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UTST球状トカマク実験における
プル・リコネクションとプラズモイド誘起の検証

Plasmoids Induced Pull Reconnection Experiments of UTST

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Helicity injection experiments were performed in the University of Tokyo Spherical Tokamak (UTST) by using external poloidal field coils. When a spherical tokamak (ST) plasma is connected to the coil flux, magnetic helicity is injected from the helicity source (the coil flux) into the helicity sink (the ST plasma), and the plasma current is substantially ramped up as reported in Ref. [1]. This helicity injection, in other words, the pull reconnection process was often observed to be accompanied by the formation of plasmoids around the x-point. However, it was not clear how the plasma parameters affect plasmoid formation. There are many theoretical reports about the relationship between the reconnection and plasmoids, but only few experimental reports. Recently, we have measured the time evolutions of plasmoid formation process during the pull reconnection in UTST by two dimensional pickup coil arrays, which were located in the r-z plane and we investigated the generation and growth of the plasmoids in various conditions, e.g., changing the guide field (toroidal magnetic field), and analyzed the interrelation between the pull reconnection and plasmoids.
The pull mode reconnection is driven between the coil flux and the ST plasma. In this configration, the common poloidal flux which encloses the coil and the ST plasma is pulled back toward the x-point. Under the condition that the guide field was weak, no plasmoids were observed, and the length of the current sheet and the electric field stayed almost constant in time. By contrast, formation of large plasmoids were clearly observed under the condition that the guide field was relatively strong. When the plasmoids were generated, the length of the sheet became much longer than the thickness of that and the reconnection electric field increased. As the plasmoids grew, the long current sheet was further stretched. As a consequence, the formation and ejection of plasmoids provided non-steady fast reconnection condition. In the case that pasmoids were induced, the reconnection rate drastically changed. Although the reconnection rate was small, fast magnetic reconnection was impulsively achieved concurrently with the ejection of the grown-up plasmoid. In the experiments that large plasmoids were observed, the plasma current was ramped up higher.

[1] T.G. Watanabe *et al.*, Plasma Fusion Res. 6 **(**2011**)** 1202131.