Neo-classical tearing modes in reversed magnetic shear tokamak plasmas

With the support by the National Natural Science Foundation of China and the Ministry of Science and Technology of China, the nonlinear features of neo-classical tearing modes (NTM) in the reversed magnetic shear (RMS) tokamak plasmas are investigated by using a magnetohydrodynamic code (MHD@DLUT, MD) developed by Prof. Wang Zhengxiong's research group at the School of Physics and Optoelectronic Technology, Dalian University of Technology. The result was published in *Nuclear Fusion* (2015, 55(4): 043005), and Figure 6 in this article was selected as its cover image.

RMS configuration is assumed to be the steady-state operation scenario for the advanced tokamak like International Thermonuclear Experimental Reactor (ITER). However, RMS is prone to exciting double tearing mode (DTM), a kind of severe MHD activities, which can cause the disruption event in the tokamak plasmas. Thus the neo-classical DTM (NDTM) due to the bootstrap current (BC) effect is studied by using the MD code. It is found that in the case of large separations between two same rational surfaces, an explosive burst of fast reconnection, which was previously observed only in the intermediate separation case without BC, can also be induced if the fraction of BC is sufficiently high. The dynamics of this burst of NDTM is illustrated in the following figure. In the small separation case, the local modification of bootstrap current near the magnetic islands makes the islands move inwards, while the recovery of the Ohm current tends to make them move outwards. The mechanism of the complicated motions of magnetic islands (or rational surfaces) determined by these two effects is revealed.

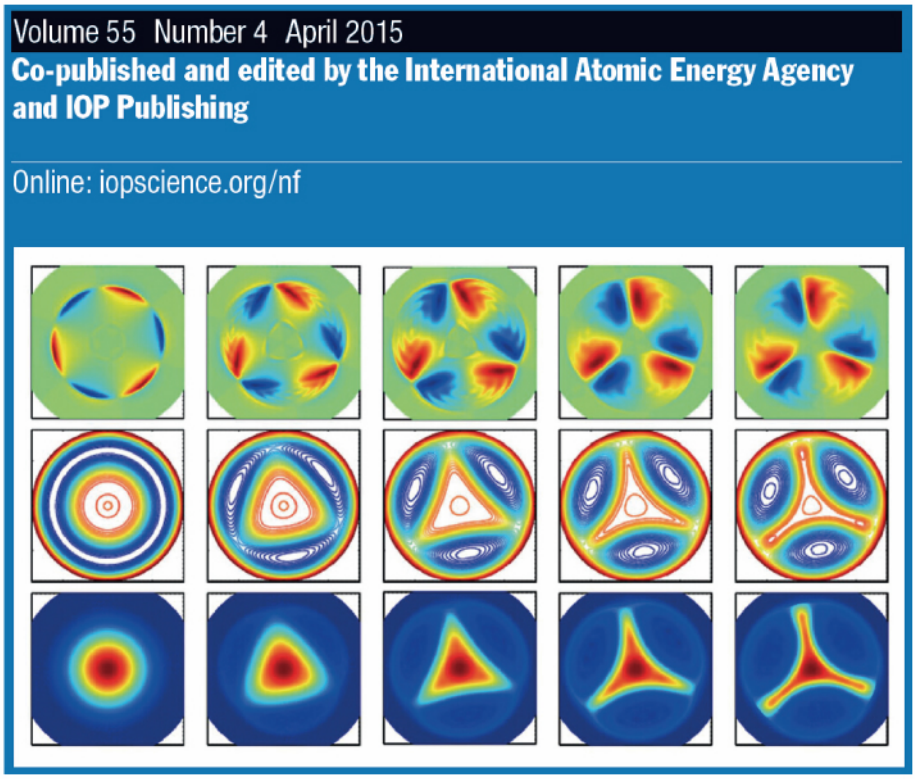

Figure Nonlinear evolution of the NDTM with large separation. The mode structures of the potential, helical magnetic flux and pressure during the NDTM explosive burst are shown in the top, middle and bottom rows, respectively.