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VLBI in ASIAA
Contribution to Sub-Millimeter VLBI Network

M. Inoue, K. Asada, M.T. Chen, Y.D. Huang, C.P. Chen, S. Matsushita, and P. Ho

Academia Sinica Institute of Astronomy and Astrophysics, P.O. Box 23-141, Taipei, 10617 Taiwan

Abstract. A new effort has been launched to perform frontier VLBI studies in Academia Sinica Institute of Astronomy and Astrophysics (ASIAA) with the addition of new staff members. The main targets of the new VLBI group are sub-mm and space VLBI to open new physics on super massive black holes (SMBHs) and related issues. Recent observations shows an exciting possibility to see event horizon of SMBH. To get high quality images of it, additional VLBI stations are essential, and site survey has been planned for a new sub-mm VLBI station somewhere in the world. Collaboration has been also discussed to increase the observing efficiency by providing a tracking station for the VSOP-2 project. To pursue these exciting projects, the group is planning to promote a larger science group in ASIAA.

1. Introduction

Sub-mm VLBI observations have recently shown an exciting potential to make a direct imaging of the event horizon for SMBHs (Doeleman et al. 2008). Further in this proceedings, the following new observations are given (Doeleman et al. this proceedings). The high quality imaging of the SMBH shadows needs, however, more sub-mm VLBI stations and higher sensitivity. To investigate the event horizon and its close vicinity of SMBHs, high quality imaging with a sufficient angular resolution is essential, and sub-mm VLBI and space VLBI should be straight forward approaches. The most promising targets to reveal the event horizon, or black hole shadow are Sgr A* and M87, because of their apparent size based on their SMBH mass and distance. Additional sub-mm VLBI stations somewhere in the world are essential and urgently required.

2. Sub-mm VLBI Network

At the sub-mm wavelength region, we could achieve the spatial resolution of several tens of micro arcseconds by the ground based VLBI network. The shadow size of SMBH is thought to be around 5 times of Schwarzschild radius, and, in fact, the experiments at 230 GHz by Doeleman et al. (2008) and the following ones (Doeleman et al. this proceedings) attained well the resolution higher than the expected shadow size of Sgr A*. For M87, VLBI observations have achieved the angular resolution of 50 μas, which is almost 20 times of the Schwarzschild radius of M87 (Krichbaum et al. 2007). However, it is a little difficult to make an image because of lack of the observing telescopes. The experiments of Sgr

A* were performed by three stations, JCMT in Hawaii, CARMA in California, and SMT in Arizona. Coordinations to increase the participating telescopes are essential, and new telescope systems operational at sub mm region are expected to join. Several efforts have been made for sub mm telescopes to incorporate in the experiments, and some new telescopes are being planed to join. In addition, we are planning to set a new telescope in a good observing site at sub-mm region, taking into account a good imaging capability. As very powerful stations like phased ALMA and SMA will be hopefully available in near future, the new site would be better to have mutual visibilities with these stations. High mountain area is also inevitable for dry atmosphere. Under these conditions, we are looking for several possible sites and then planning to make monitoring observations of transparency and weather conditions.

3. Space VLBI, VSOP-2 Collaboration

VSOP-2 Project aims to investigate relativistic jets and accretion disks in the immediate vicinity of SMBHs. Collaborating with the ground VLBI elements, VSOP-2 project is expected to investigate in the close vicinity of SMBHs with up to 40 μas spatial resolution
(e.g., see http://vsop.mtk.nao.ac.jp/2009/index-eng.html). The satellite ASTRO-G has been being built by the Institute and Astronautical Science (ISAS), and ground facilities (i.e., co-observing arrays, telescopes, tracking stations, correlators, etc.) have been coordinated internationally. To get high quality images, several tracking stations are required in addition to co-observing arrays/telescopes. The satellite has to contact to one of the tracking stations during observations, getting an accurate reference signal and transferring observed data with a very broad bandwidth. Thus, the satellite data cannot be recorded nor correlated without a tracking station on the ground, and several tracking stations well distributed on the ground are essential to improve observing efficiency of the satellite. We are looking for a possibility to establish one tracking station in the Southern Hemisphere, as the tracking station is probably only two in the Northern Hemisphere, Japan and Spain.

4. Concluding Remarks

In ASIAA, a new VLBI group has been formed aiming at sub-mm VLBI and space VLBI. These activities are both focused on SMBHs and related issues like launching mechanism of relativistic jets, nature of accretion disks, etc., by their superb spatial resolutions. The group is also promoting a larger scientific team on these fascinating issues, from both scientific and engineering points of view.

References

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