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Astro Space Center
RadioAstron Newsletter
Number 14
July 5, 2012
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Russian version of the Newsletter can be found here:
http://www.asc.rssi.ru/radioastron/news/news_ru.pdf

First results of the RadioAstron early science program

The RadioAstron early science program has started in February 2012 within the following three main areas: active galactic nuclei, cosmic masers, and pulsars. These activities are being conducted by international early science program working groups coordinated by the Astro Space Center. Some first results are presented below.

First experiment to image an active galaxy 0716+714 was conducted in the middle of March 2012 by RadioAstron together with the European VLBI network including the Russian Kvazar system as well as Evpatoria and Usuda. Despite a low activity phase of the object during these observations, 0716+714 was detected at 6 cm between the space radio telescope (SRT) and many ground telescopes in the array up to 5.2 Earth diameters. Preliminary analysis estimates the size of the core in this blazar to be about or less than 40 microarcseconds (0.2 parsec).
The RadioAstron survey of active galactic nuclei in all frequency bands continues. The record is being set so far by a detection of the active galaxy OJ287 at 6 cm with the SRT and Effelsberg at 7 Earth diameters (see the figure). This detection was achieved at about one order of magnitude higher resolution than the one available to ground-based radio interferometers. A preliminary estimate of brightness for these objects is about or greater than 10^13 K. Results of the survey will help to better understand nature of relativistic jets in active galactic nuclei.

First fringes for the water maser line at 1.35 cm in the star forming region W51 are obtained. W51 is one on the brightest water masers in our Galaxy situated at 5.4 kpc in the Sagittarius spiral arm.
Correlated signal between space telescope Spektr-R and the 100-m ground radio telescope in Effelsberg (MPIfR, Germany) was obtained on May 12, 2012. Projected baseline of the earth-space interferometer was about 1.14 Earth diameters. The angular resolution which is the highest ever achieved for the spectral line observations is about 0.2 milliarcsec. These observations are aimed on evaluation of the possibility to use masers for studies of the physics and dynamics of associated objects with ultra-high angular resolution. Such observations for the first

time provide possibility to measure extremely high brightness temperatures which are the key input for studies of the physics of maser sources in the regions of the star and planet formation, envelopes of evolved stars, accretion discs and outflows around young stellar objects and black holes in galactic nuclei. See the figure attached. Several bright details in the plot correspond to different components of the maser source.

Radio pulses from the Vela pulsar propagate through inhomogeneous interstellar plasma. Pulsar radio waves are distorted, scattered and focused by these inhomogeneities which act like lenses with a size of about one astronomical unit. Near the Earth different scattered rays interfere in a narrow cone with an angle of a few milliarcseconds. Details of the interference can be studied only with a space-ground interferometer which provides necessary angular resolution. In May 2012 radio emission from the Vela pulsar was recorded by the RadioAstron in conjunction with large radio telescopes in Australia and South Africa: Parkes, Mopra, Hobart, Hartebeesthoek and 70-m NASA DSN antenna in Tidbinbilla. Results of data processing have showed that scattering disk is completely resolved on the baseline of SRT-Tidbinbilla (100,000 km). Detailed study of the scattered image and its evolution in time will allow to determine space structure of the inhomogeneities of the interstellar plasma. In addition to that, important constraints can be imposed on the location and structure of the emission region in the magnetosphere of the Vela pulsar. See figures attached. The SRT-ground interferometric response consists of numerous narrow spikes, reflecting multi-ray propagation due to scattering.

First fringes with the DiFX correlator in MPIfR, Bonn!

The Max-Planck-Institute for Radio Astronomy in Bonn has successfully upgraded the software correlator DiFX to allow for correlation of RadioAstron data. The first fringes were detected with DiFX for the December 1, 2011, RadioAstron-Effelsberg observations of BL Lacerate at 6 cm confirming results by the ASC correlator reported in the RadioAstron Newsletter 11.
See details in:
http://www.mpifr-bonn.mpg.de/public/pr/pr-radioastron2012-en.html

RadioAstron International Science Council meeting 2012

The RadioAstron International Science Council (RISC) met in Pushchino near Moscow, on June 18-20, 2012. Members of the RISC include representatives of Russian and international science institutions and observatories, as well as leading experts in the field, from most of the major radio facilities around the globe. The RISC was very pleased to see the significant progress and success of the RadioAstron mission. In order to optimize the scientific return from RadioAstron, the RISC suggested that following the experimental early science phase which is now in progress, that an Open Skies phase starting in mid 2013 be organized around a limited number of key science projects. A call for expressions of interest from self organized science teams will be issued in August 2012 with a goal of receiving formal proposals by February 1, 2013. Based on suggestions from the RISC, a Program Evaluation Committee (PEC) is also being organized to review proposals. Phil Edwards has agreed to Chair the PEC.

