

**Istituto Nazionale di Astrofisica
Istituto di Radioastronomia**

Internal Report 486-15

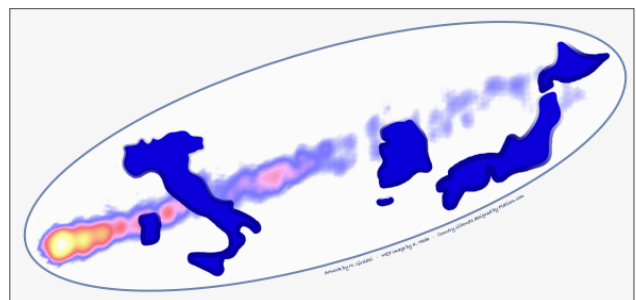
**East Asia To Italy: Nearly Global VLBI
(Eating VLBI 2014)**

Bologna, CNR Research Area
13-14 October 2014

hosted by INAF Istituto di Radioastronomia

Scientific Organizing Committee

K. Hada - IRA/INAF & NAOJ
Y. Hagiwara - NAOJ
M. Honma - NAOJ
G. Giovannini - DIFA/UniBO & IRA/INAF
M. Giroletti - IRA/INAF
S. S. Lee - KASI
M. Orienti - IRA/INAF
B. W. Sohn - KASI



Local Organizing Committee

F. D'Ammando - DIFA/UniBO & IRA/INAF
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1. Background

The Italian, Japanese, and South Korean Very Long Baseline Interferometry (VLBI) communities have been in close contact for the last few years. The Italian and Japanese Ministries for Foreign Affairs have approved a bilateral project inside the Italy-Japan collaboration and have funded a multi-year joint activity for the periods 2010-2012 and 2013-2015; the Japanese and Korean synergy has led to the successful regular operation of the Korean VLBI Network (KVN) and the Japanese VLBI Exploration of Radio Astrometry (VERA) in a joint network known as KaVA (KVN and VERA Array). The three communities share strong scientific interest in the study of supermassive black holes at the center of active galaxies (the so called Active Galactic Nuclei, AGN), of our own galaxy central black hole, and of the processes taking place in star formation regions.

A first joint Italian-Japanese-Korean two day meeting took place in 2012 in Bologna (Italy, see <http://www.ira.inaf.it/meetings/EatingVLBI>), with about 40 participants from the three countries. The 2012 meeting achieved three main goals: the communities from the three countries developed a better mutual knowledge, common science projects were started, and the participants expressed a strong will to work together towards the realisation of a nearly global VLBI network extending over the three countries.

2. The 2014 meeting

After two years, the ideas proposed in the 2012 meeting have largely turned into reality. A relevant number of visits have been exchanged through the three countries; scientific projects have turned into papers published in international peer reviewed journals and generated new ideas for more advanced studies; the operation of KaVA are regularly taking place; fringe search and data transfer tests have taken place between Italy and Japan. As we felt the need to review the achieved goals and plan further cooperation together, we organised a new meeting in Bologna, which took place on 2014 October 13-14.

There were 44 registered participants: 21 from Italy, 12 from Japan, 5 from Korea, and 6 from other countries (Australia, Germany, Spain); more than one third of the participants were students and post docs, and one fourth were female. We had two full days of talks and discussion, posters were on display for the entire duration of the workshop, and we continued our interaction also during the conference dinner. There were seven sessions, the main results of which are summarised in the following:

- *National reviews*: we had three talks (*Giroletti, Hagiwara, Sohn*), reviewing the available instrumentation, the national science context, the latest news, and the planned developments for each of the three countries. Among the highlights, we heard about the opening of the new 64m Sardinia Radio Telescope, the start of regular activity of KaVA (whose name in 2012 was not even been firmly established), and the first fringes at 129 GHz for the KVN.
- *Results from ongoing collaboration (two sessions)*: in these two sessions, there were reports about important results obtained and recently published about AGNs, including the newly discovered transverse motions and structures in the jet of M87, Mrk501, and OJ287 (*Hada, Koyama, Sawada-*

Satoh), important constraints on the location of the high energy emission in gamma-ray blazars (*Orienti*), and even the multi-wavelength properties of a newly discovered class of gamma-ray sources (Narrow Line Seyfert 1s, *D'Ammando*). In addition, three talks described the impressive imaging capabilities and the first results on AGNs and on the center of our own galaxy obtained by KaVA (*Niinuma, Kino, Zhao*).

