3D STRUCTURE OF RECONNECTED FLUX ROPES AT EARTH'S MAGNETOPAUSE: RESULTS FROM MULTIPLE SPACECRAFT OBSERVATIONS

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Although magnetic reconnection (MR) on Earth's magnetopause has been extensively studied for many years, the details of the reconnected flux ropes on the dayside boundary has proven to be rather illusive in view of their geometry and magnetic topology. While theoretical models often assume open tube-like shapes, global simulations always show that flux ropes formed via reconnection at the magnetopause possess complicated 3D structures. To reveal the natures/features of these flux ropes requires detailed multiple spacecraft measurements and may greatly improve our understanding of solar wind impact on the geospace environment.

This paper reports six case studies and a comprehensively statistical study based on ESA Cluster, CNSA TC-1 and NASA Themis measurements. We will show, for the first time, (a) the observed 3-D large structure of the flux ropes across the dayside magnetospheric boundary; (b) Different field topologies seen, respectively, in the magnetospheric branch of the ropes, the ropes' azimuthally extended section, and the magnetosheath part of the ropes away from the magnetopause; and (c) Magnetopause reconnection makes important contributions also to the formation of magnetospheric boundary layer of closed field lines. Evidence and process of multiple X-line reconnection that leads to appearance of magnetopause flux ropes are presented and discussed.

978-1-4673-5225-3/14/$31.00 ©2014 IEEE