

Observation and Study of the Objects Approaching the Earth

Evpatoria 2007

Location of the Radio Antennas Applied in VLBI observations along with RT-70 (Evpatoria)



Main Radio Antennas Used in VLBI Observations



Transmitting telescope RT-70
in Evpatoria



Receiving telescope RT-64 in
Medvezhii Ozero

Objectives of VLBI location coordinated by the initiative staff group comprising M.V. Keldysh Institute for Applied Mathematics of RAS, Institute of Radio Astronomy of NAS (Ukraine), Radio Physical Research Institute, Scientific Research Institute “Crimea Astronomic Observatory” and Pulkovo Observatory of RAS

- Determination of the near-Earth space object revolution characteristics (period of revolution, its short-period variations and revolution pin orientation) as well as reception of the information about their surface structure;
- More accurate definition of the near-Earth space objects motion trajectories (Doppler shift measurement to calculate a range rate and angular coordinates) including the quasi-inertial coordinate system;
- VLBI technique verifying in quasi-real time through Internet;
- Formation of the optical station network for detection of space objects and more accurate definition of their ephemeris (grant support of the Ministry of Education and Sciences and INTAS 03-70-567).

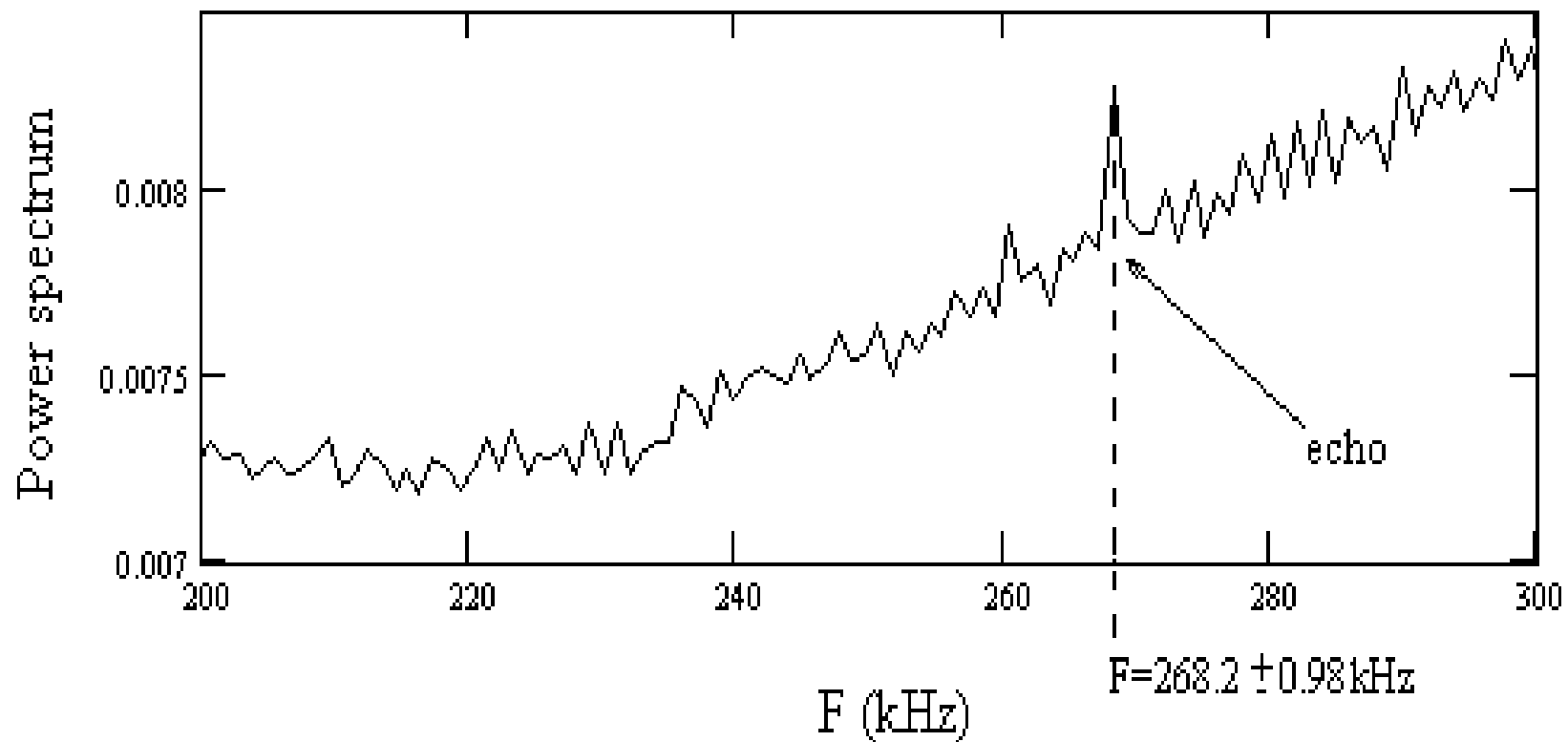
LFVN Experiments on VLBI Location Using RT-70