- *Presentations from junior researchers*: in this session, seven PhD students from all the participating countries had the chance to present their Thesis project, in the field of multi-wavelength observations of gamma-ray sources (*Casadio, Fujinaga, Lico*), studies of AGNs of various luminosity (*Chida, Kim, Nakahara*), and of HII regions near the galactic center (*Sakai*). All the presentations were of excellent quality, and it was a very reassuring fact meaning that there will be a bright future for the joint science thanks to this brilliant new generation
- *Status and plans for joint observations*: this was a very much needed session aiming at getting everyone on the same page in terms of the various elements required for joint observations: telescopes, receivers, backends, recorders, networks, correlators. There was significant focus on the implementation of high frequency, multi-wavelength observations in existing and future systems (*Jung, Orfei*), and on the status of correlators and associated elements for current and future observations (*Stagni, Oyama, Hagiwara*). This was a fundamental session to significantly improve the chance of success of joint observations - moreover, the delegates had later the chance to visit to the correlator facilities at the Institute of Radioastronomy, which also helped in setting a common operating framework.
- *Science results of mutual interest*: this session started with two reports on the latest techniques developed at the KVN in the field of phase referencing technique, a necessary step to study faint sources and to obtain astrometric information of the highest quality (*Rioja, Dodson*), which could also be relevant for the study of faint blazars (*Mantovani*). Finally, two talks addressed another important area of common interest, i.e. the study through spectral lines of maser emission associated to star formation (*Hirota, Moscadelli*). Another topic of great interest is the measurement of fundamental quantities such as time and frequency (*Ambrosini*) and it should be taken into account in future collaboration.
- *Towards the future*: the final session reported on important updates about the most recent developments and opportunities brought about by new and planned facilities, such as SKA (*Giovannini*), Space VLBI (*Gomez*), ALMA (*Nagai, Casasola*), and other promising data analysis techniques (super resolution imaging, *Honma*). Finally, the summary talk by Honma reviewed the highlights of the workshop, the advances since the first meeting (reporting an improvement in the number of talks and papers published), and set some important goals for the next meeting (fringes and maps from joint observations, more papers, and high quality results from the junior members of the community).

In total, there were thus 36 presentations, which are made public at the meeting web page (<http://www.ira.inaf.it/meetings/EatingVLBI/2014/>). While after the first meeting it was not clear at all if a second one would have followed, the present edition has been such a success that without doubt there should be a third workshop. Talks about the exact time and location of such meeting have already started. We also note that many participants stopped in Bologna for a few days just after the

workshop; Italian researchers also visited Japan and Korea soon after the event to continue the collaboration.

3. Financial Report

The meeting was supported by the Italian Ministry for Foreign Affairs, RadioNet3, the Department of Physics and Astronomy of the University of Bologna, and the Institute of Radio Astronomy of the Italian National Institute for Astrophysics. No registration fee was paid by the participants. We offered coffee breaks, lunches, and the social dinner for all the attendees. Support for the travel and the accommodation costs was also provided to many participants from East Asia.

4. List of Annexes

Annex 1 - Scientific program

Annex 2 - List of participants

Annex 3 - Conference flyer

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Annex 1: Programme

Day 1 - Monday, October 13th

Morning - chair M. Cappi

9:30 Vettolani Welcome speech

Session 1 - National reviews

9:35 Giroletti Status of VLBI in Italy
10:00 Hagiwara Status of VLBI in Japan and East Asia
10:25 Sohn Status of VLBI in Korea

10:50 COFFE BREAK

Session 2 - Results from ongoing collaboration (first part)

11:20 Hada M87
11:40 Niinuma Imaging capability of KVN and VERA Array (KaVA)
12:00 Kino Key science observations of AGNs with KaVA array
12:20 Orienti 1510-08, 3c454.3
12:40 Sasada Optical Photopolarimetric Study of Blazar Outbursts

