Session:	**[B3B-6] S6 : Observing Facilities and International Collaborations**
Date:	August 20, 2014 (Wednesday)
Time:	14:00~15:30
Room:	Room F (Room 108)
Chair:	Hideyuki Kobayashi (National Astronomical Observatory of Japan)

[B3B-6-1] 14:00~14:15

[Invited] Status and Feature of East Asian VLBI Network

Hideyuki Kobayashi (National Astronomical Observatory of Japan, Japan), Yoshiaki Hagiwara, Se-Hyung Cho, Jongsoo Kim, Xiaoyu Hong, Zhiqiang Shen, and EAVN Team

East Asian VLBI network is under organizing as one of largest VLBI array in the world. Japan has VERA, VLBI exploration for Radio Astrometry, which consists of four 20-m telescopes. It has two-beam system to make simultaneous observations for two targets and phase referencing VLBI observations. Also Japanese VLBI network has been organized, which consists of 13 VLBI stations including VERA four stations. It makes high sensitivity VLBI observations at 22, 8 , and 6.7 GHz. Korea has KVN, Korean VLBI network, which consists of three 21-m telescopes. It has simultaneous multiband receivers for multi-frequency VLBI observations with 2,8,22,43,86, and 129 GHz. Chinese VLBI network has been organized for lunar satellite tracking, which consists of four VLBI stations. Moreover Shanghai 65-m telescope was constructed and is under commissioning. Shanghai 25-m and 65-m and Urumqi 25-m telescopes are joining European VLBI Network. Therefore East Asian VLBI network is organizing these arrays. Korea and Japan developed the new large scale VLBI correlator at Daejun, which has a capability of 16 station correlation with 8 Gbps data rate per station. East Asian VLBI network succeeded to detect fringes at 8 and 22 GHz with Japanese, Korean and Chinese stations. It is under commissioning to check the sensitivity, resolution and other feasibilities. East Asian VLBI network has 6,000 km extension and around 20 stations possibly, which is one of largest VLBI network at 6.7, 8, 22, and 43 GHz. We will show the possible feasibilities, current status and future schedule.

[B3B-6-2] 14:15~14:30

[Invited] Overview of Japanese VLBI Network and Science Results

K. Fujisawa (Yamaguchi University, Japan)

Japanese VLBI Network (JVN) is a VLBI network operated by National Astronomical Observatory of Japan together with seven universities. The network consists of more than 10 radio telescopes with diameter of 11 m to 64 m owned or operated by research institutions and universities. The baseline length of JVN ranges 50 - 2500 km, and the observation frequencies are 6.7 , 8 and 22 GHz. JVN started its operation in 2005 and there are about 20 published papers so far. Main subjects of research are AGNs and star forming regions by using masers as probes. From 2010, an effort to extend the VLBI network to the East Asia in cooperation with China and Korea has been made. A VLBI survey observation of methanol maser sources was published in 2014 as the first result of EAVN.

[B3B-6-3] 14:30~14:45

KVN Source-Frequency Phase-Referencing Observation of 3C 66A & 3C 66B

Guang-Yao Zhao (Korea Astronomy and Space Science Institute, Korea), Bong Won Sohn, Taehyun Jung, Maria Rioja, and Richard Dodson

In this presentation, I will introduce the ongoing KVN campaign of Source-Frequency Phase-Referencing (SFPR) observations of 3C 66A and 3C 66B. These two are both very interesting objects which show peculiar properties. Especially, 3C 66B was once argued to be harboring a SMBH binary at its center based on the

position measurements of the jet core with respect to the core in 3C 66A. However, recent analysis show non-stationarity of the core exist in both sources, which disfavors the binary scenario. Core-shift measurements would be important to understand the non-stationarity of the core. The simultaneous multi-frequency receiving capability of KVN makes it the best array to study the core-shift related sciences. In the KVN campaign, two more sources are observed as secondary reference calibrators and each source was observed at 22, 43, and 86 GHz simultaneously. The core-shift measurements are found to be affected by structural blending effect because of the large beamsize, but this can be corrected with higher resolution maps (e.g. KAVA maps). The future multi-epoch results will enable us to locate the central SMBH in each source and trace its possible motion.

