Geophysical Research Abstracts
Vol. 16, EGU2014-223, 2014
EGU General Assembly 2014

Fluxes of energetic neutral helium atoms from the heliosheath and the IBEX Ribbon

Pawel Swaczyna, Stan Grzedzielski, and Maciej Bzowski
Space Research Centre PAS, Warsaw, Poland (pswaczyna@cbk.waw.pl)

Full sky maps of energetic neutral hydrogen atoms (H ENA) obtained with the Interstellar Boundary Explorer revealed a bright, arc-like Ribbon, which dominates over the heliosheath emission on large swaths of the sky. We simulate the emission of helium ENA from the heliosheath and the IBEX Ribbon. To estimate the heliosheath signal, we use a set of simple models of the heliosphere, where we take the newest results from the Voyagers spacecraft into account. We simulate the evolution of energy spectra of α-particles and He^+ ions using a number of binary interactions of He ions with plasma and neutral background in the heliosheath. The suprathermal ions from this distribution are a source of emerging He ENA flux, which we calculate. The fluxes in the observer frame are corrected for the Compton-Getting effect and the re-ionization losses on the path to detector. We conclude that the highest intensities should be expected from the heliospheric tail. For 1 keV He ENA, they are $\sim 0.5 - 10$ $(\mathrm{cm^2\,s\,sr\,keV})^{-1}$, depending on the employed model, whereas the expected intensities in the forward and flank sectors of the heliosphere in models with the heliosheath thickness ~ 25 AU do not exceed 0.02 $(\mathrm{cm^2\,s\,sr\,keV})^{-1}$ and 0.2 $(\mathrm{cm^2\,s\,sr\,keV})^{-1}$, respectively. For assessment of the IBEX Ribbon emission we compare the He ENA emissions from two models of the Ribbon origin previously developed to explain the hydrogen emission. In the first one, the Ribbon ENAs are produced outside the heliopause from the ionized neutral solar wind in the direction where the local interstellar magnetic field is perpendicular to the line-of-sight. The second model proposes the ENA production at the interface between the Local Interstellar Cloud (LIC) and the Local Bubble (LB). In the first model, the expected intensity is ~ 0.014 $(\mathrm{cm^2\,s\,sr\,keV})^{-1}$, i.e., of the order of the emission from the forward sector of the heliosphere, whereas in the second model, the intensity is $\sim 2 - 7$ $(\mathrm{cm^2\,s\,sr\,keV})^{-1}$. If the IBEX Ribbon requires a source population of ENAs leaving the heliosphere, then the Ribbon should not be visible in He ENA because of the insufficient supply of the He ENA from the neutralized α-particles from the solar wind. Full-sky measurements of He ENA could create a possibility of distinction between proposed models of the Ribbon origin. We check that He ENA have a potential to probe distant sources of ENA production owing to the expected long mean free path against ionization and elastic scattering (up to 8000 AU for 1 keV/n He) in the interstellar medium.