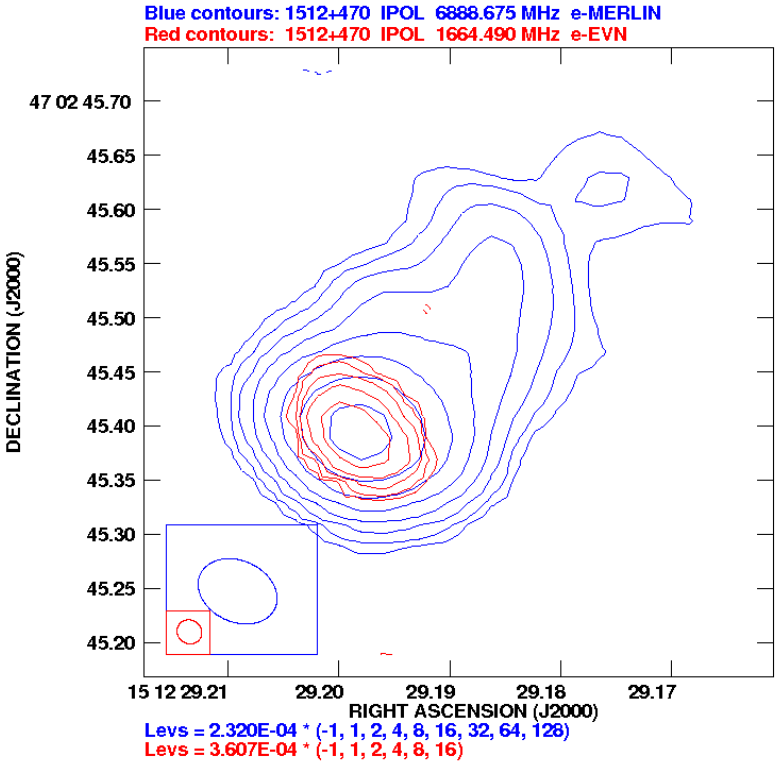
The first of our detections, J072212+291042, is the weakest of the three VLBI-detections; the e-EVN observations show an unresolved source of ~2mJy, recovering only 27% of the simultaneous Westerbork flux density. Since the source is undetected with e-MERLIN at 6.6GHz to a 3-sigma limit of 0.12mJy/bm, this implies the spectral index remains steep (<-1.4) at these frequencies. With no catalogued counterparts at other wavebands, the nature of this source remains unclear. Given its properties, the most likely scenario is either a steep spectrum AGN core, or a Galactic pulsar. No known pulsar or pulsar candidate is listed at these coordinates, but further follow-up will allow us to test this scenario.

The only source in our sample to have an SDSS counterpart, J130612+514407 appears to be associated with a brightest cluster galaxy at a redshift of 0.2773. The EVN observations recover 94% of the Westerbork flux but, since the source was not observed with e-MERLIN, we do not yet know if the spectral index remains steep at higher frequencies. The SDSS association, together with corresponding 2MASS and ROSAT counterparts, suggest that the AGN core scenario is the most likely in this case.

The final VLBI-detection in this survey, J151229+470245 is something of an anomaly. Owing to an error in one of the catalogues used to compile the initial sample, the source turns out to have "only" a steep spectrum, but not ultra-steep. This makes it a peculiar compact steep spectrum source, rather than a USS source, but interesting nonetheless. The EVN results recover less than 21% of the simultaneous WSRT-only flux density, and show the source to be resolved on VLBI scales, elongated in a NE-SW direction. The e-MERLIN map shows an apparent core-jet morphology, with the "core" coinciding with the (resolved) EVN source, suggesting that it is not an AGN core (see figure). The observed steep spectrum, low brightness temperature and lack of variability between VLA and WSRT epochs suggest lobe emission on 10-mas scales, rather than strong core emission. What makes this source peculiar is that it is an example of an infrared-faint radio source (e.g. Norris et al. 2006), and the first of these to show signs of being resolved on VLBI scales.

Whilst this is a small sample, and the data are clearly not sufficient to uniquely determine the nature of these sources, these results demonstrate that VLBI is a useful tool in attempting to understand this class of object. For our two VLBI-detected USS sources, significant flux is lost between Westerbork and EVN scales and further follow-up observations are planned at intermediate resolution. The unexpected results from this observational project show that compact USS sources are a diverse class of object where VLBI can provide vital clues as to their nature.

