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Study of locking mechanism of locked-mode-like instability in helical plasmas

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The frequency slowing-down mechanism of the locked-mode-like instability without a large magnetic island is investigated for the first time, based on the LHD experimental analysis. The slowing-down frequency is caused by two processes. One is the resonant surface moving to the small E × B rotation frequency region and the other is the slowing-down E × B rotation frequency around the resonant surface. Both processes are almost the same as those of the instability with a large magnetic island. The new exprerimental results presented in this synopsis suggest that the mode frequency slows down even though the precursor does not have a large magnetic island. In addition, the duration of the frequency slowing-down phase becomes longer as the external RMP amplitude becomes smaller. This is because the slowing-down rate of the E × B rotation frequency around the resonant surface after excitation of the precursor is smaller for a smaller external RMP amplitude. These results also suggest that error fields, which have the same effect as the RMP, should be reduced to obtain sufficient time for controlling the locked-mode-like instability.

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