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P4.1051 Nonlinear MHD simulation of plasma termination events in stellarators

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Nonlinear dynamics of plasma termination events in stellarators are studied using a 3D nonlinear MHD simulation code. In this study, two types of plasma termination events, which are MHD instabilities driven by the pressure gradient and plasma current, are studied, respectively. In the Large Helical Device (LHD) experiment, many MHD instabilities are observed. In particular, if the peaked pressure profile was sustained by the pellet injection, a collapse event, so-called the core density collapse (CDC), was happen. In nonlinear MHD simulations, it is expected the CDC is driven by the resistive ballooning mode [1]. Recently, a new imaging diagnostics of the two-dimensional soft-X ray arrays is installed in the LHD. Using the new diagnostics, perturbations localized at the outward of the torus. That is a characteristic of the ballooning mode. So, it seems the ballooning mode is observed in the LHD experiments. However, to interpret the experimental observation, we need to know what kind mode patterns should be observed. On the other hand, in Wendelstein 7-X (W7-X) experiment, collapse events simultaneously happened in the plasma core, if the strongly localized plasma current is driven in the plasma core. That expects a MHD event driven by the plasma current. But, we did not identify what kind mode makes the collapse event in such a case. In this study, we study 3D MHD equilibria with reconstructed pressure profile using a 3D MHD equilibrium code, which does not assume nested flux surfaces [2]. And then, we will study nonlinear MHD simulations based on the 3D MHD equilibrium with the magnetic island [3]. In this study, we note nonlinear saturation to compare with the experimental observation.

1. N. Mizuguchi, et al., Nucl. Fusion 49 (2009) 095023 2. Y. Suzuki, et al., Nucl. Fusion. 46 (2006) L19 3. Y. Todo, et al., Plasma Fusion Res. 5 (2010) S2062

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