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Spectral polarimetric observations of the Sun by the VIRAC RT-32 radio telescope: first results

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Abstract. The article describes microwave observations of the Sun with the radio telescope RT-32 of the Ventspils International Radio Astronomy Center. The observations were performed using a multichannel spectral polarimeter for the 6.3–9.4 GHz frequency range. A set of 2D microwave emission maps of the Sun for the Stokes I and V parameters has been obtained and analyzed.

Key words: Sun: radio emission – instrumentation: polarimeters

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Perspective ground-based method for diagnostics of the lower ionosphere and the neutral atmosphere

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Abstract. We present a new perspective ground-based method for diagnostics of the ionosphere and atmosphere parameters. The method uses one of the numerous physical phenomena observed in the ionosphere illuminated by high-power radio waves. It is a generation of the artificial periodic irregularities (APIs) in the ionospheric plasma. The APIs were found while studying the effects of ionospheric high-power HF modification. It was established that the APIs are formed by a standing wave that occurs due to interference between the upwardly radiated radio wave and its reflection off the ionosphere. The API studies are based upon observation of the Bragg backscatter of the pulsed probe radio wave from the artificial periodic structure. Bragg backscatter occurs if the spatial period of the irregularities is equal to half a wavelength of the probe signal. The API techniques makes it possible to obtain the following information: the profiles of electron density from the lower D-region up to the maximum of the F-layer; the irregular structure of the ionosphere including split of the regular E-layer, the sporadic layers; the vertical velocities in the D- and E-regions of the ionosphere; the turbulent velocities, turbulent diffusion coefficients and the turbopause altitude; the neutral temperatures and densities at the E-region altitudes; the parameters of the internal gravity waves and their spectral characteristics; the relative concentration of negative oxygen ions in the D-region. Some new results obtained by the API technique are discussed .

Key words: instrumentation: detectors – ionosphere: structure

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Radio interferometric research of ionosphere by signals of space satellites

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Abstract. Since 2012, the Radiophysical Research Institute and the Lobachevsky State University at Nizhny Novgorod, Russia and the Ventspils International Radio Astronomy Centre at Irbene, Latvia are making radio interferometric experiments on study of ionosphere parameters in a quiet (natural) state of medium and research of artificial turbulence of the ionosphere, heated by the emission from the SURA facility. Remote diagnostics of the ionosphere is implemented using a method of radio sounding by signals of navigation satellites in combination with the Very Long Baseline Interferometry (VLBI) method. As a result of spectral and correlation analysis, interferometric responses of the two-element (RRI–UNN) and three-element (RRI–UNN–Irbene) interferometers were received by observations of 12 satellites of the navigation systems GLONASS and GPS. Here the first results are reported.

Key words: instrumentation: interferometers, VLBI – Earth ionosphere – space vehicles – solar-terrestrial relations

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An experiment on radio location of objects in the near-Earth space with VLBI in 2012

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Abstract. An experiment on radar location of space debris objects using of the method of VLBI was carried out in April, 2012. The radar VLBI experiment consisted in irradiation of some space debris objects (4 rocket stages and 5 inactive satellites) with a signal of the transmitter with RT-70 in Evpatoria, Ukraine. Reflected signals were received by a complex of radio telescopes in the VLBI mode. The following VLBI stations took part in the observations: Ventspils (RT-32), Urumqi (RT-25), Medicina (RT-32) and Simeiz (RT-22). The experiment included measurements of the Doppler frequency shift and the

delay for orbit refining, and measurements of the rotation period and sizes of objects by the amplitudes of output interferometer signals. The cross-correlation of VLBI-data is performed at a correlator NIRFI-4 of Radiophysical Research Institute (Nizhny Novgorod). Preliminary data processing resulted in the series of Doppler frequency shifts, which comprised the information on radial velocities of the objects. Some results of the experiment are presented.

Key words: instrumentation: interferometers, Very Long Baseline Interferometry – techniques: interferometric, radar astronomy – ephemeris

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Radio astronomical and radiophysical studies in the near-Earth space in the Radiophysical Research Institute

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Abstract. The paper describes possibilities of the experimental investigations of the near-Earth space by the facilities of the Radiophysical Research Institute at Nizhny Novgorod. We describe the experimental equipment, development of the research methods and some recent results.

Key words: techniques: radar astronomy, interferometric – instrumentation: detectors, interferometers – methods: observational – Earth: ionosphere – space vehicles

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Investigation of the Earth ionosphere using the radio emission of pulsars

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Abstract. The investigation of the Earth ionosphere both in a quiet and a disturbed states is still desirable. Despite recent progress in its modeling and in estimating the electron concentration along the line of sight by GPS signals, the impact of the disturbed ionosphere and magnetic field on the wave propagation still remains not sufficiently understood. This is due to lack of information on the polarization of GPS signals, and due to poorly conditioned models of the ionosphere at high altitudes and strong perturbations. In this article we consider a possibility of using the data of pulsar radio emission, along with the traditional GPS system data, for the vertical and oblique sounding of the ionosphere. This approach also allows to monitor parameters of the propagation medium, such as the dispersion measure and the rotation measure using changes of the polarization between pulses. By using a selected pulsar constellation it is possible to increase the number of directions in which parameters of the ionosphere and the magnetic field can be estimated.

Key words: Earth: ionosphere – techniques: radio astronomy – – stars: pulsars

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The multifractal structure of small-scale artificial ionospheric turbulence

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Abstract. We present the results of investigation of a multifractal structure of the artificial ionospheric turbulence when the midlatitude ionosphere is affected by high-power radio waves. The experimental studies were performed on the basis of the SURA heating facility with the help of radio sounding of the disturbed region of ionospheric plasma by signals from the Earth's orbital satellities. In the case of vertical radio sounding of the disturbed ionosphere region, the measured multipower and generalized multifractal spectra of turbulence coincide well with similar multifractal characteristics of the ionosperic turbulence under the natural conditions. In the case of oblique sounding of the disturbance region at small angles between the line of sight to the satellite and the direction of the Earth's magnetic field, a nonuniform structure of the small-scale turbulence with a relatively narrow multipower spectrum and small variations in the generalized multifractal spectrum of the electron density was detected.

Key words: techniques: radar astronomy – Earth: ionosphere: turbulence