Megan Argo, Zsolt Paragi, Huub Rottgering, Hans-Rainer Klockner, George Miley and Mehreen Mahmud
MNRAS Letters (2013) astro-ph/1301.4813



e-MERLIN and EVN image of the USS source J151229+470245.

4) EVN Technical Developments

a) Towards 4Gbps VLBI with the EVN

As the reader may remember, an attempt was made to do 4Gbps VLBI with the EVN last year June. But although technically everything worked, both recorded and real-time, fringes were not found. On January 16 2013, right after the e-VLBI session, another 4Gbps test observation took place, first at C-band (Ef, On, Ys), followed by X-band (Ef, Ys, Mh). Depending on the equipment available at the various stations recordings were made on Mark5B+ units at 2Gbps (only one polarisation), on a Mark5C unit at 4Gbps and on a FlexBuff recorder (developed at Mh for the NEXPReS project), also at 4Gbps. Data were also transferred in real-time to the SFXC correlator at JIVE.

At this time, lots of data still have to be correlated and analyzed. However, as a first step, fringes were successfully found in the Mark5B+ data at C-band, proving that the 4Gbps mode of the DBBC works correctly. The investigation continues, stay tuned.

5) EVN Scheduler's Report

a) SESSIONS SCHEDULED SINCE THE LAST NEWSLETTER

2012 Session 3: 18 October - 8 November
Wavelengths: 18/21, 6, 3.6, 5, 1.3 cm
Number of different user projects observed: 19
SESSION DURATION: 21.1 days
Scheduling efficiency: 60.1 %

Breakdown of observations by type and correlator. T-BYTES indicates the estimated disk useage (in TB) at EVN telescopes.

	N-OBS	HOURS	DAYS	T-BYTES
TOTAL	47	304.0	12.7	661.2
EVN-only	31	209.5	8.7	559.2
GLOBAL	4	58.5	2.4	60.8
Short Obs.	0	0.0	0.0	0.0
Tests	12	36.0	1.5	40.9
User: Cont.	21	151.0	6.3	523.0
User: Line	11	106.0	4.4	60.3
User: Pulsar	3	11.0	0.5	37.0
EVN-Corr.	38	254.5	10.6	627.7
Bonn-Corr.	4	31.0	1.3	23.5
VLBA-Corr.	0	0.0	0.0	0.0
eEVN-Corr.	0	0.0	0.0	
Other-Corr.	0	0.0	0.0	0.0
CAL-only	5	18.5	0.8	
MERLIN	0			
Arecibo	7			
VLBA	1			
GBT	2			
VLA	0			
Robledo	8			
Goldstone	0			
Radioastron	5			

b) e-VLBI SCHEDULING

SESSION	DATE	WAVELENGTH	HOURS	e-VLBI PROPOSAL TYPE				
				NORMAL	SHORT	DISK	ToO	TRIGGER
12e08	09OCT12	6cm	22h	2	-	-	1	2 sched 0 trig
12e09	13NOV12	6cm	24h	2	-	-	-	2 sched 0 trig
12e10	04DEC12	6cm	14h	2	-	-	-	2 sched 0 trig
13e01	15JAN13	6cm	17h	2	2	-	-	2 sched 0 trig

6) EVN Programme Committee:

The EVN Programme Committee (PC) consists of 12 voting members populated from the EVN institutes (8) and "At Large" representatives from other European institutes (4). In addition the EVN Scheduler attends PC meetings as a non-voting member. Members typically serve on the committee for a period of around 2-3 years, and are then replaced by other representatives invited by the EVN Consortium Board of Directors. The PC meets three times a year - typically around a month after each proposal deadline, to discuss recent proposal received, to allocate a grade to each successful proposal, and to provide detailed feedback to each PI. For the consideration of Global VLBI proposals, independent grades are provided by NRAO. In addition, 2 additional voting members from NRAO join the PC meetings for extended discussions. Target of Opportunity proposals received outside formal deadlines are circulated to PC members by the PC Chairperson; grades and feedback being returned to the PI typically within a few days.

The present EVN PC membership is as shown below:
Members from EVN Institutes:
A. Bartkiewicz (Torun), B. Campbell (JIVE), M. Giroletti (INAF-IRA), Z. Shen (Sh + Ur), M. Lindqvist (OSO), A. Lobanov (MPIfR) - Secretary, A. Polatidis (ASTRON), T. Muxlow (JBCA/e-MERLIN) - EVN PC Chair.

