

The effect of magnetic field fluctuations on the initial distribution of pick-up ions

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Abstract

In an environment where strong magnetic field fluctuations are present, the initial distribution of pick-up ions is not a ring-beam distribution but rather a nontrivial function, which extends to a significant portion of the pick-up shell. Due to the fluctuations each freshly picked-up particle feels a different magnetic field. Each magnetic field direction has a corresponding ring, and the initial distribution is the sum of these rings. The properties of the magnetic field fluctuations in the region of the pick-up influence the initial distribution strongly. We have studied the effect of the fluctuations on the initial distribution of pick-up ions. We found that the distribution resembles a signet-ring in velocity space; the function has a strong peak in the vicinity of the neutral velocity and a more extended shape on the opposite side of the pick-up shell. Both the intensity and the spectrum of the fluctuations influence its shape. Since the fluctuations are often in a large part waves generated by the pick-up ions themselves, the fluctuation spectra can have strong variations around the gyrofrequency of some ion species. We also found that the initial distribution is only sensitive to fluctuations having frequencies lower than the gyrofrequency of the pick-up ion. Thus the same magnetic field fluctuations can result in significantly different source distributions for different ion species.

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