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Two different types of plasmoids in the plasma sheet: Cluster multi-satellite analysis application

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Two successive plasmoids previously reported [Eastwood et al., 2005; Henderson et al., 2006] are re-investigated with emphasis on their fine magnetic structure by magnetic rotation analysis (MRA) and multi-satellite timing analysis using four Cluster satellite data. Within these two plasmoids, the curvature radius (Rc) variations of the magnetic field lines from the boundary to the inner part have opposite trend. The different variations of Rc reflect that the two plasmoids have different magnetic configurations, and allow to identify that the first observed plasmoid is of 2-D magnetic loop (ML) type and the second plasmoid is of 3-D magnetic flux rope (MFR) type. We also study the local structure of the plane nested in the MFR (2nd plasmoid) and find the normal direction of the plane in GSM coordinates at (0.5099, 0.6088, 0.6087) largely deflected with an angle of from the GSM Z-axis. This result differs from the expected MFR model with a circular cross-section. Based on this analysis, the possible cross-section geometry in MFR is discussed, and the configuration of the plane is identified to have potential applications for improving future MFR models and for studying the interaction of plasmoid with other magnetized plasma.