European VLBI Network Newsletter
Number 11
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1. Call for Proposals - Deadline 1 June 2005

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 EVN is open to all astronomers. Use of the Network by astronomers not specialised in the VLBI technique 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.

EVN Observing Sessions in 2005-2006

2005 Session 2	Jun 02 - Jun 20	18/21cm (+MERLIN), 6cm + ...
2005 Session 3	Oct 20 - Nov 10	18/21 cm +6cm + 1.3cm + 30cm...
2006 Session 1	February/March	6cm (+MERLIN), 5cm (+MERLIN), +...

Proposals received by 1 June 2005 will be considered for scheduling in Session 3, 2005 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure. Other wavelengths which may be scheduled in 2005-2006 are: 90cm, 50cm, 3.6cm, 7mm. Special features for Sessions in 2005-2006.

Recording at 1 Gb/s (Mark 5A) available at all EVN telescopes (see http://www.mpifr-bonn.mpg.de/div/vlbicor/evn_tog/EVN_Mark_5_Status.html). Use of this data rate should be clearly justified.

More information can be found at http://www.obs.u-bordeaux1.fr/vlbi/EVN/call.html

* It is anticipated that the NRAO GBT will be available to participate in a limited number of 1 Gb/s observations (for a total time of up to 24-48 hours) in the October/November 2005 Global session. Support will be provided by Haystack Observatory. As time for this will be limited by the available disk resources, preference will be given to projects that utilize a small subset of large antennas: Effelsberg, Jodrell Bank (Lovell Telescope), Westerbork, Arecibo, GBT. Proposals requesting this array will be treated as standard global VLBI proposals and should be submitted to both the EVN and NRAO.

* Lovell Telescope available for observing at 6 cm.

* 0.25s integrations available at EVN MkIV Data Processor at JIVE for wide-field applications.

* EVN Data Analysis pipeline in operation. See http://www.evlbi.org/pipeline/user_expts.html.

Large 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 - Complete a coversheet and attach a scientific justification (maximum 2 pages). Up to 2 additional pages with diagrams may be included; the total, including cover sheet, should not exceed 6 pages. Submit to: Dr. Richard Porcas, EVN Scheduler, MPIfR, Auf dem Huegel 69, D 53121 BONN, GERMANY or by email to: proposevn@HP.mpifr-bonn.mpg.de. For further details see http://www.evlbi.org/proposals/prop.html.

Additional information - The detailed "Call for Proposals" has further information on Global VLBI, EVN+MERLIN and guidelines for proposal submission: see http://www.obs.u-bordeaux1.fr/vlbi/EVN/call-long.html. The EVN User Guide (http://www.evlbi.org/user_guide/user_guide.html) describes the network and provides general information on its capabilities. The EVN Status Table (http://www.mpifr-bonn.mpg.de/EVN/EVNstatus.txt) gives current antenna capabilities. The On-line VLBI catalogue (http://db.ira.cnr.it/evn//) lists sources observed by the EVN and Global VLBI.

2. Message from the Chairman

The EVN experiences one breakthrough after another. After the first successes in *e*VLBI initiated by JIVE, the EVN continues with real-time VLBI development as the network connectivity at all EVN stations continues to improve. While initially this capacity would be used for network monitoring experiments, already some "hot science" experiments have been executed in this mode. Eventually the *e*VLBI operational mode c/would complement and/or replace disk-based recording. In addition, the technical developments at JIVE have resulted in considerable EVN testing of high bandwidth recording and some regular 1 Gbps recording experiments have already been done during recent EVN sessions. The recent EVN Call for proposals announced increased scheduling capability for the October 2005-3 session for 1 Gbps experiments, which is only limited by the availability of diskpacks. This

experience with recording at the highest data rate attainable with the current Mk5A units will be the basis for going to even higher recording rates of up to 4 Gbps with the Mk5B systems.

The next meeting of the EVN Directors will be held 23-25 May and will be hosted by Hartebeesthoek Observatory. Further issues on the table are the IRA-led *digital*BBC project to build a replacement for the analogue BBCs that are currently used at EVN stations. This dBBC system will integrate with the Mk5B systems (anticipated to arrive in November 2005) to form a new digital backend for old and new VLBI stations. There will also an evaluation of the success of Ultra-wideband VLBI during recent sessions and a discussion of plans for new HW and SW initiatives for the EVN and for JIVE.

After two years of serving as the Chairman of the Consortium Board of Directors, I am pleased to announce that Franco Mantovani (IRA, Bologna) will be installed as the new EVN CBD Chairman after the upcoming CBD meeting. Franco has a long experience with VLBI and knows the EVN activities and objectives very well. I wish him well in leading this exciting consortium and its scientifically productive users group for the next two years.

