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Characterization of tearing modes in NSTX using ultra-soft X-ray measurement and integrated simulations

Tearing mode (TM) instabilities are analyzed experimentally in NSTX plasmas. 2-D ultra-soft X-ray measurements are used to infer the magnetic island width, phase and radial location, by fitting the simulated perturbed emissivity to the measured one. Fitted results are further complemented by the data, on mode frequency and number from Mirnov coils and on mode frequency and location from plasma rotation. The TM parameters are then input to interpretive TRANSP simulations to test two physics models. The first model has been used for DIII-D to assess energetic particle transport caused by the magnetic islands (Bardoczi et al., Plasma Phys. Control. Fusion 2019), therefore in this work validity of the model in the low aspect ratio geometry will be tested. The second model includes an analytic representation of the island to assess its effect in general (Poli et al., Nucl. Fusion 2018). Both models, when validated, will enable predictive studies of the role of TM instabilities in integrated simulations.

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