

Magnetotail Reconnection

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Magnetic reconnection takes place in association with substorm onset in the magnetotail. The spacecraft Geotail has provided in situ observations of magnetic reconnection for substorm onsets. Formation of the Hall current system is best evidence for ongoing magnetic reconnection, since it is manifestation of ion-electron decoupling process in magnetic reconnection. Observations of the Hall current system are made in the near-Earth plasma sheet, and highly accelerated electrons were observed simultaneously. In the boundary region adjacent the tail lobe, there are counterstreaming electrons; high-energy (higher than 10 keV) electrons stream away, whereas medium-energy (near 3 keV) electrons stream into the magnetic reconnection site. Currents induced by these medium-energy electrons are part of the Hall current loop. The highly accelerated electrons, which coexist with highly accelerated ions, indicate ongoing acceleration processes. Magnetic reconnection can take place at radial distances of 10-30 R_E in the magnetotail for substorm onsets. Solar wind and interplanetary magnetic field (IMF) conditions determine the magnetic reconnection site in the magnetotail. Magnetic reconnection takes place closer to (far from) the Earth when the solar wind energy input is high (low), where the solar wind energy input is expressed by $-V_x \times B_s$, where V_x is the x component of the solar wind velocity and B_s is the southward component of IMF. It is likely that magnetotail reconnection is controlled by external factors.