Willem Baan (EVN Chairman)

3. e-VLBI - First Continuum Science Results & Current Status

As part of the continuing development of e-VLBI, a continuum science demonstration was organised on 12 March 2005 by the e-VLBI science group led by John Conway. The idea was to build on the very successful spectral line e-VLBI science demo (see EVN Newsletter No. 10). Telescopes involved included Arecibo, WSRT phased-array, Onsala, Torun, Jodrell Bank and Cambridge. The target source was SN2001em, a supernova that was recently shown to have a rising radio and x-ray luminosity (Stockdale et al., IAUC 8282), 2 years after the initial explosion. Granot & Ramirez-Ruiz, (ApJ 609, L9) have proposed a "GRB jet" explanation for the enhanced radio & X-ray emission at late times, in this scenario the emission from a relativistic but substantially off-axis jet only becomes visible as it turns sub-relativistic - a hypothesis that might be tested with high resolution radio observations of the source.

The e-VLBI observations of SN2001em were conducted at λ18 cm using a sustained data rate of 64 Mbps. These data rates were achieved throughout most of the run, even via the 155 Mbps link to Arecibo. Unfortunately, due to poor weather conditions in the UK the radio telescopes at Jodrell Bank and Cambridge were "winded-off" but the remaining telescopes performed flawlessly. In the morning various technical tests were conducted – before Arecibo joined the array. The tests included long scans on well known calibrators with the EVN correlator performing well. Just after lunchtime, the observations switched to the faint supernova, since this is a sub-mJy source phase-referencing was employed, involving rapid source switching and short scans. Enhancements made to the correlator control software that had worked well for long and continuous single source scans (on calibrators), were found to be less optimal for rapid source switching observations. e-VLBI fringes disappeared as soon as the SN2001em experiment began and the next hour was spent frantically trying to identify and then correct the problem. By the time a quick fix had been made the visibility of the source was becoming less than optimal but about 45 minutes of reasonable data were obtained. Although phase-referencing failed there is a tentative

detection of the source with self-calibration, the presence of Arecibo in the array (and appropriate data re-weighting) playing a crucial role in this process. Figure 1 shows the tentative detection of SN2001em (Garrett et al. in prep).

All-in-all, a great deal was learned from this science demo, in particular, further technical tests should include more realistic scheduling scenarios. We are confident that the lessons learned from this demo will greatly increase the efficiency rate of future observations.

A few days after the e-VLBI science demo was run, a large and ambitious e-VLBI proposal was submitted to the EC, as part of the Research Infrastructures Grid programme. The proposal coordinated by JIVE, aims to make e-VLBI a production grade astronomical instrument, transparently combining the e-EVN telescopes and e-MERLIN together into a powerful interferometer, sensitive to scales ranging from the arcsecond to milliarcsecond scale, with sub-microJy sensitivity. The proposal also includes network provision for telescopes that are not yet connected to the pan-European research network, GEANT. A significant R&D aspect is also present within the proposal, looking forward to data rates of 10-30 Gbps per telescope and the next generation correlator that will be required to process these data. An evaluation hearing takes place in May and we expect to find out if the proposal will be funded or not shortly thereafter. Fingers crossed…

Finally, Steve Parsley, head of R&D/Maintenance at JIVE, will leave Dwingeloo in July, taking up a new position at Cardiff University as project manager of a new CMB experiment, destined for the Antarctica. We wish Steve all the best in his future position. Steve has played a major role in pushing forward e-VLBI in Europe, from an interesting concept to a practical reality. He has also been instrumental in raising the profile of e-VLBI within the wider networking community, often taking the lead in the various e-VLBI demos that have appeared at Terrena and iGRID meetings around the world. As Steve leaves, a new student is joining the e-VLBI team at JIVE, Julianne Sansa is a PhD student at the University of Groningen (Kapteyn Institute) and part of her thesis will investigate various networking aspects of e-VLBI, including the use of different transport protocols. Julianne will be co-supervised by several staff members at the Kapteyn and JIVE, including Arpad Szomoru. Until a successor to Steve Parsley is chosen, Arpad will also serve as the main point of contact for all matters concerning e-VLBI at JIVE.

