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Cold Bubble Formation from 2/1 Modes during Massive Gas Injection in a Tokamak[1] SHIYONG ZENG, University of Science and Technology of China, PING ZHU, Huazhong University of Science and Technology, University of Wisconsin-Madison, HAOLONG LI, University of Science and Technology of China — Two events often observed in MGI experiments are the excitation of the m=2/n=1 (m is poloidal mode number, n is toroidal mode number) magnetohydrodynamic (MHD) modes before thermal quench (TQ), and the formation of cold bubble structure in temperature distribution during TQ. However, the physics mechanisms underlying those phenomena have not been entirely clear. Recent NIMROD simulations have reproduced main features of both events and revealed potential connections in between. In particular, 3/1 and 2/1 islands form successively upon arrivals of impurity at the corresponding rational surfaces. At the interface between impurity and plasma, peaked poloidal magnetic perturbation along with a thin current sheet moves inward following the gas cold front. This eventually leads to the formation of an inner 2/1 mode in the region between q = 2 and q = 1 surfaces, which has an opposite phase to the dominant 2/1 mode at the vicinity of q = 2 surface. It is through the O-point of the inner 2/1 mode that the impurity front further penetrates inside the q = 1 surface, and enables the formation of a cold bubble at the beginning of TQ. In addition, a 1/1 mode appears on the q = 1 surface after the impurity penetration, and dominates the subsequent start phase of current quench (TQ).

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