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Multi-region, multi-timescale plasma burn dynamics modeling for ITER. WESTON STACEY, Georgia Institute of Technology — A global confinement time (e.g. ITER98) defined to balance global power sources and sinks in steady-state discharges, does not describe the dynamics of tokamaks [1] because the overall plasma dynamics is determined by the interaction of different phenomena with different time constants acting in different spatial regions. In burning plasmas an increase in core fusion rate produces energetic alpha particles that first transfer their energy to heat electrons, producing Electron Cyclotron Radiation [2,3] that distributes this energy to heat electrons over the entire plasma and to heat the wall. The remaining core electron and alpha energy collisionally heats the core ions in $\approx \quad 10^{-2}s$, increasing the core fusion rate $\langle \sigma v \rangle_{fus} \sim T_{ion}^2$. Globally, this additional fusion energy can be compensated by an increase of radiation from edge impurities, but only after that increased core energy has been transported to the edge [4]. Thus we are developing a multi-region burning plasma dynamics model with different time dependences for the different transport, heating, radiation cooling etc. phenomena that occur in the different spatial regions, which can in part be tested in DIII-D. Refs: [1] FS&T 72,162(2017); [2] Nucl. Fus 41,665(2001, [3] Nucl Fus 49,115017 (2009); [4] M.D. Hill, Phd Thesis, GaTech (2018.

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