Mike Garrett & Arpad Szomoru (JIVE)

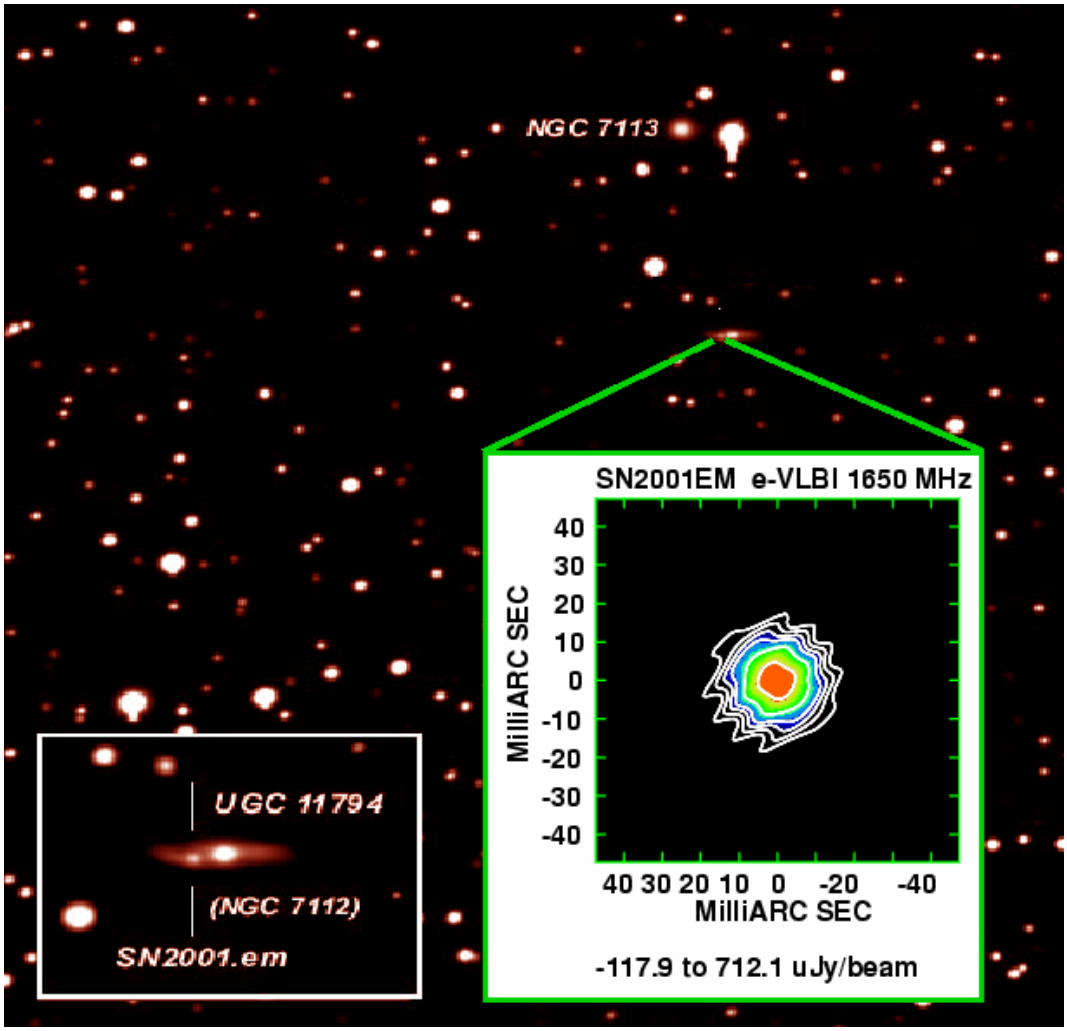


Figure 1: The tentative e-VLBI detection of SN2001em (Garrett et al. in prep).