[B3B-6-4] **14:45~15:00**

[Invited] Submm VLBI Activities in Taiwan

Makoto Inoue (Academia Sinica Institute of Astronomy and Astrophysics, Taiwan)

A group of Very Long Baseline Interferometry (VLBI) was formed in 2009 in Academia Sinica Institute of Astronomy and Astrophysics (ASIAA). Although several universities have a radio astronomy group or an astronomy department, VLBI activities are only in ASIAA so far. Discussion on collaboration is occasionally made between the VLBI group and the university groups or individual researchers, but it is not so actively coordinated yet. Consequently, this talk will begin with a brief history of the VLBI group in ASIAA, followed by its present status. In 2011, ASIAA VLBI group was awarded the ALMA prototype antenna, collaborating with the Smithsonian Astrophysical Observatory (SAO), MIT Haystack Observatory, and National Radio Astronomy Observatory (NRAO). We proposed to deploy it as a submm VLBI station at the Summit Station in Greenland, to get the first shadow image of the Super Massive Black Hole (SMBH) in M87. The shadow image is expected to be observed against bright environments of accretion flows and possibly jets, proving a direct evidence of the existence of black hole. As the size and shape of the shadow depends on the mass and spin, respectively, we could directly measure these fundamental parameters of the SMBH. Together with the study of bright environments, the observation will enable us to open new windows to investigate General Relativity in a strong gravity field, accretion mechanism of flows, launching mechanism of relativistic jets, etc. Our VLBI group is studying these and the relativistic jet physics. The telescope in Greenland (named as the Greenland Telescope: GLT) could achieve the angular resolution of 20 micro arcsec (μas) at 350 GHz, combined with the Phased ALMA in Chile and the Submillimeter Telescope (SMA) in Hawaii. As the size of the shadow image is expected to be about 40 μas for the M87 SMBH, it is very convincing to be able to image the shadow. The Phased ALMA will provide high sensitivity and angular resolution with the GLT. ASIAA jointly operates the SMA and closely involved in the ALMA project, and we have a lot of experiences on submm observations.
The GLT has been retrofitted for the cold environment in Greenland. These components will be shipped to Greenland in 2015 and reassembled at Thule, a North West coast of Greenland. We are planning to make commissioning tests and some early sciences there. Parallel to our telescope and site arrangements, our VLBI group participates in the ALMA Phase-up Project. For this project, we have a small set of a computer cluster to run the DiFX software correlator on it. Based on this experience, we are planning to have a DiFX system by ourselves, or in collaboration with other correlator groups, to process the submm VLBI observations. In this region, there are active groups on VLBI and its sciences, and possible collaborations will be also discussed.

[B3B-6-5] **15:00~15:15**

[Invited] The Korean VLBI Network and the Highlights of its Scientific Results

Jongsoo Kim (Korea Astronomy and Space Science Institute, Korea) and KVN Team

We introduce a very long baseline interferometry (VLBI) network in Korea. The Koran VLBI network (KVN) is the first millimeter-dedicated VLBI network in East Asia. It consists of three 21 m radio telescopes with baseline lengths in a range of 305–476 km. It has unique capability to perform VLBI observations at 22, 43, 86, and 129 GHz bands, simultaneously. The observational data have been processed using a distributed FX software correlator or a hardware correlator developed by Korea and Japan. The first fringes of the KVN were obtained at 22 GHz on 2010 June 8. Since then, VLBI observations using the KVN have been routinely done. From the 2014A semester, the KVN was open to the East Asian community. We introduce highlights of science cases of the KVN such as detection of 44 GHz methanol masers, polarization observations of

Zeeman splitting of maser lines, fringe detection of 129 GHz SiO masers from evolved stars

[B3B-6-6] **15:15~15:30**

[Invited] VERA Science Results

M. Honma (National Astronomical Observatory of Japan, Japan)

We introduce the recent results of science results from VERA (VLBI Exploration of Radio Astrometry). The VERA is a dedicated array to explore the 3-dimensional structure and dynamics of the Galaxy based on high-accuracy VLBI astrometry, and since 2007 we have been observing Galactic H2O and SiO masers to measure their accurate parallaxes and proper motions. In this talk, we briefly review the current status of the VERA project, and then show the highlights of the recent results such as determinations of Galactic parameter and also spiral arm structures. We also briefly introduce our recent works for building the East Asian VLBI Network (EAVN) including Japanese, Korean and Chinese radio telescopes and show some early science results such as the mapping of methanol maser sources as well as faint AGN jets.