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LHD の MHD 崩壊現象における因果律の検討

Causality study in MHD collapse events in LHD

市口勝治[1,2]、榊原悟[1,2]、B.A.Carreras[3]
ICHIGUCHI Katsuji[1,2], SAKAKIBRA Satoru[1,2], B.A.Carreras[3]

核融合研[1]、総研大[2], BACV Sol.Inc.[3]
NIFS, BACV Sol.Inc.[1]

In high beta experiments in the Large Helical Device (LHD), partial collapse phenomena caused by the interchange mode can be observed [1]. These phenomena occurs in two types of discharge condition. One is the real-time inward shift of the vacuum magnetic axis. This condition enhances the magnetic hill, where the driving force is enhanced. The other is the ramp-up of the net toroidal current during the discharge that increases the rotational transform. This condition reduces the magnetic shear, so that the stabilizing effect is reduced. In both cases, the growth of the interchange modes leads to the partial collapse of the electron temperature profile. In some collapses, clear correlation between the decay of the mode frequency and the growth of the mode is seen. That is, the disappearance of the mode frequency and the beginning of the mode growth look to synchronize. The mode frequency is mainly due to the ExB rotation and the diamagnetic rotation of the plasma, and the former is usually dominant [2]. Therefore, these results suggest that the plasma rotation play a significant role in the collapse phenomena. In the nonlinear simulation for the interaction of the interchange mode and the ExB shear flow, we obtained that the flow has a stabilizing contribution against the mode growth [3].

However, the causality of the events is not still clear, whether the plasma rotation stopping causes the mode growth or the mode growth stops the rotation. van Milligan et al. [4] show that the transfer entropy [5] is a powerful tool to investigate such causality. They examine the transfer entropy to investigate the causality of the fluctuations detected in the TJ-II experiments. Thus, we apply this method to the time evolution of the magnetic fluctuations and the mode frequency. Utilizing the results, we also discuss the similarity and the difference in the collapse property between the cases of the hill enhancement and the shear reduction in the aspect of the causality.

[1] S. Sakakibara, et al., Nucl. Fusion, **55**, 083020 (2015).
[2] Y. Takemura, et al., 2013, Plasma and Fusion Res. **8**, 1402123.
[3] K. Ichiguchi et al., Proc. IAEA FEC 2016 Kyoto, TH/P1-4.
[4] B. Ph. van Milligan, et al,. Nucl. Fusion **54**, 023011 (2014).
[5] T. Shreiber, Phys, Rev. Letters, **85**, 461 (2000).