Data Release 15

Variability in the Position of the IBEX Ribbon

by Dayeh et al.

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Abstract: The ribbon of enhanced energetic neutral atom flux, discovered by the Interstellar Boundary Explorer (IBEX) in 2009, has redefined our understanding of the heliosphere's interaction with the local interstellar medium (LISM). Yet, its origin continues to be a topic of scientific debate. The ribbon is circular and traces the region where the putative LISM magnetic field (BLISM) is perpendicular to the radial direction from the Sun. Using nine years of IBEX-Hi observations, we investigate the ribbon circularity and location as functions of time and energy. We provide updated locations of the ribbon center at five energy passbands (centered at 0.7, 1.1, 1.7, 2.7, and 4.3 keV) in ecliptic coordinates [longitude, latitude]: [217°.41 ± 0°.95, 44°.36 ± 0°.93], [219°.72 ± 0°.95, 41°.50 ± 0°.87], [220°.51 ± 1°.19, 39°.96 ± 1°.00], [218°.08 ± 1°.66, 38°.44 ± 1°.24], and [214°.68 ± 1°.48, 34°.13 ± 1°.19] respectively. The weighted mean center location over all energies and all years is [218°.33 ± 0°.68, 40°.38 ± 0°.88] and its radius is 74°.81 ± 0°.65. As viewed by IBEX at 1 au, we find that (1) the ribbon is stable over time, with distinct centers at each energy; (2) ribbon centers exhibit small temporal variations, likely caused by the solar wind (SW) speed and density variations; and (3) ribbon location in the sky appears to be driven by (i) the inherent alignment of the ribbon centers along the plane connecting the presumed BLISM and the heliospheric upwind direction, and (ii) the variable SW structure along the heliographic meridian, further emphasizing that the ribbon source is outside the heliosphere.