Name	Realization date	Objects under investigation	Used radio telescopes
VLBR99.1	02-08th June, 1999	Venus, Mars	Evpatoria, Svetloe, Shanghai, Uroomchi, Toroon, Kashima
VLBR00.2	03-09th August, 2000	Venus, Mercury, asteroids Mitra and 2000CE59	Evpatoria, Svetloe, Shanghai, Uroomchi, Toroon, Medvezhii Ozera
VLBR01.1	23-29th May, 2001	Venus, Mercury, asteroid 1999KW4, 7 geostationary objects	Evpatoria, Svetloe, Shanghai, Kashima, Noto, Uroomchi, Toroon, Medvezhii Ozera, Merlin
VLBR01.2	14-19th December, 2001	Asteroid 1998WT24, 5 geostationary, 4 high elliptical objects, tests in geostationary orbits	Evpatoria, Svetloe, Shanghai, Uroomchi, Toroon, Kalyazin, Zelenchuk, Algonquin
VLBR02.1	23-29th July, 2002	Asteroid 2000PH5, Venus, 7 geostationary, high elliptical, semi-diurnal objects	Evpatoria, Medvezhii Ozera, Kalyazin, Shanghai, Noto, Uroomchi
VLBR03.1	23-29th July, 2003	Asteroid 2000PH5, Mars, 10 geostationary, high elliptical, semi-diurnal objects, test beam-park in low orbits	Evpatoria, Medvezhii Ozera, Noto, Uroomchi, Simeheez
VLBR04.1	21-25th June, 2004	Asteroid Itokawa, 15 objects in geostationary, high elliptical and semi-diurnal orbits, beam-park, test beam track	Evpatoria, Medvezhii Ozera, Noto, Simeheez
VLBR04.2	23-29th July, 2004	Asteroid 2000PH5, Venus, 18 geostationary, high elliptical and semi-diurnal objects, beam-park, beam track	Evpatoria, Medvezhii Ozera, Noto, Simeheez
VLBR04.3	29th September- 5th October, 2004	Asteroid Tautatis, Venus, Moon, 12 geostationary, high elliptical and semi-diurnal objects, beam-park, beam track	Evpatoria, Medvezhii Ozera, Noto, Simeheez
VLBR05.1	10-16th September, 2005	Asteroid 1999 RQ36, Mars, Moon, 18 geostationary, high elliptical objects (including small-sized), beam-park, beam track	Evpatoria, Medvezhii Ozera, Simeheez, Puschino, Uroomchi
VLBR06.1	3-9th July, 2006	Asteroid 2004XP14, Mercury, Moon, 20 geostationary, high elliptical objects (including small-sized), beam-park, beam track	Evpatoria, Goldstone, Noto, Simeheez, Kalyazin, Uroomchi, Zelenchukskaya

VLBI location experiment VLBR06.1 (2006)

- The experiment was conducted from the 3rd of July till the 9th of July, 2006. Its objective was a radio location of the planet Mercury, the Moon, the asteroid 2004XP14 and debris objects.
- The most interesting task was a radio location of the asteroid 2004XP14 detected in 2004. At the moment of the Earth rendezvous on the 3rd of July, 2006 at 04:25 UT the asteroid was at the distance of merely 432338 km (approximately equal to the distance from the Earth to the Moon). The physical features of the asteroid are unknown, its diameter is presumably 430 m. Earlier no traditional location neither VLBI location of such a large-sized asteroid at so short distances was carried on. Because of its large size and closeness of its orbit to the Earth this asteroid is considered as a potentially dangerous object.

