

STEP-F Satellite Telescope for measuring electrons and protons is in space and it's operational

The unique satellite telescope for measuring electrons and protons STEP-F became operational in space on February 20, 2009 on board the Russian spacecraft "Coronas-Photon". A few weeks earlier it was lifted into space on January 30, 2009 this satellite was launched into low near-Earth orbit by the Ukrainian rocket "Cyclone -3" which took off from Russian cosmodrom "Plesetsk" situated in Arkhangelsk region.

The STEP-F Satellite Telescope was developed for continuous measurement of electron, proton and alpha-particle fluxes trapped in Earth's inner and outer radiation belts. These particles precipitate from radiation belts into the atmosphere after and during solar flares, geomagnetic storms, and sudden ionospheric disturbances.

First models of the instrumental-laboratory model, weight-dimensional and technology models were developed with financial and organizational assistance of STCU. Under STCU Project #1578 V. Karazin Kharkiv National University in 1999-2001 led developed a new version of satellite devices for measurement of charged energetic particle fluxes. The main features of this model are the application of position-sensitive detectors matrices as well as scintillation detectors viewed by large area silicon photodiodes. A major advantage of this design is a wide energy range for each particle type with simultaneous definition of spatial direction.



Pic.1. "Coronas-Photon" satellite before the launch on "Plesetsk" cosmodrom

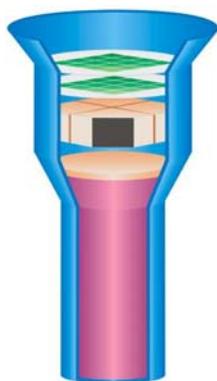


Pic.2. Flight model of the STEP-F device in the set of complex scientific apparatus "Photon" before transportation to the start platform.

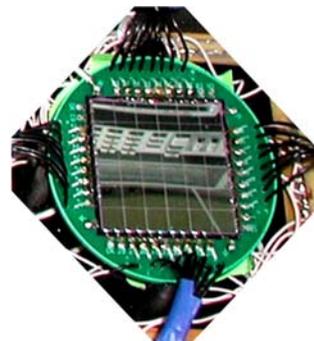
The STEP-F instrument was introduced into complex of scientific apparatus "Photon" of the spacecraft "Coronas-Photon" as a result of Agreement between representatives of Russian Academy of Sciences and Russian Space Agency, and Ukraine's National Academy of Sciences and National Space Agency. In 2005 an Agreement on the scientific and technical collaboration was signed between Kharkiv National University named after V.N. Karazin (KhNU) and Moscow Engineering & Physics Institute (MEPHI) – main organization on payload of the satellite. This collaboration has realized the joint cosmic experiment STEP-F on board the low Earth orbit spacecraft "Coronas-Photon". The spacecraft "Coronas-Photon" has the next trajectory of the flight: the orbit is almost round; the height is near 550km; the orbit's incidence is 82,5 degrees. The spacecraft's traversal around the Earth is about 95min. The number of traversals in 24 hours is 14.

KhNU has designed, assembled, tested and adjusted models of the device as well as provided all needed autonomous tests at the certified stationary equipment of Ukraine, while MEPHI provided participation of the STEP-F instrument in the set of complex tests of the payload at MEPHI, at the adjusting complex of the organization - manufacturer of the satellite as well as on the Russian cosmodrom "Plesetsk".

Russian organizations continue to assist to realize the STEP-F experiment distributing scientific information from the space system via ftp-protocols, analyzing health and status of STEP-F through onboard telemetry information, giving recommendations on the operation by instrument taking into account ballistic parameters of the next orbits.



Pic.2. Artist view of STEP-F' detecting head



Pic.3. Silicon PIN matrix detector of charge particle providing position sensitivity of the device

The STEP-F Satellite Telescope of Electrons and Protons was designed and manufactured in V.N. Karazin Kharkiv National University managed by the Corresponding member of National Academy of Science of Ukraine professor Illya Zalyubovskiy in the framework of National space program of Ukraine. Head of Division for Space Research of Kharkiv National University Dr. Oleksiy Dudnik is a principal investigator and design manager of STEP-F Satellite Telescope. It was developed in cooperation with Science and Research Institute of Radio Technical Measurements (Kharkiv). Research Institute of Micro Devices (Kyiv) and the Institute of Scintillation Materials (ISMA, Kharkiv) under the National Academy of Science of Ukraine. The Satellite Telescope was created for obtaining information about fluxes and spectra of energetic particles to study energetic solar cosmic rays and their transport through interplanetary space, to study the dynamics of Earth's radiation belts during the 23-rd cycle of solar activity.



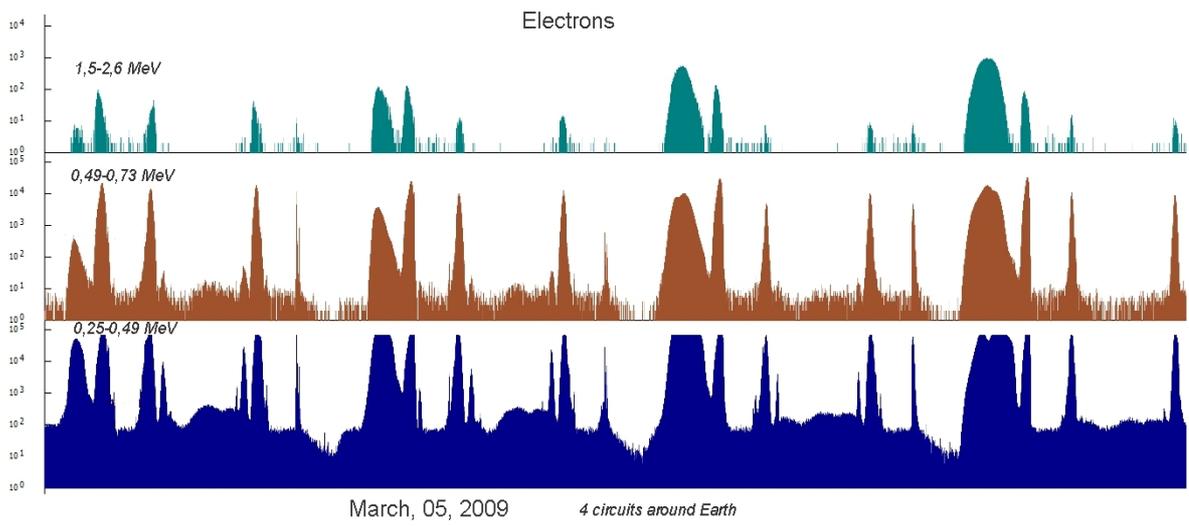
Pic.4. Technology model of the STEP-F device



Pic.5. Dimensional model of the STEP-F device

The STEP-F instrument provides registration of electron fluxes and energy spectra in the energy ranges $E_e = 0,2 - 15,0$ MeV, proton fluxes and energy spectra in the energy range $E_p = 3,7 - 61,0$ MeV, proton fluxes in integral range $E_p > 61,0$ MeV, alpha-particle fluxes and energy spectra in the energy range $E_a = 15,9 - 246,0$ MeV,

The first experimental data were obtained during flight tests of spectrometer-telescope STEP-F. The preliminary processing of results demonstrates full reliability of instrument, gives a chance to show “breathing” of radiation in the polar cups and Earth radiation belts.



Pic.6. Four circuits around Earth. March 05, 2009