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Author: Mr. Sergey Matvienko
Kurs Research and Production Complex, Ukraine, matvienko_2005@ukr.net

PRACTICAL IMPLEMENTATION OF THE SPACE SYSTEM FOR PREDICTING SEISMIC ACTIVITY ON BOARD AN INTERNATIONAL SPACE STATION

Abstract

The author in 2005 developed an original radiophysical method for measuring the parameters of the gravitational field in the radio frequency range using the relativistic effect "redshift". A stationary radiophysical relativistic gravimeter (RRG) was designed, manufactured, tested and certified, which allows you to measure the absolute value of gravitational acceleration with an accuracy of 3-5 gal, as well as a change in gravitational potential at a height of less than 1 cm. The main element of the gravimeter is the hydrogen frequency standard VCH-1003 Russia). A modification of the differential radiophysical gravimeter was also developed, the measurement scheme of which allows to exclude the Doppler frequency shift, which occurs when measuring on mobile objects, including spacecraft. In 2019, as part of the scientific and research work "Navigation-Gravica", which was carried out under a contract between RPC "Kurs" and the "National Center for the Management and Testing of Space Systems", certification of a radiophysical gravimeter at the NSC "Institute of Metrology" in Kharkov was carried out. After certification, two-month measurements of the free fall acceleration at the GC "Ukrmetrteststandart" were carried out, which were compared with data on the fact of earthquakes that had already occurred. The studies revealed abnormal sinusoidal changes in the value of the acceleration of gravity with an amplitude of about 200 Gal two days before the earthquakes in Ukraine and Romania. The earthquakes that occurred in the Philippines and other countries of the far abroad did not have any effect on the values of the acceleration of gravity. These facts are reflected in the final report on research work. The ACES (Atomic Clock Ensemble in Space) is a project led by the European Space Agency, where a highly stable atomic clock was placed at the International Space Station (ISS) in 2019. Functioning in a microgravity environment made it possible to obtain stable and precise measurements of time for different areas of research, including general relativity, time and frequency metrology and others. Currently payload consist of two clocks: cesium clock for long-term stability and a hydrogen maser for short-term stability (or PHARAO and SHM), which generate the reference frequency instability and inaccuracy of 1*10-15 . The characteristics of PHARAO and VCH-1005 are very close, which allows us to create a three-axis differential radiophysical gravimeter onboard the ISS, which allows us to measure the absolute value of the acceleration of gravity with an accuracy of 3-5 Gal and ensure resolution on the Earth's surface not worse than 5-10 km. It should also be noted that the cost of gravimeter equipment, except PHARAO, will not exceed 500 thousand euros. The characteristics of the differential radiophysical gravimeter are close to the parameters of the GOCE and GRACE missions, the cost of which creation exceeds 500 million euros. Keywords: "redshift", radiophysical relativistic gravimeter.