# Theoretical Transport Modeling of Ohmic Cold Pulse Experiments

J.E. Kinsey,* R.E. Waltz, and H.E. St. John

*General Atomics, P.O. Box 85608,*
*San Diego, California 92186-5608 U.S.A.*

***Abstract***

The response of several theory-based transport models in Ohmically heated tokamak discharges to rapid edge cooling due to trace impurity injection is studied. Results are presented for the IFS/PPPL, GLF23, Multi-mode, and Itoh-Itoh-Fukuyama transport models with an emphasis on results from the Texas Experimental Tokamak (TEXT). We find that critical gradient models containing a strong ion and electron temperature ratio dependence can exhibit behavior that is both spatially and temporally consistent with experimental observation while depending solely on local parameters. The IFS/PPPL model yields the strongest response and demonstrates both rapid radial pulse propagation and a noticeable increase in the central electron temperature following a cold edge temperature pulse (amplitude reversal). Furthermore, the amplitude reversal effect is predicted to diminish with increasing electron density and auxiliary heating in agreement with experimental data. An Ohmic pulse heating effect due to rearrangement of the current profile is shown to contribute to the rise in the core electron temperature in TEXT, but not in the Joint European Tokamak (JET) and the Tokamak Fusion Test Reactor (TFTR). While this phenomenon is not necessarily a unique signature of a critical gradient, there is sufficient evidence suggesting that the apparent plasma response to edge cooling may not require any underlying non-local mechanism and may be explained within the context of the intrinsic properties of electrostatic drift wave based models.

*Oak Ridge Associated Universities, Oak Ridge, TN 37831