1. Introduction

The National Report presents main results in the field of the Fundamental Space Research (FSE), obtained by Russian scientists in 2014-15, and the nearest planned scientific space missions, including those prepared under the new Federal Space Program of the Russian Federation for 2016-25. We present the outcome of the analysis and interpretation of the scientific data, collected by Russian scientific instruments aboard Russian and foreign spacecraft.

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In March 2016 two spacecraft of the ExoMars project were launched from Baikonur cosmodrome, as envisaged by the mutual agreement between European Space Agency and Roscosmos signed in 2013. The first two craft of ExoMars-2016 mission are Trace Gas Orbiter (TGO) and Schiaparelli descent module. Two Russian instruments are included into scientific payload of TGO: Atmospheric Chemistry Suite (ACS) and Fine-Resolution Epithermal Neutron Detector (FREND). The spacecraft were launched by Proton launcher with Briz-M booster. Now both spacecraft are in the cruise phase, first tests of the instruments were performed successfully.

New scientific spacecraft LOMONOSOV to study cosmic rays, atmospheric glows and transients, was launched in 2016 from the new Vostochny cosmodrome. Besides these tasks, it is dedicated to study space debris and micrometeorites, UV- and gamma-ray flashes connected with lightnings.

In 2014 the next serial small spacecraft (SSC) for fundamental studies on the base of standard “Karat” platform was launched, under the name of RELEC, later renamed Vernov. The goal of the program was to study precipitation and acceleration of relativistis electrons in the magnetosphere, its influence on the Earth's upper atmosphere and ionosphere. It also registered gamma-ray bursts. The data are still being analyzed.

Small re-entry spacecraft Foton-M4 for biological and technological experiments was launched in 2014. The mission lasted for 45 days, a breakthrough for the spacecraft of this type, and included around 20 experiments in biology, biotechnology, and educational.

Russian scientific spacecraft “Spektr-R” (RadioAstron), launched in July 18, 2011, operates successfully. The radio images of active galactic nucleus BL Lacertae with the highest resolution ever achieved in astronomy — 21 microarcseconds— were obtained in joint experiments with 15 Earth-based telescopes in Russia, Europe, and the USA. The observations yielded important results in the fine structure of the jets, emitted by the supermassive black hole. RadioAstron observations of quasar 3C273 gave the estimated brightness temperature more than 1013 K, which can change current ideas on quasars.

Plasma suite PLASMA-F aboard Spektr-R spacecraft found fast variations of energetic ions' fluxes near the Earth's bow shock, both in solar wind and in the magnetosheath with the periodicities of 10-30 seconds. For the first time, Fourier transform spectrum of the solar wind fluctuations was built, not only in the Kolmogorov universal part of spectrum (this was done earlier), but for the first time in the high-frequency range, where the fluctuations energy dissipates.

Around 100 experiments are run under the program of scientific experiments aboard the Russian segment (RS) of the International Space Station (ISS). In particular, from March 2015 to March 2016 a full-scale experiment of a

year-long space expedition was performed, with the participation of Russian cosmonaut Mikhail Kornienko and the US astronaut Scott Kelly. Special section of the national report is dedicated to the most important results of the ISS program and the prospects of future works.

We also described the results of the Russian scientific instruments included in the payload of the foreign space missions, as well as additional payload aboard Russian non-scientific spacecraft. Among the latter are:

- NUCLEON instrument aboard Earth remote sensing satellite Resurs-P No2 (launched in 2014) to study cosmis rays;
- Rim-Pamela Italian-Russian experiment aboard Earth remote sensing satellite Resurs-DK No1. It discovered the excess of high-energy positron, which can be explained as a result of decay of annihilation of dark matter particles.

Instruments developed in Russia and installed aboard foreign spacecraft have been used to study Mars, Venus, and the Moon in the missions such as Mars Odyssey, Lunar Reconnaissance Orbiter, Mars Science Laboratory-Curiosity (NASA) and Venus Express (ended in 2015), Mars Express (ESA). Russian scientists participated in the annual planning of the observations and studies of cosmic sources in gamma and x-ray ranges in the frame of a 25% quota of exposure time at the international astrophysical observatory "Integral" (ESA).

Future space projects envisaged under the new Federal Space Program of the Russian Federation for 2016-25 are described in the according section.

In 2017 Russian-German X-ray orbital observatory Spektrum-Roentgen-Gamma will be launched, comprising two X-ray mirror telescopes: eRosita (Germane) and ART-XC (Russia). It will study the Universe in gamma and X-ray spectral ranges.

Spektr series will be continued with the launch of World Space Observatory — UV (WSO-UV). It includes the 1.7 m telescope to work in ultraviolet part of the spectrum (110-300 nm).

The National Report gives a summary of lunar program, whose first stage includes both landers (Luna-25, Luna-27) and orbiter (Luna-26). The numbers of the mission succeed the last Soviet project Luna-24, which in 1976 delivered samples of the lunar soil rom Mare Crisium. The Report also presents new projects for solar, heliospheric, and magnetospheric studies: Interhelioprobe, and Resonance. The second stage of ExoMars project, planned for launch in 2020, is also described.