4. Official Inauguration of the new 40-m Radiotelescope at Yebes, Spain

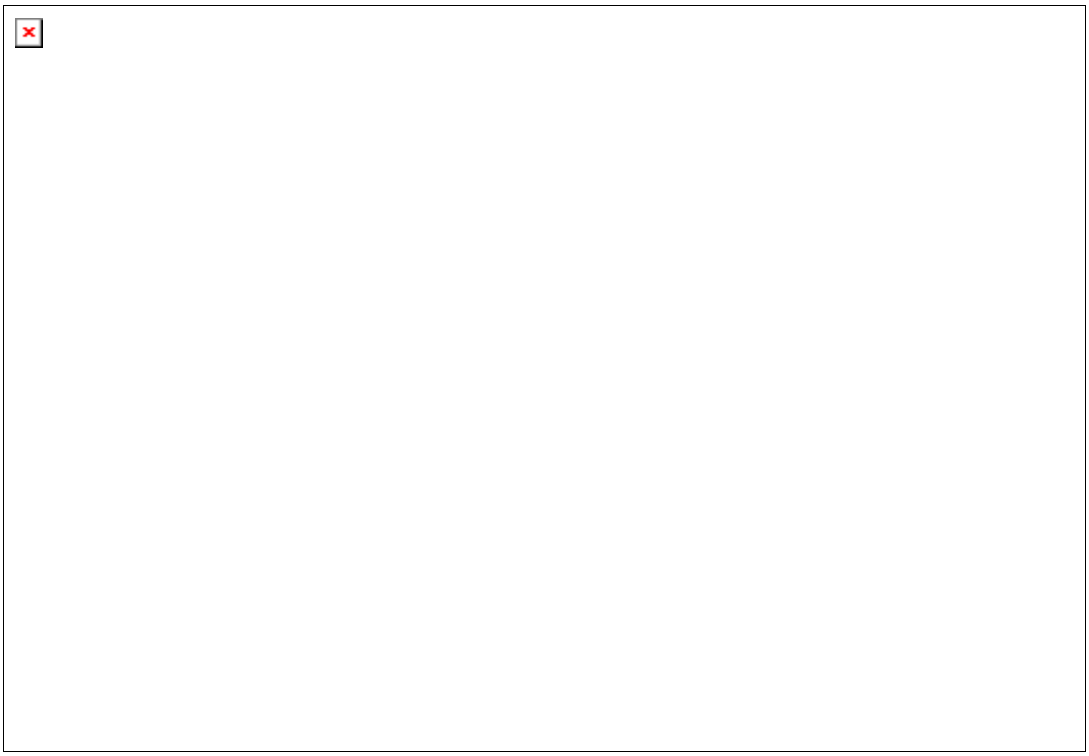
The inauguration of the new 40-m radiotelescope of IGN in Yebes was held on April 26th, 2005, with the presence of Their Royal Highnesses the Princes of Asturias. The Yebes site is protected against radio interference by law since 2003.

The project of building a new 40-m radiotelescope was born as one of the most important elements of the plan drawn by the Instituto Geográfico Nacional (IGN) for the development of radioastronomy in Spain since the early 90s. During a scientific international workshop of experts held in 1992, the astronomers and engineers of the National Astronomical Observatory (OAN) identified the most interesting fields of scientific research in order to define the technical characteristics of the new radiotelescope. The feasibility study followed in 1994-95, which pointed out that most of the instrument could be built by the spanish industry. The engineering project was finished in 1996-97, and the construction of the radiotelescope started in 1998.

The radiotelescope is of turning head alt-azimutal mount, with Nasmyth-Cassegrain optical configuration. The main reflector is a 40-m paraboloid, made of high-precision 420 aluminum panels. The subreflector, an hyperbolic mirror of 3-m diameter, is located on a quadrupode. The receiver cabin is quite large (8x9x4 m), therefore allowing the simultaneous installation of many receivers. The telescope structure follows the homology principles, and can survive winds of up to 180 km/h. Pointing is better than 4 arcseconds. The instrument is designed to perform observations in the range from 2 to 120 GHz. All cryogenic receivers for the different frequency bands are being constructed in the laboratories at Yebes. First light is foreseen for the end of 2005.

The new radiotelescope will be able to perform observations as single-dish or in combination with other large radiotelescopes spread around the world. By using the Very Long Baseline Interferometry (VLBI) techniques, combining the signals of several distant telescopes, it is possible to obtain maps with the highest angular resolution ever achieved in astronomy. These studies are of fundamental importance to understand some of the most distant objects known in the universe, like black holes in the center of radiogalaxies. Also VLBI has applications in Geodesy and Geophysics, as it can measure the tectonic plate displacements or the precise position of the Earth's pole. As single-dish antenna, the radiotelescope will be a general-purpose instrument in astronomy, so it will be used for many interesting studies such as the chemical composition of comets, the formation of stars in our Galaxy, or the structure of local and distant galaxies.

Francisco Colomer (OAN)



5. Report from the EVN TOG

All EVN stations now have Mark 5 recorders and since 2005 use only these for VLBI observations to be correlated in the EVN. Experiments which require the VLBA correlator are still recorded on tapes which excludes Noto from such arrays as their tape recorder is broken beyond repair.

A number of observations with bitrates of 1 Gbit/s have been performed successfully. As a further step towards increased ease of use the EVN is planning to make 1 Gbit/s the default observing mode for all continuum observations.

The near-real-time fringe checks have proven to be a very valuable tool to verify the performance of the EVN. They are now done at the beginning of each frequency in each session. The aim is to monitor each observation in this way to increase the reliability and performance further.

