Workshop on the mm-VLBI with ALMA

INAF-Istituto di Radioastronomia
Italian ALMA Regional Center
Centro congressi Area della Ricerca
Bologna, 22-23 January 2015

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Programm

Thursday, 22 January 2015 - Open Sessions *(I = invited, C = contributed)*

08.30 - 09.00 *Registration*

09.10 - 09.30 *Welcome*

09.30 - 11.00 First Session

* S. Doeleman (I) - The Event Horizon Telescope: Imaging and Time-Resolving a Black Hole
* C. Goddi (I) - Zooming-in onto the Galactic Center Black Hole with BlackHoleCam
* V. Fish (I) - The ALMA Phasing Project: Motivations and Status

11.00 - 11.30 *Coffee Break - Posters*

11.30 - 12.45 Second Session

* M. Giroletti (I) - Review on BLAZARS Science with mm-VLBI
* J. Gomez (C) - Probing the innermost regions of AGN jets with RadioAstron and mm-VLBI at tens of microarcsec resolution
* M. Kadler (C) - Resolving the Jet-Launching region in NGC1052
* T. Krichbaum (C) - Imaging AGN at highest frequencies and resolution

12.45 - 13.45 *Lunch - Posters*

13.45 - 15.50 Third Session

* M. Kramer (I) - Pulsars Science with a phased ALMA
* F. Colomer (I) - Maser Science with mm-VLBI
* A. Richards (C) - Sub-mm maser VLBI: how do stellar winds break free from the star's gravity?
* A. Rushton (C) - VLBA monitoring of SgrA* during the G2 encounter
* A. Baudry (I) - The ALMA 64-antenna correlator to phase up the ALMA array, status and perspective
* F. Gueth (I) - VLBI with IRAM/NOEMA
* T. Jung (I) - Multi-frequency VLBI telescopes and synergy with ALMA

15.50 - 16.20 *Coffee Break - Posters*

16.20 - 17.45 Fourth Session

* F. Tazaki (C) - EHT-J Activities and new imaging technique with sparse modelling
* R. Tilanus (C) - Next generation mm-VLBI equipment
* I. Marti-Vidal (C) - Solving the polarization problem in ALMA-VLBI observations
* E. Ros (I) - Joint Observations of ALMA with GMVA
* C. Lonsdale (I) - US perspective on mm-VLBI

17.45 - 18.05 Discussion session

Friday, 23 January 2015 - Closed Sessions- for invited participants only

09.00 - 15.00 Closed discussion session
Break for coffee and lunch at 11.00 and 13.00

List of participants

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Part one

Oral Presentations *

*** Abstracts of oral contributions appear in chronological order of their presentation.**

First session

The Event Horizon Telescope: Imaging and Time-Resolving a Black Hole

S. Doeleman (I)
SAO/MIT

A convergence of high bandwidth radio instrumentation and Global mm and submm wavelength facilities are enabling assembly of the Event Horizon Telescope (EHT): a short-wavelength Very Long Baseline Interferometry (VLBI) array, which can observe the nearest supermassive black holes with Schwarzschild Radius resolution. Initial observations with the EHT have revealed event horizon scale structure in SgrA*, the 4 million solar mass black hole at the Galactic Center, and in the much more luminous and massive black hole at the center of the giant elliptical galaxy M87. Over the next 2-3 years, this international project will add new sites and increase observing bandwidth to focus on astrophysics at the black hole boundary. EHT data products will have an unprecedented combination of sensitivity and resolution with excellent prospects for imaging strong GR signatures, detecting magnetic field structures through full polarization observations, time-resolving black hole orbits, testing GR, and modeling black hole accretion, outflow and jet production. This talk will describe the project and the latest EHT observations.

European efforts towards the EHT

C. Goddi (I)
Radboud University Nijmegen

TBD

The ALMA Phasing Project: Motivation and Status

V. Fish (I)
MIT Haystack Observatory

The ALMA Phasing Project (APP) will provide a beamformer that will enable ALMA to be phased up as an extremely sensitive station for VLBI at millimeter wavelengths. Key science drivers for the APP include event horizon science, AGN/jet physics, spectral-line VLBI, pulsar science, and more. This presentation will summarize the scientific potential of the beamformer and provide a status update on the progress of the APP.

Second session

Review on blazar science with mm-VLBI.