"At Large" Members drawn from other European Institutes:
J.C. Guirado (Univ. Valencia), M. Perez-Torres (IAA-CSIC), E. Koerding (Radboud Univ. Nijmegen)*, N. Vlahakis (Univ. Athens),

Representatives:
R. Porcas EVN (Scheduler), B. Campbell (EVN Correlator at JIVE),

NRAO Representatives:
M. Reid (CfA) - Chair NRAO Review Committee, M. Claussen (NRAO Scheduler)

Tom Muxlow
EVN PC Chair

7) Applications sought for Helena Kluyver Female Visitor Programme at JIVE and ASTRON

The Helena Kluyver female visitor programme has been in operation at JIVE and ASTRON for several years. Its goal is to host advanced career female researchers in Dwingeloo for an extended period of time, in order to exchange experience with younger staff. In addition to sharing professional expertise, an important part of the exchange is in coaching young women to build careers in a male dominated environment. The programme covers all travel, food and accommodation expenses for the visitor, for up to three months.

Each visit is based on a research project in collaboration with a JIVE or ASTRON employee (male or female!). This may be in astronomy research, correlator control systems, connectivity for e-VLBI, antenna design, or other relevant software or algorithm development. Applications are open to women from any relevant field and any nationality.

For more information, email helenakluyver@astron.nl or visit the Helena Kluyver web page. If you know any potential candidates, please bring the Helena Kluyver programme to their attention.

8) 11th European VLBI network Symposium

The 11th European VLBI Network Symposium was held in Bordeaux from the 9th to the 12th of October 2012. The purpose of the symposium was to share and publicize the latest scientific results and technical developments from VLBI, space VLBI and e-VLBI. The conference was attended by a total of 122 participants originating from 47 institutes in 19 countries world-wide. Of these, 96 participants were from Europe while 26 participants came from outside Europe. Germany had the largest number of delegates (22 participants), followed by France (15 participants), The Netherlands (13 participants) and Japan (11 participants). More than 20 students at the PhD level (or at a lower level) attended the symposium.

The program of the meeting consisted of 71 oral presentations (including 9 invited speakers) spread over the 3.5 days of the conference along with 43 posters. The program was organized in 11 scientific sessions covering a very wide range of topics in stellar, galactic and extragalactic astrophysics as well as in astrometry and planetary science. The Scientific Organizing Committee also encouraged presentations addressing synergy between (e-)VLBI and other new or planned radio facilities (ALMA, LOFAR, e-MERLIN,...) or instruments at other wavelengths (Fermi, CTA, Gaia,...). Several of these were the subject of invited talks. Additionally, the program comprised an EVN Users Meeting on one of the evening to foster interaction between the EVN users and the EVN organization. The meeting was chaired by Tom Muxlow, the Chair of the EVN Program Committee. A number of aspects, from proposal evaluation to data correlation, were addressed and fruitful discussions came up.

The program also included social activities during one of the afternoon. One of these was the traditional football match opposing an international team of symposium participants to the local team. Experience of the international team prevailed and they beat the local team 3-0. Those not fans of football could enjoy a guided tour of Bordeaux in parallel during that afternoon. Following these events, all participants gathered in the evening for the conference dinner, which was held in a "Chateau" in the vicinity of Bordeaux, overlooking vineyards. The dinner was preceded by a guided tour of the winery which drew much attention.

The symposium reached its end with the closing speech given by the Chair of the EVN Consortium Board of Directors, Simon Garrington, who highlighted the big steps forward and the fantastic science done by a growing global VLBI community. Proceedings of the symposium are on their way and will be published by the Proceedings of Science.

I would like to warmly thank the members of the Local Organizing Committee and Scientific Organizing Committee, along with our sponsors, with RadioNet3 on first hand, for making this symposium a memorable event.

Patrick Charlot, SOC Chairman


inpi
inpi

Group photo of the participants in the 11th EVN symposium. The photo was taken at "Place de la Bourse", one of the major historic squares in Bordeaux, in the vicinity of the conference center. Other pictures are available from http://evn2012.obs.u-bordeaux1.fr.

