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The free escape boundary of diffuse ions upstream of the Earth's quasi-parallel bow shock

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The Earth's bow shock is very efficient in accelerating ions out of the incident solar wind distribution to high energies ($\approx$ 200 keV/e). Energetic ions accelerated at the quasi-parallel bow shock are also known as diffuse ions and are best represented by exponential spectra in energy/charge, which require additional assumptions to be incorporated into the models. One of these assumptions is a free escape boundary along the interplanetary magnetic field into the upstream direction.
We use two years of data from the background monitor on the IBEX spacecraft to investigate the existence of an upstream free escape boundary for bow shock accelerated ions. The IBEX mission was launched into an 18000 km by 50 RE orbit with a 7.5 day period, which provides extended periods of time in the region upstream of the bow shock. The IBEX background monitor is sensitive to protons > 14 keV which includes the energy for the maximum flux for diffuse ions. With increasing distance from the bow shock along the interplanetary magnetic field, the background count rates from diffuse ions stays constant for ions streaming away from the bow shock while diffuse ion count rates streaming towards the shock decrease for distances > 10 – 15 RE. These observations appear to support the existence of a free escape boundary for ions > 14 keV at a distance of $\sim$10 - 15 RE from the shock.