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Coalescence of magnetic flux ropes during magnetic reconnection

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Magnetic flux ropes are commonly observed in the vicinity of magnetic reconnection site and have been believed to play an important role for evolution of magnetic reconnection. By the measurements of Cluster in the magnetotail, a number of magnetic flux ropes on the ion scale are identified in the ion diffusion region of a reconnection event in the magnetotail. From the polarity consistency between the core field of the ropes and the localized Hall field, most of the ropes are inferred to be embedded in a region with the Hall quadrupolar magnetic field rather than centered in the plasma sheet. Furthermore, 63% of the ropes are found to be coalescing. The observations therefore reveal that the ion diffusion region is filled with the ropes and interaction of these ropes is intrinsic to the dynamics of collisionless reconnection in the magnetotail.