Statistical Differences of Magnetic Field Kinks Observed by PSP and WIND

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Parker Solar Probe’s (PSP) observations near the sun show the extensive presence of magnetic field kinks (switchback for large kinks) in the slow solar wind. These kinks are usually accompanied by the enhancement of radial solar wind velocity and ion temperature, increasing or decreasing of number density. The magnetic field kinks have also been observed by WIND and Ulysses to exist near and beyond 1 AU, respectively. In this study, we statistically analyze the property difference of magnetic field kinks observed by PSP and WIND. We obtain the following four points of results. (1) Inside the PSP-kinks, the radial velocity and protons’ temperature increase while density shows enhancement or descent. However, inside the WIND-kinks, besides the slight enhancement of radial velocity, the density and temperature show no obvious change compared with the outside plasma. (2) By employing the Walen-test of kinks, we find that, R components of some PSP-kinks but not all satisfy the rotational discontinuity (RD) features, while the three components of most WIND-kinks well match the RD features. (3) The correlation between magnetic field and velocity inside the PSP-kinks and WIND-kinks does not show significant differences. (4) Both the PSP-kinks and WIND-kinks can be divided into two groups based on the histograms of $\theta_{Bn}$, where B is the background magnetic field, and n is the normal direction of kink. The first group (group-I) has $\theta_{Bn}$ concentrating around 20° for PSP-kinks and 30° for WIND-kinks, indicating that the satellites were crossing the same kinked interplanetary magnetic field (IMF) from the upstream to the downstream. The second group (group-II) has $\theta_{Bn}$ concentrating around 90° for PSP-kinks and WIND-kinks, suggesting that the satellites were crossing an interface between the unkinked and kinked IMF regions. Our findings help better understanding the nature of kinks and provide the observational basis for testifying models about radial propagation and evolution of magnetic field kinks.