With best regards,
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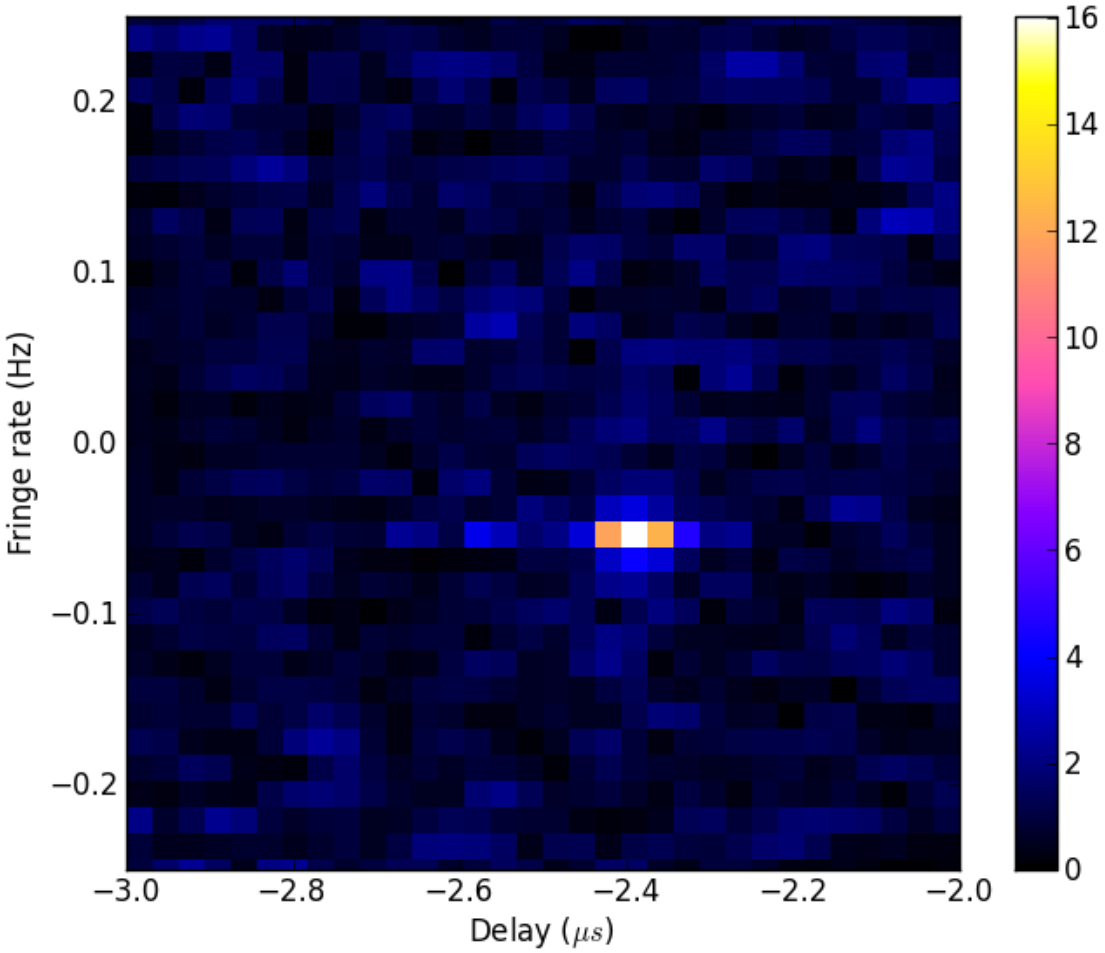
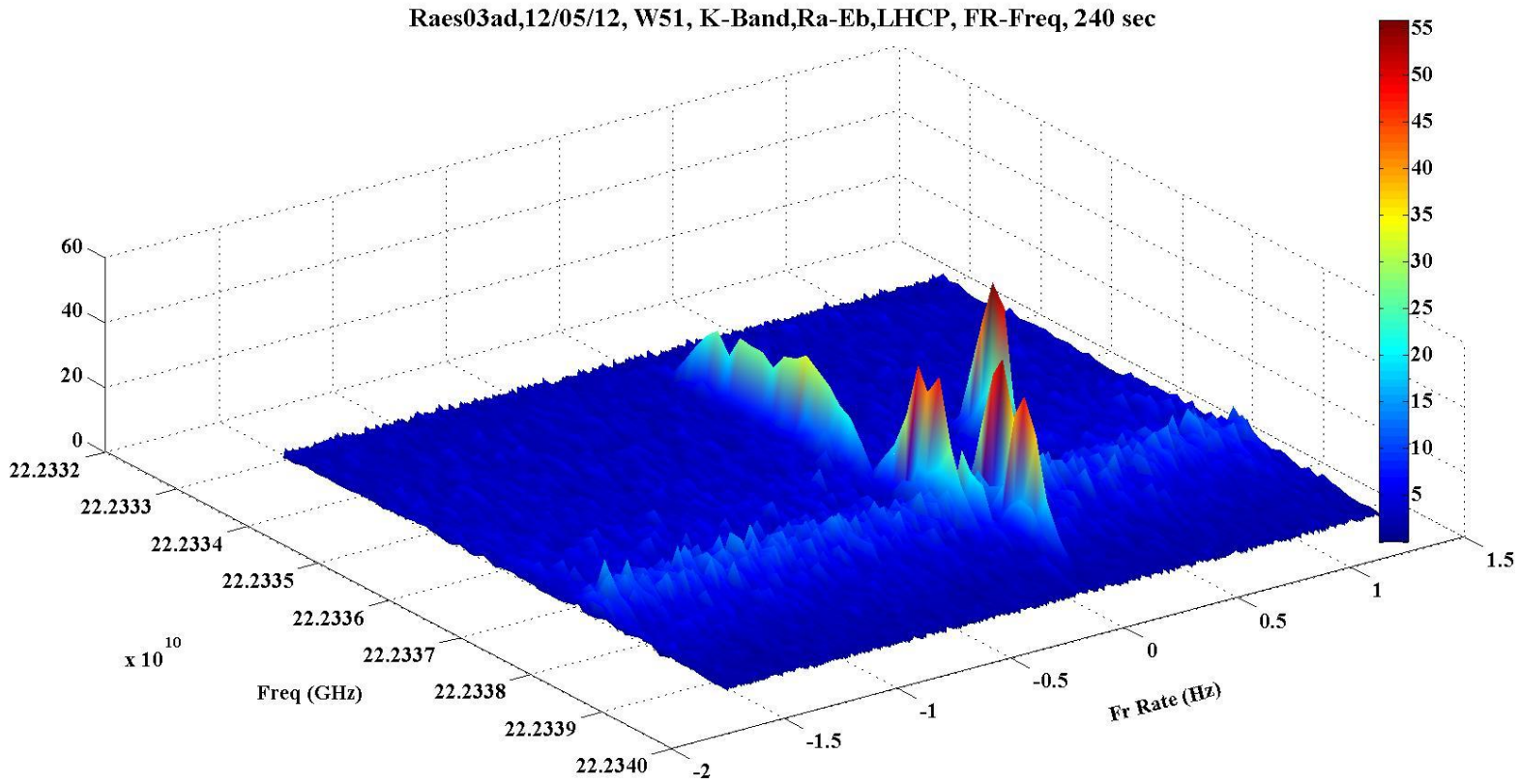
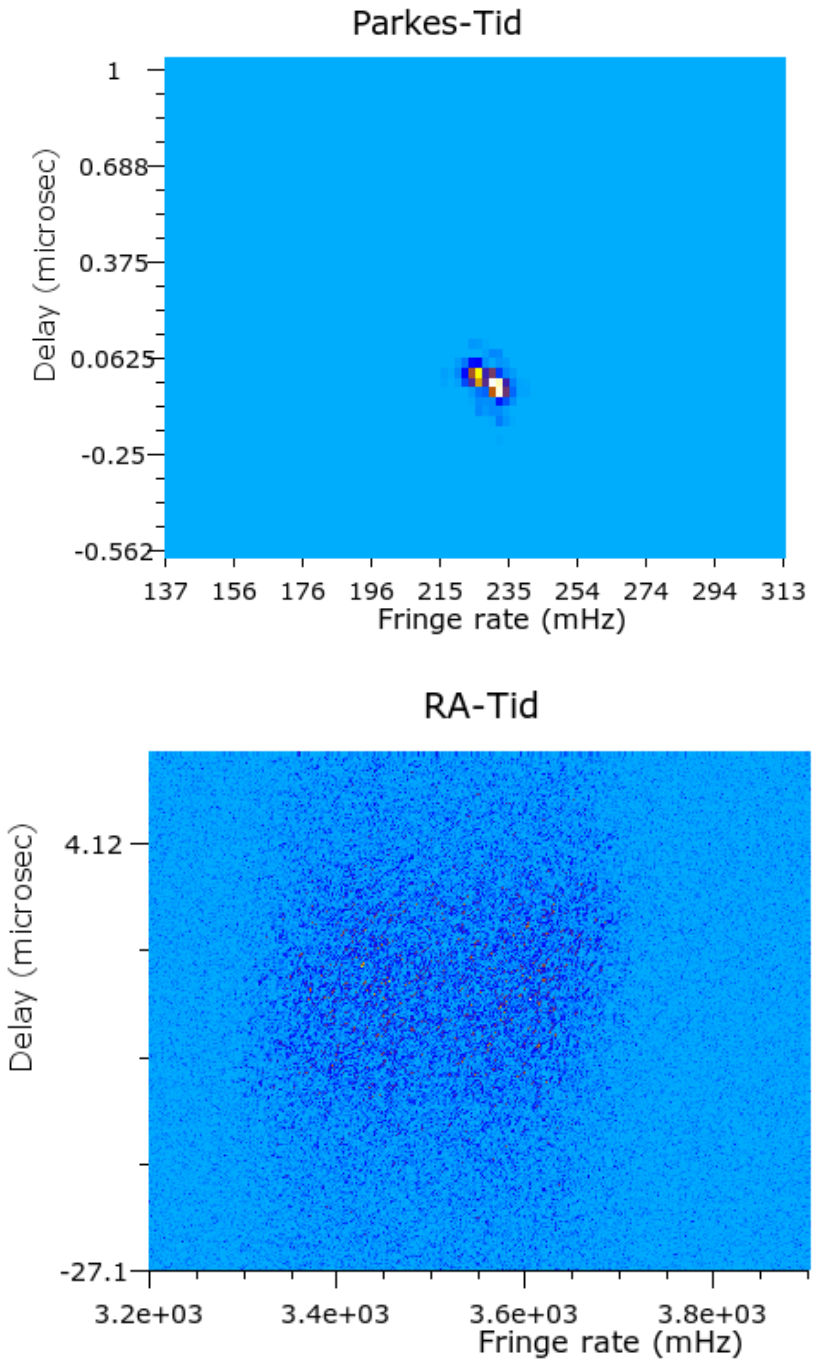


Interference signal from the compact core of the active galaxy OJ287 detected on April 6, 2012, on the baseline projection 7.2 Earth diameters at 6 cm by SRT-Effelsberg. Integration time: 65 seconds. The plot presents significance of detection (color, signal-to-noise ratio) versus residual delay and rate.



Interference signal from the water maser in the star forming region W51 detected by SRT-Effelsberg on May 12, 2012, at a projected baseline 1.14 Earth diameters. Integration time: 240 seconds. Correlated signal (color, signal-to-noise ratio) is shown versus spectral frequency and fringe rate.



Top: Interference response from the Vela pulsar detected by the ground interferometer Parkes-Tidbinbilla (Australia) in a 10-min scan on May 10, 2012. The signal is found in a narrow range of fringe rate (+- 5 mHz) and delay (+- 30 ns). The scattering disk is not resolved. Bottom: Interference response from the Vela pulsar detected by the space-ground interferometer SRT-Tidbinbilla in the same scan. The signal covers a large range in the fringe rate-delay space (+- 200 mHz and +- 10 microsec). The scattering disk is completely resolved. This allows to study its structure and evolution in great details.