M. Giroletti (I)
INAF - Istituto di Radioastronomia

The Large Area Telescope on board Fermi has discovered and characterized about one thousand blazars, providing fundamental advances in the knowledge of the physical properties of relativistic jets. Supporting multi-wavelength data have further contributed to the advancement of our understanding in this field; in particular, high angular resolution observations in the optically thin regime are of critical importance as they can provide images and direct measurements of the gamma-ray emitting regions. In this contribution, I will review some of the most recent results and discuss some of the still open issues for which a gamma-ray—mm-VLBI synergy can be of extraordinary importance.

Probing the innermost regions of AGN jets with RadioAstron and mm-VLBI at tens of microarcseconds resolution.

J. Gòmez (C)
Instituto de Astrofisica de Andalucia – CSIC

We present polarimetric 1.3 cm RadioAstron, 7 mm VLBA, and 3 mm GMVA observations of a sample of blazars probing the innermost jet regions at tens of microarcseconds angular resolution. Comparison of the total and polarized emission across these wavebands allows to determine the magnetic field structure and strength in the vicinity of the central black hole through Faraday rotation analysis. It also allows to probe the angular sizes and spectra across and along the innermost jet to determine the physical parameters of the fluid (velocity field, energy density) and that of the non-thermal electron population. This information can be used to i) understand how AGN jets are formed, accelerated and collimated; ii) what is the role played by the magnetic field in these processes; iii) test whether the mm-VLBI core can be associated with a recollimation through its characteristic three-component structure in polarization — of relevance to understand gamma-ray flares in blazars; iv) better constrain numerical models of the black hole shadow and innermost jet structure used in the interpretation of the Event Horizon Telescope observations.

Resolving the Jet-Launching Region in NGC1052

M. Kadler (C)
Univ. Wuerzburg

The active galaxy NGC1052 is located at a distance of only about 20 Mpc and exhibits a twin-jet system oriented near the plane of the sky. The small distance and unique geometry make it an ideal target for mm- and sub-mm VLBI studies of jet formation on the smallest accessible scales. Free-free absorption by a circumnuclear torus obscures the central engine at cm wavelengths. Our mm-VLBI observations at 43 GHz and 86 GHz are able to peer through the torus and reveal one compact central core with a high brightness temperature of $T_b > 4 \times 10^{11}$K, well above the equipartition limit. If interpreted as a blended feature from the bases of both jets, this constrains the separation to be less than 50 Schwarzschild radii. Here, we present preliminary results from the first simultaneous 3mm/7mm-GMVA observation. Future mm- and sub-mm VLBI observations with ALMA will provide the final boost in sensitivity and angular resolution to resolve the structure of the jet launching region in NGC1052.

Imaging AGN at highest frequencies and resolution

T. Krichbaum (C)
MPIfR

VLBI observations at the highest possible frequency penetrate the opacity barrier in the nuclear regions of radio-galaxies and blazars, which are synchrotron self-absorbed at longer wavelength. This facilitates a direct and sharper than ever view into the 'heart' of Active Galactic Nuclei (AGN), into region in which BH physics and general relativity effects become important and where radio jets are launched. Here we report on new results from global (3mm and 1.3mm) VLBI observations adding the APEX and IRAM to the Event Horizon Telescope. New images and core size estimates for a number of AGN jets and for Sgr A* are presented and discussed.

Third session

Pulsar Science with a phased-ALMA

M. Kramer (I)
MPI fuer Radioastronomie

Even though pulsars are usually considered as cm-wave sources, as they are most strongly emitting at a few hundred MHz, a lot of interesting physics is possible by their studies at mm-wavelengths. This includes the emission physics of pulsars, population studies, as well as the possibility to observe pulsars in the very centre of the Galaxy. This talk will review the science possible in these areas by a phased-ALMA.

Maser Science with mm-VLBI

F. Colomer (I)
Instituto Geografico Nacional (IGN-OAN), Spain

Astronomical masers are present in a variety of scenarios in the Universe, and have been studied with radio astronomy techniques for decades. High resolution observations of several transitions of SiO, water, and other molecules have provided estimates of the physical conditions and dynamics in these scenarios, from circumstellar gas around young and evolved stellar objects, to the environments of AGN. The participation of phased-ALMA in VLBI observations will refine these estimates, plus i) provide the needed sensitivity to map weak masers, such as those of HCN in carbon-rich stars, and help to explain the problem of the missing flux in current long baselines, and ii) allow to study maser lines at millimeter and submillimeter wavelengths, where no VLBI arrays exist yet. Moreover, VLBI polarization observations including phased-ALMA will be able to map in detail the magnetic field on very small scales of star formation regions and evolved stars. Accurate parallaxes and proper motions will allow to trace infall and outflow of the gas, and to estimate source distances.

