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Recent VLBI Activities at the Korean VLBI Network

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Abstract. The Korean VLBI Network (KVN) is a dedicated mm-VLBI system consisting of three 21 meter radio telescopes in Korea with a maximum baseline length of 480 km. A unique 4-channel receiving system, which observes four radio bands (22, 43, 86 and 129 GHz) simultaneously, has been introduced in order to compensate the atmospheric phase fluctuations of interferometer visibilities by using multifrequency phase referencing technique. The KVN is keeping high activities in both technical developments and observations in order to achieve high precision astrometry and high sensitivity at millimeter wavelengths. We introduce here the recent progress on the KVN and some results from the test VLBI observations.

1. Introduction

The Korean VLBI Network (KVN) is the first very long baseline interferometry (VLBI) facility in Korea and the three 21 m antennas are located in Seoul (Yonsei Univ.), Ulsan (Ulsan Univ.) and Jeju island (Tamna Univ.) with a maximum baseline length of 480 km. The 4-channel receiver operating at 22, 43, 86 and 129 GHz will be able to compensate the atmospheric phase fluctuations, which are highly variable in millimeter wavelengths. The first full set of 4-channel receiver was installed at the Yonsei telescope (Fig. 1) and the first light of H_2O (22 GHz) and SiO (43, 86, 129 GHz) masers towards Orion KL were successfully detected (Fig. 2).

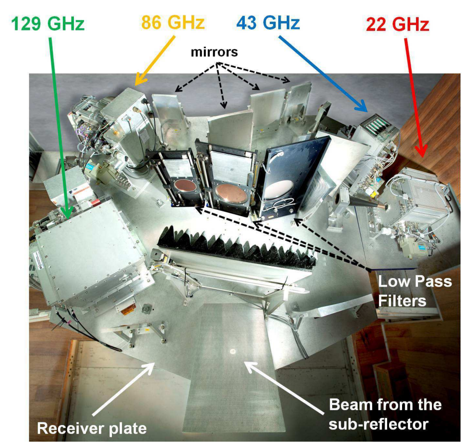

Fig. 1. KVN 4 channel receiving system (Han et al. 2008)

As a dedicated mm-VLBI system, the KVN is aiming to expand our understanding of the formation and death of starts, the structure and dynamics of our own Galaxy, and the nature of active galactic nuclei (AGNs) at the mil-

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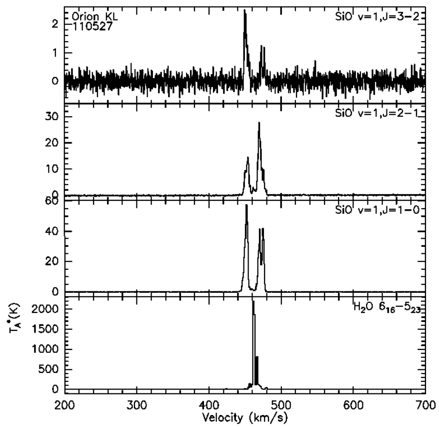

Fig. 2. First simultaneous 22/43/86/129 GHz maser lines from the single dish observation towards Orion KL

limeter wavelength regime (Kim et al. 2004).[1]

2. Phase referencing with a new 4-channel receiver

In the VLBI, the irregular distribution of water vapor in the troposphere causes the short coherence time, which degrades the sensitivity and impedes the ability to detect weak sources. This effect is particularly bothersome at millimeter wavelengths because the phase deviations are proportional to the frequency.

A unique 4-channel (multifrequency) receiving system of the KVN is designed for calibrating non-dispersive phase errors by observing four bands (22, 43, 86 and 129 GHz) simultaneously, so called multifrequency phase referencing (MFPR). The feasibility of MFPR was confirmed from the VERA dual-frequency experiment (Jung et al. 2011). The preliminary result of recent MFPR tests using the KVN 22/43 GHz simultaneous observation mode shows an excellent correlation between two fringe phases of 22 and 43 GHz at the KVN Yonsei-Ulsan baseline (Fig. 3). The residual

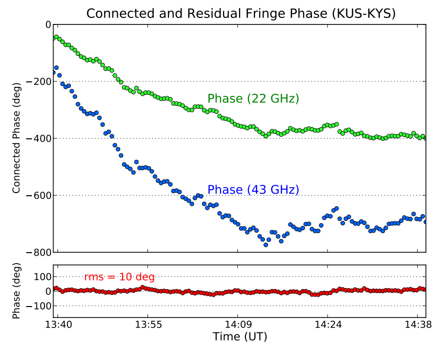

Fig. 3. The fringe phases (22/43 GHz) and residual phase (43 GHz) of the MFPR experiment at the KVN Yonsei-Ulsan baseline

phase (red dots) at 43 GHz, which is calibrated by 22 GHz fringe phase multiplied by two (frequency ratio, 43.4/21.7=2) is almost constant at the phase 0° with an rms $\sim$ 10° during the 1 hour experiment. This result implies that the KVN with MFPR will be able to compensate the atmospheric fluctuations effectively.

3. Summary

Since the completion of antennas and instruments, we have been conducting test VLBI observations to the various fields of VLBI science. Recently, two papers have been published based on the single dish observations (Kim et al. 2011; Lee et al. 2011). Together with the high capability of MFPR, new and promising perspectives are open in the research of multifrequency VLBI with the KVN.

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[1] KVN website, http://kvn-web.kasi.re.kr