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9) Future Meetings

a) Locating Astrophysical Transients

13-17 May 2013
Lorentz Center, Leiden, Netherlands

Meeting webpages

We are organizing a workshop on fast localization and high angular resolution radio imaging of astrophysical transients. A new generation of wide-field instruments, and the possibility of rapid follow-up with very long baseline interferometry (VLBI) at the highest possible angular resolution, provide a great opportunity to understand these enigmatic transient sources. Our main aims are to have both students and experienced researchers, from both the wide-field and the VLBI communities: 1) learn practical hands-on methods from each other's fields, 2) form the new collaborations needed to make this new connection of fields a success. Furthermore, by offering a scientific program of excellent confirmed speakers from across the electromagnetic and gravitational-wave spectrum, we aim to introduce VLBI to a wider, non-radio astronomy transient community. We expect to strengthen the scientific case for a long-baseline configuration SKA as well.

The science topics covered will be Galactic neutron stars (pulsars) and black holes, gamma-ray binaries, unidentified TeV sources, novae, supernovae, GRB, tidal disruption events and astrophysical sources of gravitational waves. The instruments and techniques to be introduced are the European VLBI Network (EVN), real-time e-VLBI, WSRT Apertif, SKA pathfinders (e-Merlin/LOFAR/ASKAP/MeerkAT/MWA/LWA) as well as transient facilities and programmes in the other parts of the electromagnetic spectrum. We will leave ample time for discussions during the workshop.

Scientific organizers: Zsolt Paragi (JIVE, Netherlands), Joeri van Leeuwen (Astron, Netherlands)

SOC: Felix Aharonian (DIAS/Ireland, MPIK/Germany), Francisco Colomer (OAN, Spain), Rob Fender (Univ. Southampton, United Kingdom), Bryan Gaensler (CAASTRO, Australia), Stefanie Komossa (MPIfR, Germany), Chryssa Kouveliotou (NASA MSFC, USA) Gijs Nelemans (RU Nijmegen, Netherlands), Steven Tingay (ICRAR, Australia)

Important dates: Registration and abstract submission: 15 February 2013 Final programme: 15 March 2013 For more information or to sign up, visit our workshop webpage.

There is no registration fee, but space is limited. Please consult the webpages or contact the **workshop coordinator Ikram Cakir (cakir [at] lorentzcenter [dot] nl)** if you have questions. Questions about the scientific programme should go directly to **Zsolt Paragi (zparagi [at] jive [dot] nl) and Joeri van Leeuwen (leeuwen [at] astron [dot] nl)** .

We will publish the presented results in a special issue of Publications of the Astronomical Society of Australia.

Workshop attendance is limited to 55 people

This workshop is supported by the Lorentz Center, RadioNet, and NEXPReS.

b) 2013 European Radio Interferometry School (ERIS)

9-13 September 2013
Dwingeloo, Netherlands

Conference email:eris2013@astron.nl

The Fifth European Radio Interferometry School will take place in Dwingeloo (The Netherlands) during the week 9-13 September 2013. ERIS will provide a week of lectures and tutorials on how to achieve scientific results from radio interferometry. The topics covered by the lectures/tutorials will include:

- Calibration and imaging continuum, spectral line, and polarization data
- Low frequency (LOFAR domain), high frequency (ALMA/IRAM domain), and VLBI interferometry
- Extracting the information from the data and interpreting the results
- Choosing the most suited array and observing plan for your project

Examples will be drawn from instrument like LOFAR, IRAM, ALMA, VLA, EVN and e-MERLIN, with the most widely-used data reduction packages such as AIPS, CASA, GILDAS and Parseltongue.

The school will be hosted by ASTRON & JIVE (Dwingeloo). The participants and lecturers will be accommodated in local hotels. Participants will be sharing double rooms.

A registration fee of 150 euro is requested, which will cover the accommodation and half board for the 5 days of the school, from the arrival on Sunday 8 September 2013 to the departure on Friday 13 September 2013. Please send an email to eris2013@astron.nl, indicating your interest to be notified of future announcements. Forms for registration and further instructions will soon be made available. Note that due to logistical limitations we will be able to accommodate about 80 participants, so we encourage you to express your interest as soon as possible.

SOC: R. Pizzo (ASTRON) & Z. Paragi (JIVE), M. Bremer (IRAM), M. Brentjens (ASTRON), B. Campbell (JIVE), R. Laing (ESO-ALMA), J. McKean (ASTRON), A. Richards (JBCA), T. Venturi (INAF, IRA), O. Wucknitz (MPIfR)

LOC: L. Elpenhof, S. Mellema , Z. Paragi, R. Pizzo, G. Surcis, C. Toribio

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Edited by Rob Beswick (JBCA/e-MERLIN)