13:00 LUNCH

Afternoon - chair L. Foschini

Session 3 - Presentations from junior researchers

14:15 Casadio Fermi gamma-ray detection of the radiogalaxy 3C120 and its connection with the VLBI jet
14:30 Chida Probing very Early Stage of Radio Source Evolution in NGC 1275 with VERA
14:45 Fujinaga The survey for new AGN candidates within the field of Fermi unassociated gamma-ray sources
15:00 Kim Investigating plasma-physical properties of jets in nearby radio-bright AGN with KVN and KaVA
15:15 Lico Very Long Baseline Polarimetry and the Gamma-ray connection in Markarian 421 during the broadband campaign in 2011
15:30 Nakahara Multi-epoch, quasi-simultaneous 22/43GHz observations of the M84 nucleus with VERA
15:45 Sakai Absolute proper motions measurement of Sgr D HII region with VERA

16:00 COFFE BREAK

Session 4 - Results from ongoing collaboration (second part)

16:30 D'Ammando Narrow Line Seyfert 1s
16:50 Koyama Detection of new component perpendicular to the jet axis in Mrk 501
17:10 Sawada-Satoh VERA/GENJI Monitoring of OJ 287 in 2010-2013
17:30 Zhao KaVA K and Q band observations of Sgr A*

20:00 DINNER

Day 2 - Tuesday, October 14th

Morning - Chair G. Tuccari

Session 5 - Joint observations: status and plans

- 9:30 Jung Recent Activities of KVN and Multi-Frequency AGN Survey project
9:50 Orfei Using multifeed systems for simultaneous multifrequency mm-VLBI observations from 18 to 100GHz and above
10:10 Stagni VLBI-IT - towards the Italian VLBI network
10:30 Oyama The development and performance of OCTAVE-DAS and Correlator System
10:50 Hagiwara Planning Italy-Japan observations (10min talk)

11:00 COFFE BREAK

Session 6 - Science results of mutual interests

- 11:30 Ambrosini Prospects in Time and Frequency observables from VLBI (5 min flask talk)
11:35 Rioja Astrometric Continuum Observations with KVN
11:55 Dodson Non-integer Spectral line Source Frequency Phase Referencing
12:15 Mantovani Faint blazars potential target for KVN observations
12:35 Hirota Observational study of star-forming regions with VERA and beyond
12:55 Moscadelli Outflow Structure on small scales in high-mass protostars

13:15 LUNCH

Afternoon - Chair T. Venturi

Session 7 - Towards the future

- 14:30 Giovannini SKA
14:50 Gómez Probing the innermost regions of AGN jets and their magnetic fields with RadioAstron
15:10 Nagai Detection of Kpc-scale Jet Emission with ALMA
15:30 Casasola AGN fueling with ALMA: from Cycle 0 results to Cycle 2 incoming data
15:50 Honma Super resolution imaging
16:00 Honma Summary and Conclusions