Schedule pre-checking by JIVE has proved to be a very useful service to the users of the EVN. The number of problems in the EVN sessions due to faulty observing schedules has been dramatically reduced. It is particularly useful for the current session for which for the first time users have been asked to make so-called "disk" schedules. With "disk" schedules the users can now ignore all restrictions enforced by tape-based VLBI, like length of a tape pass, or time needed for changing tapes. Even though scans of unlimited length are now possible the SCHED program will remind users that gaps every 15 minutes are needed for firing the CAL diode to measure the system temperature with
reasonable sampling and accuracy.

Efforts to improve amplitude calibration on the EVN are continuing. New software available at the stations allows them to verify their calibration data for each frequency in each session and gaps are allocated in the block schedule

for these verification runs. Concise feedback on calibration accuracy is also available from the pipeline to help stations to identify problems so that they can be remedied for future sessions. With only a few exceptions, this has
resulted in improved calibration accuracy at the most used C-band and L-band frequencies. In a related development, it will soon be possible to attach amplitude calibration data as calibration tables to the FITS files distributed
by the correlator (a la VLBA) thanks to work done by Mark Kettenis as part of the ALBUS project at JIVE.

Walter Alef (TOG Chaiman)

6. Ultra-wideband VLBI or UVLBI

The need for higher sensitivity has motivated the VLBI community to move towards higher bandwidths. JIVE and the EVN have been leading this effort. After the introduction of disk recording using Mk5A systems, JIVE has taken the lead in experimenting with recording rates starting at the limiting speeds of our beloved tape drives of 128 and 256 Mbps. The maximum data rate of the Mk5A systems lies at 1 Gbps until the Mk5B upgrade becomes available. Plans exist to double this to 2 Gbps by using two Mk5 recorders in parallel and even to 4 Gbps with the Mk5B units. The current design of the new Digital BBC project that is being undertaken by the Institute for Radio Astronomy in Noto would also allow the data conversion at 4 Gbps.

The current call for proposals includes a call for 1 Gbps recording for the EVN but also for global proposals that include the GBT and Arecibo. Haystack Observatory has received an NSF grant to implement Ultra-wideband VLBI in the USA and has plans to go towards 4 Gbps as well. The current limitations for UVLBI still lie in the availability of disk packs for the Mk5s on both sides of the Atlantic because 1 Gbps recording consumes disks at a rate of some 4 Tb per 12 hr run. Purchase plans of disks have been implemented at all EVN stations but the supply remains relatively tight.

The current EVN Call will accept standard 1 Gbps proposals for EVN for as many hours as our disk resources allow. In addition, there will also be 24-48 hrs of observing with GBT and Arecibo as supported by Haystack. For reasons of tape economy, the preference for these last proposals will be given for the use of an array consisting of GBT and Arecibo and only the larger EVN stations Effelsberg, Lovell and Westerbork.

It should be noted that the EVN wishes to make this capability widely open to the entire VLBI community and that the same peer review procedures should be used as for other global proposals.

Willem Baan (ASTRON)

7. Observing Methanol masers with the EVN

The November 2004 EVN session included several 5cm projects, mostly observing methanol masers at 6.7 GHz. This unique capability of the EVN has now grown into maturity with 9 antennas participating, including for the first time a Westerbork dish.

Particularly heroic was the last moment replacement of the Jodrell telescope by the MERLIN telescope at Darnhall producing good data throughout the session. The scientific opportunities have also been enhanced by the 5cm capabilities of MERLIN, often producing accurate a-priori positions, as well as the fast read-out of the correlator at JIVE, combining high spectral resolution with a large field of view.

In a project with Philips (ATNF) we concentrated on a sample of nearby known methanol masers. These observations were done in wide field imaging and phase referencing mode simultaneously. The aim is to obtain accurate positions of methanol masers, not only for the sources with clear counterparts at other wavelengths, but also for so-called "lonely methanol masers", which have no known counterparts, even though the presence of a maser signifies something is brewing, deeply embedded in these regions. Wide field imaging will allow us to observe many maser spots in these regions.

By observing 24 hours on 12 targets and correlating with 1024 spectral points in two polarizations and a 1/4 second correlator dump time, 280 GB of data resulted. To deal with these data volumes, we performed calibration in batch mode, exploiting the new capabilities of "ParselTongue". This is a software product being developed in the context of the RadioNet project ALBUS, and allows one to command classic AIPS tasks from Python scripts. This was a very promising experience, giving quite a bit more control over the scripts than the traditional POPS environment.

