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Can upstream ion events at the Lagrangian point L1 mimic ions accelerated at an interplanetary shock wave?

George C. Anagnostopoulos, Mιchael Maragakis, and Efthymios Vassiliadis

Division of Telecommunications, Dept. of Electrical & Computer EngineeringEngineerin, Xanthi, Greece (ganagno@ee.duth.gr, 0030-25410 79590)

Changes in plasma, magnetic field and energetic ion observations at Libration Point L1 (∼220 Re) are important for space whether research. However, short-lived (from some minutes to a few hours) ion intensity enhancements at L1 have been attributed to various sources and acceleration sites: interplanetary shock acceleration, acceleration at Earth's bow shock, leakage from Earth's magnetosphere etc. The scope of this study is to examine to which extent ion events originating from the Earth's magnetosphere environment could mimic ion events propagating up to L1 point after acceleration at (distant) interplanetary shock waves. For this reason we performed a statistical study and compared ion events observed almost simultaneously by the Geotail spacecraft near the Earth's bow shock and by ACE moving around the Libration point L1. Due to drastic changes of several parameters between the two sites, we found that at around the point L1, the ACE ion events show a strong spectrum with an average spectral index as low as γ_A = 2.1 (for a power law spectrum) at the level of 200 keV, while the average spectral index for the corresponding ion events observed by Goetail was found to be γ_G = 5.4. We infer that a short duration ion event with a hard "solar" / "interplanetary" type energy spectrum can originate from the Earth's magnetosphere, and, that, therefore, these results should be seriously taken into account in space weather prediction research. More detailed information on the varying features of travelling ions and electrons from the bow shock to far distances are important as regards the problem of their origin and are also presented and discussed in the paper.