16:30 COFFE BREAK – END OF MEETING

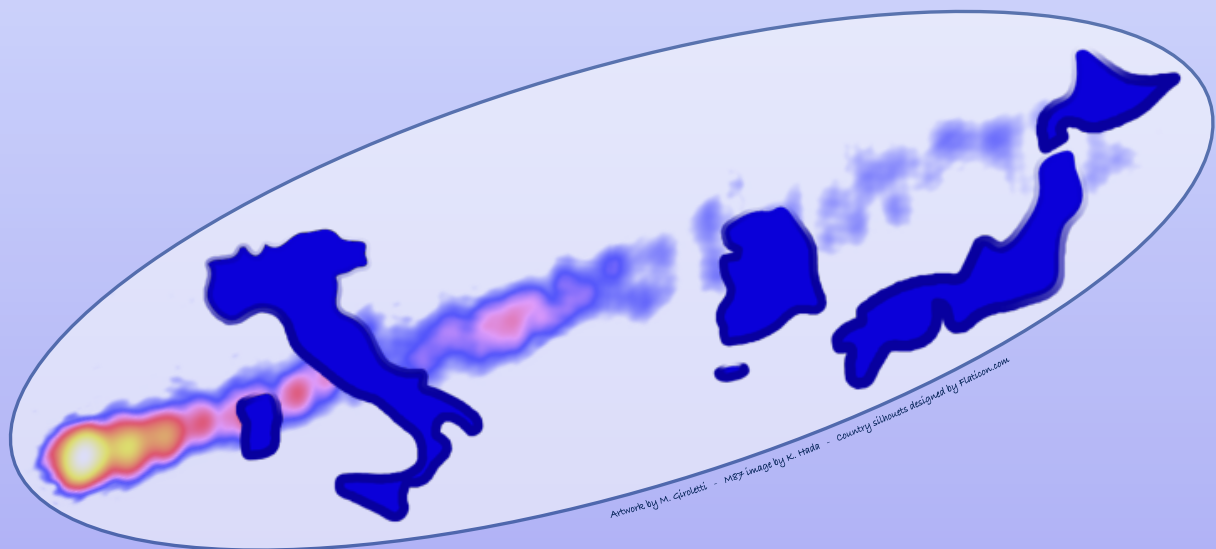
Annex 2: List of Participants

1. Roberto Ambrosini (INAF-IRA)
2. Massimo Cappi (INAF/IASF-Bologna)
3. Carolina Casadio (Instituto de Astrofísica de Andalucía (IAA-CSIC))
4. Viviana Casasola (INAF-IRA & Italian ARC)
5. Pietro Cassaro (IRA INAF Noto)
6. Riccardo Cesaroni (INAF - Osservatorio Astrofisico di Arcetri)
7. Hikaru Chida (Tokai University / NAOJ)
8. Daniele Dallacasa (DIFA - UniBO)
9. Filippo D'Ammando (University of Bologna & IRA INAF)
10. Richard Dodson (ICRAR/UWA)
11. Luigi Foschini (INAF Osservatorio Astronomico di Brera)
12. Yoshitaka Fujinaga (Yamaguchi University)
13. Gabriele Giovannini (University of Bologna & IRA INAF)
14. Marcello Giroletti (IRA INAF)
15. Jose L. Gómez (Instituto de Astrofísica de Andalucía - CSIC)
16. Kazuhiro Hada (IRA INAF & NAOJ)
17. Yoshiaki Hagiwara (NAOJ)
18. Tomoya Hirota (Mizusawa VLBI Observatory, NAOJ)
19. Mareki Honma (NAOJ)
20. Taehyun Jung (Korea Astronomy & Space Science Institute)
21. Motoki Kino (KASI)
22. Shoko Koyama (Max Planck Institute for Radio Astronomy)
23. Jae-Young Kim (Seoul National University)
24. Rocco Lico (University of Bologna & IRA/INAF)
25. Elisabetta Liuzzo (IRA-INAF)
26. Franco Mantovani (MPIfR and IRA-INAF)
27. Luca Moscadelli (Osservatorio Astrofisico di Arcetri)
28. Hiroshi Nagai (NAOJ)
29. Satomi Nakahara (NAOJ)
30. Kotaro Niinuma (Yamaguchi University)
31. Alessandro Orfei (INAF-IRA)
32. Monica Orienti (IRA INAF)
33. Tomoaki Oyama (National Astronomical Observatory of Japan)
34. Maria Rioja (ICRAR / OAN)
35. Daisuke Sakai (Univ. of Tokyo / NAOJ)
36. Mahito Sasada (Kyoto University)
37. Satoko Sawada-Satoh (Mizusawa VLBI Observatory, NAOJ)
38. Matteo Stagni (IRA-INAF)
39. Carlo Stanghellini (IRA)
40. Bong Won Sohn (KASI)
41. Monica Trasatti (IRA)
42. Gino Tuccari (IRA)
43. Tiziana Venturi (INAF, Istituto di Radioastronomia)
44. Guangyao Zhao (Korea Astronomy and Space Science Institute)

EATING VLBI

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Annex 4: Conference Picture