We obtained preliminary results on the famous Cep A young stellar object. The HW2 source (Figure 1) is supposed to originate from the ionized outflow from a massive young star. Around this object numerous water masers are known, related to shocks between the outflow from the source and the ambient molecular cloud (Torrelles et al., 1998, ApJ 509 262). Intriguingly, detailed analysis of the kinematics of the water maser sources has revealed that there exists more than a single origin for these shocks; on very small scales around Cep A a number of high mass stars are forming (Torrelles et al., 2001, Nature 411, 277; Curiel et al., 2003 ApJ 564 L35).

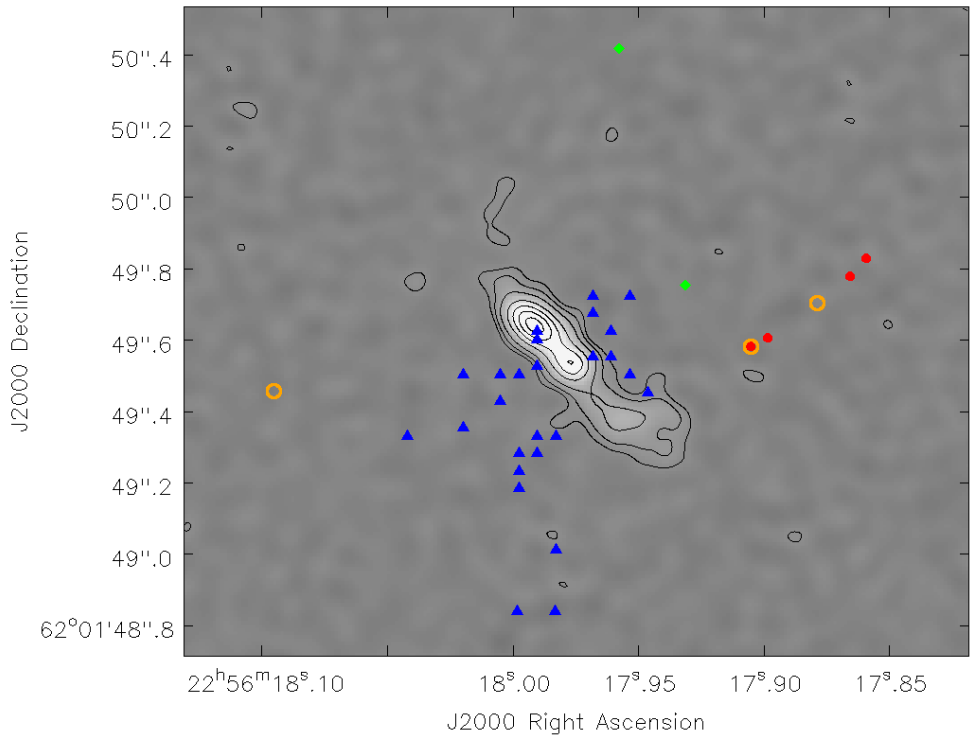


Figure 1; The source HW2 in the star forming region Cep A. The grey scales represent the 22 GHz continuum and the blue triangles the locations of H_2O masers. The red dots indicate the 6.7 GHz methanol maser positions, the orange circles the 12 GHz methanol masers and the green dots the methanol maser emission at 107 GHz.

Confirming earlier 107 GHz measurements by Mehringer et al. (1997 ApJ 475 L57) and 12 GHz determinations by Minier et al. (2001, A&A 369 278) we find the 6.7 GHz masers to lie in the equatorial region of HW2. At the distance of Cep A the offset corresponds to 300 - 700 AU. An interpretation could be that the methanol masers lie in a circumstellar disk around the central source of HW2, but at different chemical or physical conditions than those giving rise to the water masers. Another intriguing possibility is that the methanol masers are the signposts of more young stars, still embedded in this region, like the unidentified methanol masers often seen in extended star forming regions.

Because Cep A is a relatively nearby high mass star formation region, these measurements are relevant for the investigations into the nature of methanol masers. It has been claimed that these sources arise in circumstellar disks around massive protostars, but methanol masers of this kind have also been associated with the shock interfaces around ultra-compact HII regions. Even though the current observations make a very close association with a young massive star, it remains unclear whether the masers are directly associated with this particular source.

In this respect other observations from the same session are very exciting. In a collaboration with Bartkiewicz and Szymczak (Torun) we followed up methanol masers from the blind Torun survey (Szymczak et al., 2002, A&A, 392 277). Again employing phase referencing, the aim is to use methanol masers to study the formation of high mass stars, rapidly evolving deeply in the parent molecular cloud. One of the sources, called G23.657-0.127, shows a beautiful ring structure, reminiscent of the circumstellar SiO masers around evolved stars.

