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A One-Dimensional Multi-Region Multi-Timescale Burning Plasma Dynamics Model for Tokamaks ZEFANG LIU, WESTON STACEY, Georgia Inst of Tech — Fusion burning plasma with α-heating brings forth demands for research moving from the equilibrium to dynamics. When radiation and transport are included, the plasma core cannot be modeled independently. Electron cyclotron radiation from the fusion α-heating in the core can have a rapid response to temperature increases and heat the edge, while Coulomb collisions will distribute energy between ions and electrons on relatively long timescales. Such fast and slow phenomena will couple the plasma core with the edge. A one-dimensional multi-region multi-timescale transport model will be developed to simulate burning plasma dynamics in tokamaks. Regions such as the core, edge, scrape-off layer (SOL), and divertor will be modeled, where the electron cyclotron radiation, impurity radiation, and bremsstrahlung will be considered. The confinement time and transport parameters will be computed theoretically and tuned by the experimental data from DIII-D. More edge effects, including ion orbit loss, MARFEs, and ELMs, and the delayed effects of burn control mechanisms will be introduced to the model later. This model will be used for developing the optimal burning control algorithms for tokamaks in the future.

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