Low-energy neutral atom signatures of the high-altitude cusp: IMF By effect

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Remote sensing using the low energy neutral atom (LENA) imager on the IMAGE spacecraft can be used to understand the distribution of the ion flow in the region where significant source ions, which can produce neutral atom emissions through charge exchange with the Earth's hydrogen exosphere, are present. Recent studies have shown that LENA can 'see' the ion entry in the high-altitude cusp as well as the sheath flow in the cusp indentation. In this study we report on the occurrence of the LENA emission in the direction of the cusp, and discuss the IMF effect on the cusp ion entry. We searched for events of significant LENA cusp emission from the IMAGE near-noon orbits (March-April 2001) by requiring that the magnitude of the IMF clock angle, |CA|is more than 60 degree, i.e., except for the interval when IMF northward component dominates. ACE solar wind data for the identified 13 LENA events show that the emissions occur during periods of a large solar wind speed of more than 600 km/s, and a relatively large (more than 7 nT) IMF in the Y-Z plane. Results of the analyses also show that the solar wind dynamic pressure must be at least 10 nPa for the detection of the LENA cusp emission during |CA|of 150˜180 degree, i.e., southward IMF, while even 3˜4 nPa can produce detectable emission for |CA|˜90 degree, i.e., when the IMF east-west component strongly dominates. Considering the size of the magnetopause expected for such a moderate dynamic pressure and a small negative component of IMF Bz, the magnetopause is not highly compressed, and the location of the cusp indentation of that magnetopause appears to be in the region having relatively small densities of the hydrogen exosphere. This suggests that the dominant emission for |CA|˜90, i.e., large IMF |By|should be produced by the entry of ions which can reach the region having higher densities of the hydrogen exosphere, not by the sheath flow in the cusp indentation. We also interpret this IMF By effect in terms of the reconnection on the magnetopause.