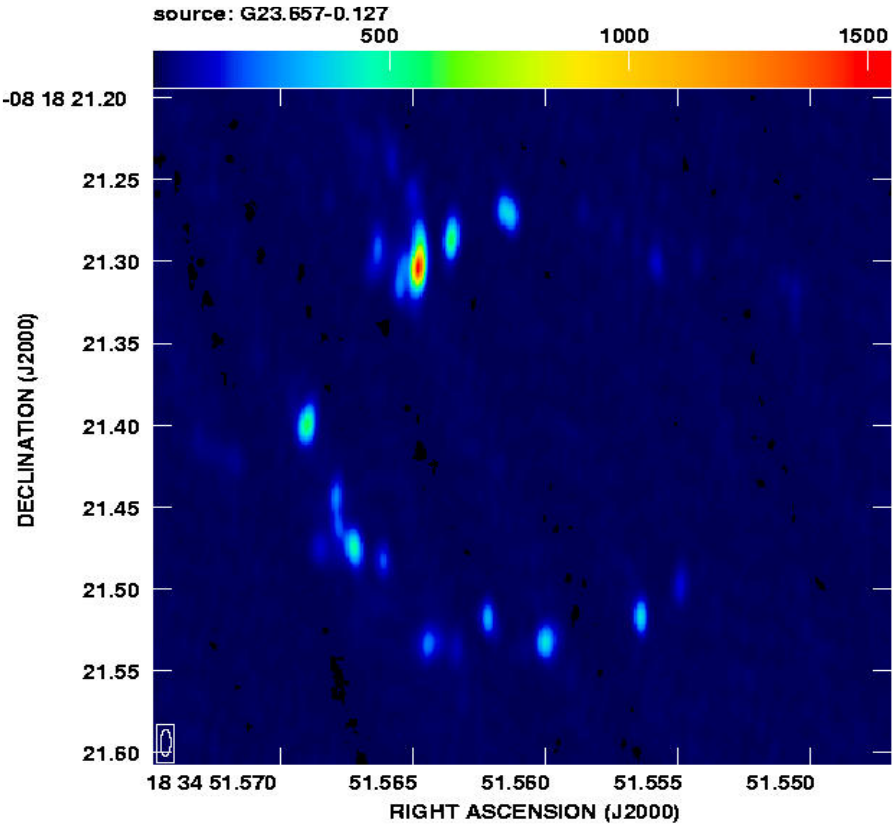


Figure 2; Zero moment map of the methanol maser G23.657-0.127.

Such a ring has not been observed in methanol masers before and it offers a unique perspective for the interpretation. Most importantly, in this case there can be no doubt where the central source is located. At the moment there is an infrared source known, but of course at much coarser resolution. The distance to this source is unknown but can be estimated from the Galactic rotation, yielding a physical size of the ring of 1000 to 2000 AU. There is no clear velocity structure around the ring, which one would expect if this was resulting from a circumstellar disk seen face-on.

Instead we prefer an interpretation were the ring delineates some sort of shock front running into the molecular material around the forming star. Follow up observations will focus on detecting a central source, as well as attempting to detect the kinematics of the ring.

These EVN results were presented in May at the IAU symposium 227, "*Massive star birth: A crossroads of Astrophysics*", Catania, Italy in two poster papers by van Langevelde & Phillips, and Bartkiewicz, van Langevelde & Szymczak.

Huib Jan van Langevelde (JIVE)

8. "Stellar end-products": summary of the workshop

The meeting, sponsored by the EU RadioNet Consortium and held in the Instituto de Astrofisica de Andalucia - CSIC (IAA-CSIC, Granada, Spain) from 13 to 15 April 2005, was attended by 52 participants, who gathered from all over Europe and America to

discuss the last stages of the lives of stars from different perspectives, and with special emphasis in the use and impact of radio observations in the advances and understanding of the field. The workshop was divided into five sessions, each devoted to a particular topic, namely (i) From AGB stars to Planetary Nebulae, (ii) Pulsars and Neutron Stars, (iii) Supernovae and Supernova Remnants, (iv) Compact objects in binary systems, and (v) GRB. Each session included one or two review talks, where the topic was presented both from a theoretical and observational point of view, and contributed oral talks followed. Each talk was followed by discussion, stimulated by questions from the audience. At the end of each session, a joint discussion of about 45 minutes, and chaired by one of the reviewers, followed. These joint discussions were of much use to get a good idea of the advances made in each field, and how to make further advances in our understanding of them. The relatively small number of people and the existence of a comfortable atmosphere at the IAA-CSIC, also allowed a lively discussion and interaction among the participants during the coffee breaks, which were held in the same place where contributed posters were also displayed. These characteristics of the meeting made of it a success, and even people who were a bit skeptical about a meeting discussing topics that ranged from Planetary Nebulae to GRBs appreciated it, and reckoned that they had learnt quite a bit by knowing how other colleagues approached problems in their fields of research. Participants came from all over Europe and America.