Sub-mm maser VLBI: how do stellar winds break free from the star's gravity?

A. Richards (C)
JBCA, Manchester

Multiple (sub)-mm water maser lines occur both sides of the dust formation zone around evolved stars. This is the transition region between pulsation-dominated outflow and infall within ~5 stellar radii, and radial acceleration away from the star, through the escape velocity. VLBI with ALMA will resolve individual maser spots and series of spots forming clouds. The relationship between maser beaming and intensity, and fractal analysis of the clustering scales, will show where the outflow is steady or turbulent or shocked. The lines arise from energy levels between 400 -2400 K, sampling a wide range of temperatures and densities. ALMA alone can resolve the maser shells and clouds along with thermal lines, dust and the star itself. Science verification results for red supergiant VY CMa at 50-100 mas resolution have resolved the 321, 325 and 658-GHz water masers for the first time, centred on a continuum peak containg the star. However, an even brighter, offset dust clump is also seen. The inner rim of the higher-excitation lines are closer to the star than the lower-excitation lines, but, astonishingly, 658-GHz masers extend to tens of stellar radii, suggesting additional heating such as from shocks when the wind impacts the large clump.

VLBA monitoring of Sgr A* during the G2 encounter

A. Rushton (C)
Oxford University

During the 2013 to 2014 period a dusty stellar object or gas cloud labelled “G2” passed within close proximity to our Galactic supermassive black hole Sgr A*. It was therefore important to monitor the Galactic Centre over the duration of this encounter to ascertain if gas clouds are responsible for significant increases in black hole activity and search for relativistic feedback. Multi-wavelength observations were coordinated between the VLA, VLBA, VLT and XMM-Newton over various epochs during the period of the encounter. We report our preliminary findings of the monitoring campaign at 7mm and 10mm with the VLBA; we show new flaring activity that may or may not be associated with G2 as well as the findings of the transient magnetar SGR J1745-29.

(CoIs G. Ponti, G. Bower, H. Falcke & R. Fender)

The ALMA 64-antenna Correlator to Phase up the ALMA Array, Status and Perspective

A. Baudry (I)
University of Bordeaux, OASU/LAB

The main features of the 64-antenna correlator and its main modes and performance will be briefly presented. Then, the basic requirements and key elements to phase up the array with the 64-antenna correlator will be reviewed. The status of the new correlator hardware and of the ALMA phasing project will also be presented. Finally, we will comment on the sensitivity enhancement which is expected with the ALMA phased array and on the importance of European initiatives in mm VLBI.

VLBI with IRAM/NOEMA

F. Gueth (I)
IRAM

IRAM is operating two major stations of the current mm VLBI network: the Pico Veleta 30m antenna and the Plateau de Bure interferometer. The PdBI is undergoing a major upgrade, with the addition of new antennas, receivers and correlator. I will summarize the specifications, status and timeline of the NOEMA project, and in particular the deployment of its VLBI capabilities.

Multi-frequency VLBI telescopes and synergy with ALMA

T. Jung (I)
Korea Astronomy & Space Science Institute

The utility of the multi-frequency (quasi-) simultaneous receiving system in mm-VLBI observations has been demonstrated by the Korean VLBI Network (KVN). The advantages of this system are (i) a significant improvement in the coherence time which is strictly limited by the turbulent media of atmosphere can be achieved, (ii) since the target itself can be a calibrator, an on-source observing time is preserved (thus no sensitivity loss) by intervening time between target and calibrator scans, and (iii) a problem with a definite lacking of reference sources at high frequency and long baselines approaching the size of Earth would be resolved. In addition, multi-frequency data will enable us to have more effective use of telescope time along with its scientific benefits. In this talk, I will present the effectiveness of multi-frequency system in mm-VLBI and synergy with ALMA including current progress in global collaboration.

Third session

EHT-J Activities and New Imaging Technique with Sparse Modeling

F. Tazaki (C)
NAOJ

We summarize the activities of Japanese working group in the Event Horizon Telescope project (EHT-J), reporting (1) the status of ALMA phase-up project, (2) pre-science with the EHT observation, and (3) development of a new imaging technique. Especially we would like to introduce the imaging technique for super-resolution with sparse modeling, which reconstructs an optimum image with high sparsity (the most pixel values are zero). Because the image of the black hole shadow is likely to be sparse, the new technique would suit for our purpose. We show super-resolved images of M87 actually obtained from observational data with VLBA. The angular-resolution was improved by a factor of ~ 3 compared with the synthesized beam size. The result demonstrates that the sparse modeling will become a powerful tool for the black hole imaging.

