Current sheet width and ion/electron scale length controlling of the tearing magnetic reconnection

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Plasma and magnetic energies from the Sun are provided to our Earth's magnetosphere by means of magnetic reconnection. Our concentrated knowledge on the solar-terrestrial physics have revealed the global circulation of these energies almost with MHD framework. It is thought however, that in the very place where energy conversion take place, so-called diffusion region, pure MHD scheme is no longer able to explain magnetic reconnection without any artificial tricks.

On discussing the phenomena in the inner magnetosphere, the tail-reconnection process plays important roles as the process is involving several energy and momentum conversions. In the place where magnetic reconnection take place, frozen-in flux constraint is broken and plasma species begin to move with their inertia nature. From the difference of ion/electron inertia length each of them has own diffusion region, in which the particle description will appear.

In this presentation, I will speak of the dependency between ion/electron scale length and the plasmasheet width. Actually magnetic reconnection takes place in the plasmasheet, it is still in remain that what relation exists for the magntic island formation between ion/electron scale length and plasmasheet width. To reveal it, computational experiment has been performed using the Harris current sheet as the initial condition. In this work the problem is modeled using a two-dimensional electromagnetic particle-in-cell code in which full particle dynamics are retained for both electrons and ions and Maxwell's equations are solved without approximation. The magnetic reconnection needs some instability to prompt the growth of reconnected magnetic field spontaneously so that the tearing instability is assumed to be the most suitable candidate for the magnetospheric tail instability.