As mentioned above, the workshop programme was divided into five sessions, each of them including review and contributed talks. In particular, we had nine reviews and 26 contributions. Furthemore, 12 poster contributions were presented. Each invited speaker presented the status of the art, as well as the open questions and the steps forward which are expected over the next few years. The overall idea of the

workshop, i.e. looking at the last stages of stellar evolution from different perspectives and a multiwavelength approach, was taken into account by the invited speakers. Below I give a personal, but clearly incomplete, overview of some of the relevant contributions.

Dieter Engels reviewed the AGB to post-AGB transition phase, which is marked by increasing mass-loss rates and wind speeds and change from spherically symmetric wind to axi-symmetric, or point-symmetric geometries. This phase is short, as it may last as little as our working life! A number of talks presented state-of-the art numerical simulations, which are able to model the shape of many PNe. While it is clear that our knowledge and understanding of the field has improved over the last decade, the evolutionary are still parametrized by the mass-loss, a process which is still very poorly understood.
John Kirk reviewed the current ideas about the structure of pulsar winds, which have progressed from one to two dimensions thanks to recent X-ray and optical imaging of pulsar nebulae. Andrea Possenti reviewed the successful pulsar search experiments carried out in the last years with the Parkes 64m radio telescopes, and the most significant results, including the first ever known double-pulsar, PSR J0737-3039, whose observations have the tremendous power of discerning among General Relativity Theories. On the "to do" side, the Equation of State of Neutron Stars is still the big question. Yet, it was pointed out that GLAST will be of much help in constraining the existing number of models for pulsars. Dave Green reviewed the statistical properties of a revised catalogue of 231 Galactic supernova remnants. The conclusion is that the normally accepted Sigma-D relation to derive diameters for individual SNRs, or for statistical studies, is of very limited use, and it might be much useful for nearby galaxies other than our own. Antxon Alberdi gave a nice overview of young radio supernovae in nearby (D < 20 Mpc) studied with VLBI, and of radio supernovae in ultraluminous infrared galaxies.
Among the relevant contributed talks, I would include the contribution by S. Moiseenko, whose magnetorotational mechanism for SNe explains the explosion of core-collapse SNe, as well as one-sided jets and kicks that have been observed. The discussion was of much use, as questions provided by "non-experts" made clear that we still don't know a number of details about SNe, e.g., the clear lower limit for producing type II SNe. Josep Martí described recent advances about X-ray binaries thanks to radio interferometric observations, e.g., the existence of relativistic jets, the disc-jet connection, and pointed out that the microJy sky opens a new perspective for the study of microquasars and X-ray binaries. Elena Gallo reviewed the current understanding of the radio properties of black hole X-ray binaries in
connection with the X-ray spectral states, and discussed them in the framework of a recently proposed unified model. In conclusion, X-ray binaries arise as a fundamental piece to a unified understanding of accreting objects, and it was pointed out the possibility of an X-ray spectral classification, based on the X-ray binary stars' states.
Yet, it is unclear whether the x-ray spectral state transitions are driven by the jet, or the other way around: it is the so-called "chicken-and-egg radio/X-ray activity" problem. The contribution of D. Perez-Ramirez showed the discovery of the putative hot spots of Cyg X-3. If confirmed, this finding would further strengthen the quasar-microquasar analogy. Alexander van der Host reviewed our current understanding of GRBs through the radio observations of their afterglows, including their spectral energy distribution, radio flare, blastwave evolution, and source size from scintillation. Alberto Castro-Tirado reviewed optical and IR observations of GRBs, and discussed the new avenues open by quasi-simultaneous imaging, and by SWIFT, HETE-2 and INTEGRAL. Our knowledge of the central engine is still rather poor, so it is difficult i to distinguish among the jungle of existing models. Also, multiple energy injections work well, but models are ad hoc, and the physics beyond them remains to

be understood.

Miguel Perez Torres (IAA-CSIC, Granada)

The European VLBI Network (EVN) website (http://www.evlbi.org/) is hosted by the Joint Institute for VLBI in Europe (http://www.jive.nl/).