MODELING OF THE EUV AND X-RAY EMISSION SPECTRA INDUCED BY THE SOLAR WINDS IONS IN THE HELIOSPHERE

NASA Grant NNG04GD57G

Annual Report

For the period 1 February 2004 through 30 November 2004

Principal Investigator
Vasili Kharchenko

January 2005

Prepared for
National Aeronautics and Space Administration
Washington, DC 20546

SMITHSONIAN INSTITUTION
ASTROPHYSICAL OBSERVATORY
CAMBRIDGE, MASSACHUSETTS 02138

Director: Charles Alcock

The Smithsonian Astrophysical Observatory is a member of the Harvard-Smithsonian Center for Astrophysics

The NASA Technical Officer for this grant is Dr. William Wagner, NASA Headquarters, Code SS, Washington, DC 20546
Progress Report 1

NASA grant NNG04GD57G

Modeling of EUV and X-ray Emission Spectra Induced by Solar Wind Ions in the Heliosphere

PI: Dr. V. Kharchenko

Harvard-Smithsonian Center for Astrophysics, 60 Garden Str., Cambridge, MA 02138

We have carried out investigation of the EUV and X-ray emission spectra induced in interaction between the Solar Wind (SW) and interstellar neutral gas. The spectra of most important SW ions have been computed for the charge-exchange mechanism of X-ray emission using new accurate spectroscopic data from recent laboratory measurements and theoretical calculations. Total spectra have been constructed as a sum of spectra induced in the charge-exchange collisions by individual O^{++}, C^{++}, N^{++}, Ne^{++}, Mg^{++} and Fe^{++} ions. Calculations have been performed for X-ray emission from the heliospheric hydrogen and helium gas. X-ray maps of the heliosphere have been computed. In figure, the power density of X-ray sources in the heliospheric ecliptic plane is shown for the H gas (left figure) and for the He gas (right figure). Distances from the Sun (0,0) are given in AU. The helium cone is clearly seen in the X-ray map of the charge-exchange emission induced by the solar wind.

X-ray emission spectra detected by the Chandra X-ray telescope from the “dark” side of Moon has been identified as a X-ray background emission induced by the solar wind from the geocorona. Spectra and intensities of this charge-exchange X-rays have been compared with the heliospheric component of the X-ray background. Observations and modeling of the SW spectra induced from the geocorona indicate a strong presence of emission lines of highly charged oxygen ions. Anisotropy in distribution of heliospheric X-rays has been predicted and
calculated for the regions of the fast and slow solar winds.

The results of investigations are published in the articles:


and reported in invited talks on Conferences:


- 2004 - AAS 204th Meeting, Denver, *Heliospheric and Cometary X-rays Induced by the Solar Wind*


- 2004 - 14th APS Conferences on Atomic Processes in Plasmas, Santa Fe, *X-ray emission from comets, planets and heliospheric gas*

We continue our investigations according to the Management Plan: Calculations of X-ray spectra at different compositions of the solar wind; analysis of heliosepheric EUV and X-rays observed with the Chandra, XMM-Newton, ROSAT, and EUVE telescopes. I would like to ask NASA administration to release the next year's award funds in the previously agreed-to amount of $94,974.

Sincerely,

Vasili Kharchenko