Next generation mm-VLBI equipment

R. Tilanus (C)
Allegro, Leiden Observatory; IMAPP, Radboud University

Convened in the summer of 2013, the Event Horizon Telescope Technical Working Group (ETWG) was tasked with: 1. Survey the capabilities at all EHT facilities 2. Establish a set of specifications for future EHT observations 3. Outline the technical developments needed to reach these goals This overview will report on the findings and conclusions arrived at by the ETWG and present specifications for future EHT observations at 230 and 345 GHz. I will also briefly discuss subsequent technical developments and the rollout of new equipment for the 2015 EHT observing campaign that will for the first time deploy recording at 16 Gb/s. With a relatively modest expansion over the next couple of years this mmVLBI system will be capable of 64 Gb/s for an aggregate bandwidth of 16 GHz i.e. 8x the bandwidth of existing 230 GHz VLBI observations.

Solving the polarization problem in ALMA-VLBI observations

I. Marti-Vidal (C)
Onsala Space Observatory

The ALMA Phasing Project (APP) will allow us to use ALMA as one VLBI station. This will be a key component of the Event Horizon Telescope (EHT), formed by the most sensitive mm VLBI antennas in the World. A problem in the APP is the polarization calibration and conversion. The circular basis is used in VLBI, but ALMA observes in a linear basis. The strategy that will be followed in the phased-ALMA VLBI observations is to correlate in a "mixed" basis (i.e., linear-to-circular) and convert the visibilities to pure circular basis after correlation. This approach minimizes hardware implementation and we can optimize the conversion by using special calibration matrices in the frame of the Measurement Equation. We have developed an algorithm to perform the polarization conversion in the APP. The results of this algorithm, applied to realistic simulations, will be presented. Results of a VLBI polarization test between Onsala (linear basis recording) and Effelsberg (circular basis recording) at 86GHz, as well as tests with real ALMA data, will be shown. This conversion strategy could also be used in future wide-band VLBI observations.

Joint observations of ALMA and the GMVA

E. Ros (I)
MPIfR

Following a call from the European Southern Observatory, we present and advanced study to prepare regular observing with ALMA together with the Global mm VLBI Array (GMVA) at 3 mm wavelength ellaborated by the MPIfR, the German, Nordic, Dutch, IRAM, and Italian ARCnodes, Aalto Univ., and OAN in coordination with ESO. The deliverable is an operations plan, to be the basis for real VLBI observations with ALMA as soon as its beamforming (ALMA Phasing Project) and the first observations of the Event Horizon Telescope Experiment are performed. The study will include recommendations for proposal handling and scheduling; disk logistics, correlation, and archiving; data rights, user support, and resource allocation.

US perspective on mm-VLBI

C. Lonsdale (I)
MIT Haystack Observatory

MIT Haystack Observatory is strongly engaged in the development of wide bandwidth high frequency VLBI, including digital backend systems, high speed recorders, and software for correlation and analysis. The advent of the phased ALMA system, the LMT, and the 3mm system on the GBT, coupled with rapidly increasing recording bandwidths, will create exciting new scientific opportunities for millimeter VLBI. In addition, the Haystack 37-meter telescope has recently been upgraded, and now has a 75 micron surface accuracy, yielding a sensitive new VLBI aperture at 3mm wavelength during the northern winter months. In this talk, a US perspective on these developments, and the future scientific opportunities for global mm-VLBI, will be presented.

Part two

Posters

Changes in Sgr A*'s accretion flow through Faraday rotation measures at mm wavelengths: An update of mm-VLBI and single dish results

I. Agudo
Jive

Since mid 2013, we perform an intensive six-frequency monitoring program of the polarimetric, and total flux, evolution of Sgr A* and its surroundings with the IRAM 30m Millimeter Radio Telescope on the 3,2, and 1mm bands, and with a time sampling of one-two weeks. Therefore, our monitoring program allows us to perform a high-sensitivity study of the time dependent changes of the Faraday rotation in the vicinity of Sgr A*. Prominent and sharp changes of Faraday rotation reflected in our data suggest changes in the electron content and magnetic field intensity and orientation on the accretion flow in the close vicinity of the source. In this talk I will summarize the observing results obtained from our IRAM 30m monitoring program since 2013, as well as the properties and first results (if any) of a recently proposed 3 & 2mm-VLBI parallel program at the Korean VLBI Network.

