Geophysical Research Abstracts
Vol. 17, EGU2015-2548, 2015
EGU General Assembly 2015

Flow direction variations of low energy ions as measured by the ion electron sensor (IES) flying on board of Rosetta

Karoly Szegö (1), Zoltan Nemeth (1), Lajos Foldy (1), James L Burch (2), Raymond Goldstein (2), Kathleen Mandt (2), Prachet Mokashi (2), and Tom Broiles (2)

(1) Wigner Res. Centre for Physics, Space Physics, Budapest, Hungary (szego.karoly@wigner.mta.hu), (2) Southwest Research Institute, San Antonio, TX, United States

The Ion Electron Sensor (IES) simultaneously measures ions and electrons with two separate electrostatic plasma analyzers in the energy range of 4 eV- 22 keV for ions. The field of view is 90ox360o, with angular resolution 5ox45o for ions, with a sector containing the solar wind being further segmented to 5o $\times$ 5o.
IES has operated continuously since early 2014. In the ion data a low energy (<50-100 eV) component is well separated from the higher energy ions. Here we analyze the arrival direction of this low energy component.
The origin of these low energy ions is certainly the ionized component of the neutral gas emitted due to solar activity from comet 67P/Churiumov-Gerasimenko. The low energy component in general shows a 6h periodicity due to cometary rotation. The data show, however, that the arrival direction of the low energy ions is smeared both in azimuth and elevation, due possibly to the diverse mechanisms affecting these ions. One of these effects is the spacecraft potential ($\sim$-10V), which accelerates the ions towards the spacecraft omnidirectionally.
To characterize the flow direction in azimuth-elevation, we have integrated over the lowest 8 energy channels using weighted energy: sum(counts * energy)/sum(counts); and considered only cases when the counts are above 30. When we apply higher cut for counts, the flow direction became more definite. For this analysis we use data files where the two neighbouring energy values and elevation values are collapsed; and the azimuthal resolution is 45o, that is the solar wind azimuthal segmentation is also collapsed.
Here we use day 2014.09.11. as illustration. On that day a solar wind shock reached the spacecraft at about $\sim$10 UT. After the shock transition the energy of the solar wind became higher, and after $\sim$12 UT the flow direction of the solar wind fluctuated, sometimes by 35o. On this day Rosetta flew at about 29.3-29.6 km from the nucleus.
In the azimuth-elevation plots summed over "weighted energy" (as defined above) we were able to identify two flow directions: one close to the anti-solar direction, and one perpendicular to it. The occurrence and variations of these directions are still under investigation.
A possible cause of the acceleration of low energy ions along the solar wind might be that electrons produced by the ionization of neutrals are immediately picked up by the solar wind generating a polarization electric field that accelerates the ions. This effect is similar to the generation of ionospheric holes at Venus [Hartle and Grebowsky, Adv. Space Res., 4, 1995]. The acceleration perpendicular to the solar wind might be due to the v x B electric field.
The variations of the low energy flow direction is analyzed in detail in the presentation.