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Temporal Response of Theoretical Transport Models to Modulated Heat Sources and Cold Edge Pulses in Transient Experiments

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Motivated by the results from the ITER Profile Database which did not significantly distinguish between various tokamak transport models using steady-state data, we have extended the model testing exercise to include transient experiments to aid in assessing various transport models. Here, we compare the results from the IFS/PPPL, GLF23, Multi-mode, and Itoh-Itoh-Fukuyama models. A unique feature of the ion temperature gradient mode that we are particularly interested in testing, is the presence of a critical gradient. Specific properties including nearness to marginality and electron-ion temperature ratio affecting the temporal behavior of the thermal transport are considered. Data from recent DIII–D modulated ECH experiments and from previous cold pulse experiments on other tokamaks is examined in order to characterize the model predicted temporal response in time-dependent simulations. Both the magnitude and phase of the response of the predicted temperature profiles relative to the modulated heat source are compared to the measured plasma response to characterize each model. These results are supplemented with similar comparisons to ohmically heated discharges from TEXT, TFTR, and JET exhibiting a rapid radial response following a cold edge pulse produced by trace impurity injection.

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