VLBI and mm/submm interferometric studies on M 87.

K. Asada
ASIAA

Understanding of the relativistic jet and accretion flow is one of the crucial information to subtract physics from the shadow image. For this purpose, we have conducted VLBI observation towards relativistic jet of M 87. M 87 is one of the primary targets for the shadow imaging with GLT/EHT. As the results, we found that the jet can be described with single power-law structure. In addition to that, we firstly found that jet is gradually accelerated upto the superluminal speed at upstream of the HST-1, which corresponds to the bondi radius of M 87. Those properties are in good agreement with MHD jet. In meanwhile, we also conducted SMA polarimetric observations towards M 87. We succeeded to derive an RM of $(2.1 \pm 1.8) \times 10^5$ rad m^{-2}, it gives the range of the mass accretion rate (M_{dot}) between 0 and 9.2×10^{-4} M_{sun} yr^{-1} at the distance of 21 rs from the SMBH. Our estimated M. is already two orders of magnitude smaller than the M_{dot} at the outer part of the accretion flow ($\sim 10^5$ r_s). This significant suppression of the M_{dot} at the inner region is expected with the radiatively inefficient accretion flow (RIAF) model.

Hunting for dark halo substructure using submilliarcsecond-scale observations of macrolensed radio jets.

S. Asadi
Department of Astronomy, Stockholm University

The mismatch between the faint end of galaxy luminosity function and the low-mass end of the dark matter halo mass function is a long-standing challenge for the cold dark matter model. While gravitational lensing provides a unique method to detect the extremely faint or completely dark galactic subhalos that are predicted to exist, observations of very high angular resolution are required. We explore the prospects of using VLBI observations of multiply-imaged quasar jets to search for submilliarcsecond-scale image distortions produced by dark substructures in the subgalactic mass range. We present lensing simulations of the angular resolutions attainable with the existing VLBI array as well in comparison to that of mmVLBI including the phased ALMA. Using simulations of strongly-lensed quasar jets, we argue that CDM halo substructure within the main lens may reveal itself through small-scale morphological distortions distinguished from intrinsic source features by obtaining data at multiple lensed images. Even null detections of this kind place constraints on the predicted CDM halo mass function at subgalactic mass range. Mapping a number of macrolensed jet systems at submilliarcsecond resolution, also makes it possible to detect or robustly rule out the more compact forms of halo substructure predicted in alternative structure formation scenarios.

Black hole imaging as GR tests in the GC.

T. Boller
MPE Garching

Einstein's General Relativity (GR) invented 100 years ago successfully describes gravitation. An algebraic extension of GR to pseudo-complex (pc) variables has been proposed, called pseudo-complex General Relativity (pc-GR). One of the important consequences of pc-GR theory is the presence of a field with repulsive properties. This has the effect that for very large masses the gravitational collapse is stopped and something what we call a “gray star” is formed instead of a black hole. We have performed ray-tracing simulations based on the pc-GR theory and standard GR for Sgr A* for different accretion scenarios and viewing angles for the observer. The simulated pc-GR images are clearly different from GR ray-tracing images. This provides the strongest test of GR theories. In addition we have simulated Fe K line profiles for both theories. As pc-GR discs are brighter, the integrated line flux is larger in pc-GR. The line profiles are clearly different from standard GR. This offers a second robust measurement to test pc-GR versus GR.

Extragalactic Water Masers and mmVLBI

L. Humpreys
ESO

TBD

Off-jet axis structure of blazars with mm/sub-mm VLBI

S. Koyama
MPE Garching

We will report the results of our test observations toward bright blazars using GMVA including KVN at 3mm for the first time in 2012 May. Among our target sources, blazar OJ 287 will be one of the best targets for mm/sub-mm VLBI observations with ALMA due to the brightness and the position in the sky. As is shown by EHT observations at 1mm, mm/sub-mm VLBI observations are the best tool to probe the irregular innermost structure of bright blazars. We will also mention about some other bright compact blazars, which would be promising targets for mm/sub-mm VLBI observations with ALMA.

Imaging an event horizon: mitigation of structure variability of Sgr A*.

