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Validation of q(0)≥1.0 in the MHD Quiescent Time after Crash of the Sawtooth Instability in KSTAR

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Long standing issue of full vs. partial reconnection model of the sawtooth instability is revisited in Korean Superconducting Tokamak Advanced Research (KSTAR). The measured central safety factor (q(0)) by Motional Stark Effect (MSE) is ˜1.0 and this measurement alone cannot validate the sawtooth instability model definitively due to non-trivial off-set error. Study of controlled experiment of the tearing modes (m>1) sensitive to magnetic shear with the resistive magnetohydrodynamic (MHD) theory supports the full reconnection model. Here, the radial position of the excited tearing modes (m/n>1/1) and their time evolution into the 1/1 kink mode before the crash in sawtoothing plasma suggests that q(0)≥1.0 in the MHD quiescent period after the crash and q(0)<1.0 before the crash. Experimental observation of long lived tearing modes with constant mode number in non-sawtoothing discharge (presumably q(0)≥1.0) further supports the fact that q(0)≥1.0 in the MHD quiescent period after crash in sawtoothing discharge and hence the complete reconnection model.

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