**Asteroid 2004XP14 echo-signal received at 07:15:10
UT on the 3rd of July, 2006 in Kalyazin (RT-64)
under radar location (Evpatoria) on 5 GHz-
frequency**



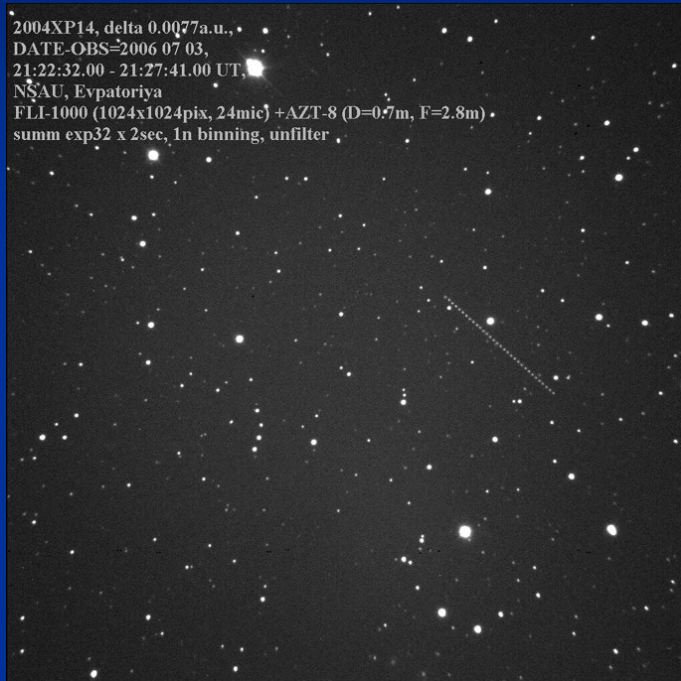
AMT-8 (Astronomic Mirror Telescope-8), Evpatoria



AMT-8 with mounted camera IMG1001E

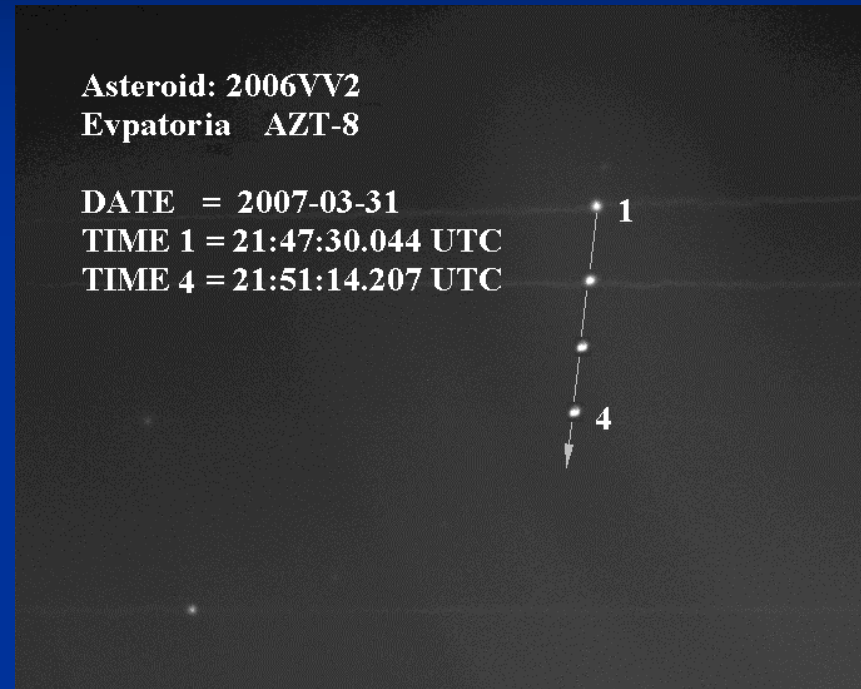
In 2006 the telescope received its own registration number at
MPC: B17 (33.1633 0.70559 +0.70625 AZT-8 Evpatoria)

Observations of the Earth Approaching Asteroids (EAA) using AMT-8



EAA 2004XP14

2007.06.03 camera FLI1001E



EAA 2006VV2

2007.03.31 camera S1C-NAO

Conclusion

- Within the complex experiment on VLBI location of the Solar System bodies (July, 2006) the radio location of the asteroid 2004XP14 was conducted for the first time in the national astronomy history. It was carried out in 2 frequency ranges. They are 5010.024 MHz under location by means of the radar located in Evpatoria and 8560.000 MHz under location by means of the radar located in Goldstone. As a result of location the method of high precision Doppler shift and interference frequency measurements has been worked through by echo-signals of debris and planets. So, VLBI radar on the base of RT-70 located in Evpatoria can be used for regular space object observations. Thanks to the high precision of received data VLBI location is an important tool of the forecast of a dangerous space object rendezvous with the Earth.
- The successful asteroid observation test experiment was conducted using AMT-8 (National Center of Space Facilities Control and Test, Evpatoria) in 2006 including observation of EAA. It is planned to continue this activity. After solving a range of the organization problems it could be possible to deliver AMT-8 asteroid observation results to the Miner Planet Center and to take part in the special international observation programs.

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