R. Lu
MPE Garching

The black hole at the center of the Galaxy, associated with the compact source Sagittarius A* (Sgr A*), is predicted to cast a shadow upon the emission of the surrounding plasma flow. General relativistic magnetohydrodynamic simulations show that radio emission from Sgr A* exhibits structural variability on timescales of minutes, much shorter than the duration of a typical VLBI imaging experiment. A changing source structure during the observations violates one of the basic assumptions needed for radio interferometry to theoretically work. By simulating realistic EHT observations of a model movie of Sgr A*, we demonstrate that an image of the average quiescent emission, featuring the characteristic black hole shadow and photon ring predicted by general relativity, can nonetheless be obtained. Moreover, it is shown that this procedure can be combined with an existing method to mitigate the effects of interstellar scattering. Taken together, these techniques allow the black hole shadow at the Galactic center to be fully recovered on the reconstructed image.

FITS IDI for VLBI in CASA.

D. Petry
ESO

The latest developments in the support for VLBI tables in the FITS IDI data format in CASA will be reported.

Constraining the non-thermal emission from young stars in Orion

V. Rivilla
Osservatorio Astrofisico di Arcetri

The Orion A region contains multiple radio sources, either in the optically visible Orion Nebula Cluster or embedded in the background Orion Molecular Cloud. We have used the Very Large Array to carry out the first multi-epoch radio continuum monitoring of the region at frequencies > 30 GHz. Most of the sources detected show clear variability, including strong variations on timescales of hours to days. This variability is a signpost of non-thermal gyrosynchrotron emission produced by electrons accelerated in magnetic loops of the young stars. Since this emission is very compact, arising from the innermost vicinities of the stars (< 1 mas), only long-baseline interferometry is able to unveil its structure. Our VLA monitoring have confirmed that the current radio detections have been strongly limited so far by the lack of sensitivity, explaining why previous long-baseline observations only detected a handful number of sources. Therefore, the advent of VLBI at (sub)millimeter wavelengths including ALMA will provide a unique combination of both spatial resolution and sensitivity, which is needed to constrain the non-thermal emission from young stars. Furthermore, the detection of many sources will improve the previous derivation of the parallax distance to the Orion cluster.

“Millimetron” Project: Space-VLBI Capabilities Overview

A. Rudnitskiy
Astro Space Center

“Millimetron” is a 10-meter cooled FIR and sub-mm space observatory. It was approved by Russian Space Agency and is a next project of Astro Space Center of Lebedev Physical Institute after “Radioastron” mission. Its parameters and capabilities will provide very high sensitivity for single-dish and the highest angular resolution for VLBI operational modes. In this report details on the VLBI mode of this challenging mission are presented.

Gaia and VLBI: new possibilities for the celestial reference frame

K. Rygl
ESA-Estec

The International celestial reference frame (ICRF) is currently defined by radio VLBI measurements of quasars. With the launch of Gaia, ESA's new astrometry satellite, soon many of the radio sources will have, in addition to the radio, also highly precise (up to 10 micro-arcsecond) optical positions. Understanding the agreement or disagreement of the radio and optical positions will not only present the limits in astrometric accuracy, but will contribute to the knowledge of physics of the measured objects themselves. Adding mm positions of similar accuracy will be important to understand a possible discrepancy between the optical and the radio, and be useful also for an improved atmospheric calibration as a wider range in frequency would be covered. In this poster, we explore the possibilities of combining Gaia with radio and mm VLBI of the ICRF references sources.

Centaurus A: High-Resolution Imaging of the AGN in our Backyard

R. Schulz
Univ. Wuerzburg; Univ. Erlangen-Nuernberg

The closest radio-loud active galaxy, Centaurus A, is a prime target for VLBI observations providing access to unprecedented small linear scales, which is essential to studies of jet emission and propagation in the inner parsec region of an AGN. I will present recent results from the AGN monitoring program on the southern hemisphere TANAMI yielding a detailed cm-VLBI view of the complex central-parsec jet dynamics of Centaurus A at a resolution of tens of light-days. Jet acceleration occurs downstream of the optically thin jet and is discussed within the framework of spine-sheath structural models. Additionally, I will discuss the possibility of mm-VLBI observations of Centaurus A with existing and future VLBI stations, which would significantly improve the accessible linear resolution down to a few light-days.

Data processing for mm-VLBI observations

I. van Bemmel
JIVE

As part of our involvement in the BlackHoleCam project, JIVE is leading the development of a pipeline for processing mm-VLBI imaging observations. A major challenge is the fringe finding step in the presence of strong atmospheric disturbances. Other components of the pipeline are phase and amplitude calibration, and imaging. I will discuss the plans and progress on the development of the full pipeline, with focus on the effort of implementing a fringe finder in the CASA package.