File Headers

The first number in the first line of each data file gives the number of lines taken up by the header followed by the number of rows times the number of columns in the data (i.e. 30X60 indicates 30 rows of declination by 60 columns of right ascension values). Row 1 corresponds to the South Ecliptic Pole, while row 30 corresponds to the North Ecliptic Pole. The columns start at ecliptic longitude 0 and step through to ecliptic longitude 360; the values of the first and last columns in each map are identical. The layout of the columns corresponds to Solar Ecliptic East Longitude, right to left as seen outward by IBEX. The keyword "h_title" gives the description of the data and the units used.
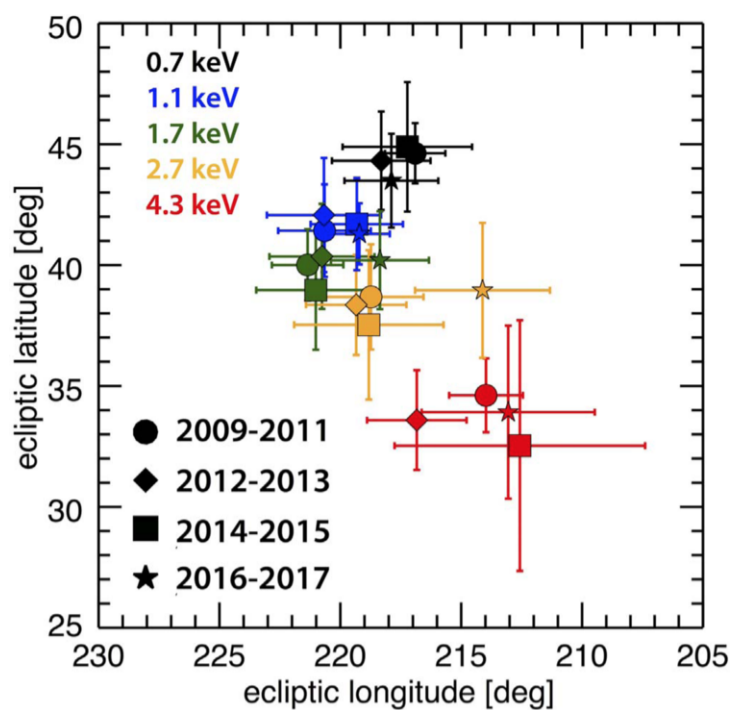
Figure 2 of Dayeh et al. 2019: (a) Derived ribbon centers over five energy passbands (color-coded) and for the four different time periods considered in this study (symbols).
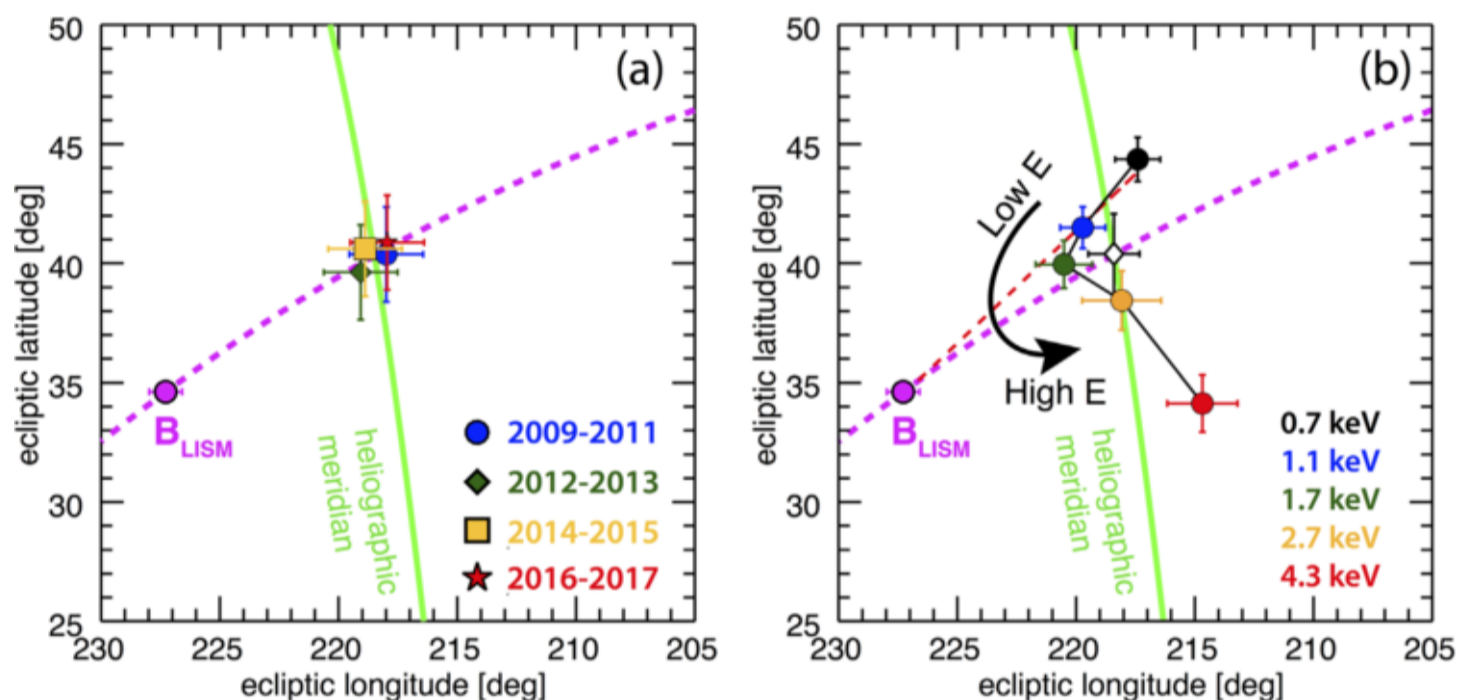
Figure 9 of Dayeh et al. 2019: (a) Derived ribbon centers over the IBEX-Hi energy range during four different time periods (symbols). (b) Ribbon weighted center locations for each energy passband. The magenta curve traces the B−V plane (BLISM from Zirnstein et al. 2016b, and V from McComas et al. 2015), the green line traces the heliographic meridian, which passes through the solar poles. The pristine interstellar magnetic field direction derived by Zirnstein et al. (2016b) is also shown in magenta. The red dashed line is a fit to the ribbon centers below 1.7 keV and the pristine interstellar magnetic field direction (4 data points; see the text for details). The open diamond symbol is the averaged ribbon center location over all energies.