The first VLBI observations with Ventspils 32 m radiotelescope under LFVN project

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The first Low frequency VLBI test sessions with 32 m radio telescope of Ventspils International Radioastronomy center were carried out on November 10 –14, 1999 and July 15-17, 2000 at 92 cm wavelength. A total of 39 sources plus the Sun were observed. A brief description of Ventspils radio telescope and equipment, of the Low Frequency VLBI network and obtained results are given.

1. Ventspils Radioastronomy Center

Near Ventspils, a city on Baltic Sea, in Irbene there is a 32 – meter parabolic, centimeter–wave range antenna RT–32 and a 16– millimetre–wave range antenna RT–16. They were taken over by the Latvian Academy of Sciences in the year 1994 after withdrawal of the Russian army from Latvia. On the basis of these antennae the Ventspils Radio Astronomy Center (VIRAC) has been established in the year 1996. The main purpose of the VIRAC is to take part in observations at high angular resolution, particularly by means of VLBI of faint sources of cosmic (natural) and artifical radiation in order to obtain observational data for fundamental and practical research programmes in radio astronomy, astrophysics, cosmology, geophysics, geodynamics, geodesy, co-ordinated time service and others.

2. The main parameters of the Ventspils radiotelescope RT–32

1. Main parameters of RT–32 Cassegrain system.

Diameter: 32.00 m; focal length: 11.45 m; effective focus length: 86.81 m; F/D ratio: 0.36; subtended angle: 139.8°(primary focus), 21.06°(secondary focus); diameter of the subreflector: 2.50 m.

2. Accuracy parameters.

Manufacture of the surface: 0.25 mm, rigging of the panels: 0.5 mm; combined rms deviation of the reflecting surface of primary reflector (including action of dead weight and wind): 1.3 mm; tracking and pointing accuracy: 20 $''$.

3. Receivers.

10.7 GHz HEM transistor, T_{noise} =80 K (system), Δf = 80K, Θ =3.9$'$; 327 MHz transistor, T_{noise} =120K, Δf =2MHz, Θ =2.1°.

3. Low Frequency VLBI Network

The Ventspils RT-32 was equipped with 327 MHz receiver and Mk-2 recording terminal as a part of developing of the Low Frequency VLBI Network (LFVN). The 8 radio telescopes in Russia, Latvia, Ukraine and India were equipped with receiver-recording hardware under LFVN Project and the two first Ventspils VLBI experiments were undertaken in co-operation with LFVN. LFVN began its operations at 327 MHz frequency band with Mk–2 recording terminals in December 1997 having the following scientific goals: (a) investigation of AGN, (b) pre–launch survey for Space VLBI Radioastron mission, (c) solar researches, (d) study of stars, (e) observations of OH masers, (f) developing of VLBI Radar method for near Space researching, (g) SETI.

Currently, the LFVN is operated at 327 MHz, 1665 MHz and 5 MHz frequencies bands with Mk-2 and S2 recording terminals and includes the following telescopes: Bear Lakes RT-64 (Moscow), Puschino RT-22 (Moscow), St.Pustyn RT-14 (N.Novgorod) and Zimenki RT-15 (N. Novgorod) at Russia, Evpatoria RT-70 (Ukraine, Crimea), Noto RT-32 (Italy), Torun RT-15 (Poland), GMRT (Pune) and ORT (Ooty) at India, Urumqi RT-25 and Shanghai RT-25 at China, Ventspils RT-32 (Latvia). Moreover, LFVN is collaborating with many international radio telescopes having a S2 recording terminal. The data are processed by the S2 correlator at Penticton, Canada, and the Mk2 correlator developed in the Radiophysical Research Institute, N.Novgorod, Russia. Under this Project: 12 different experiments were carried out during 1997-2000; the angular sizes of 60 sources at 327 MHz and 50 sources at 1665 MHz were estimated (the 25 sources were selected as potential targets for future Space VLBI observations); the limits, which the interplanetary medium puts on the operation of the VLBI-systems at the decimeter wavelength range, are determined (influence of the solar plasma irregularities is essential at the source elongation from the Sun up to 30°. (wavelength 18 cm) and up to 80°. (wavelength 90 cm); the structure of solar wind irregularities was found as strong prolonged "streams" (their directions tally with the direction of the solar wind; the cross dimension of such streams is estimated about 1500-2000 km and their longitudinal scale is no less then 100000 km); the most realistic solar radio spake model was designed; A new VLBI radar method of researching of solar system bodies was developed.

4. The first Ventspils VLBI experiments

The experiments were carried out at 92 cm (INTAS 99.3 and INTAS00.1) in November 9 to 14, 1999 and July 15 to 17, 2000 with use of MARK–2 recording terminal and participation of Ventspils RT–32, Bear Lakes RT–64, Pushino RT–22, Urumqi RT–25, St.Pustyn RT–14, Zimenki RT-15 and Torun RT-15.The sessions were mainly for test purposes, but nevertheless, they had also the following scientific goals: searching for CSOs in samples of GPS sources; investigation of bending jets in BL Lac objects; pre–launch survey for Radioastron mission; studying of solar corona and wind; searching of like-spike solar events. 24 sources plus the Sun were observed in first session; 15 sources plus the Sun, in the second session. The effective area was 65 m^2 with a feed that was specially designed for this experiment in Ventspils International Radioastronomy center.

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