

Experimental Study of the bifurcated relaxation of merging spheromaks into an FRC

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It is found that the merging spheromaks relax either into a high beta Field-Reversed Configuration(FRC) or into a spheromak in TS-3, depending on whether the initial magnetic helicity is smaller or larger than a threshold value. [1] In order to study ion kinetic effect for the bifurcated relaxation, the counterhelicity merging experiment was carried out in the TS-4 device with various ion species such as hydrogen and helium, argon plasmas. Under the various ratios of the initial poloidal fluxes $\Psi_{\text{left}}/\Psi_{\text{right}}$ of the merging spheromaks, the poloidal eigen value $\lambda \equiv I/\Psi$ of a new spheromak was measured and compared among the above ion species. Here I is the current flux function. As a result, also in the TS-4 device, the bifurcated relaxation to a high beta configuration(FRC like) and a force-free configuration(Taylor state) was identified. The clear difference among the plasmas of these ion species was observed in the sustaining time of the $\lambda \sim 0$ configuration. We also compare the behavior of troidal mode amplitudes during the relaxation among these ion species.

[1] Y. Ono, A. Morita, T. Itagaki, and M. Katsurai, Plasma Physics and Controlled Nuclear Fusion Research (International Atomic Energy Agency, Vienna, 1992), Vol. 2, p. 619; Y. Ono, Fusion Technol. 27, 369 (1995).