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# Extending the Validation of Multi-Mode Model for Anomalous Transport to High Poloidal Beta DIII-D Discharges

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The Multi-Mode Model (MMM7.1) for anomalous transport [1] is tested in predictive modeling of temperature profiles of high beta poloidal DIII-D discharges. This new H-mode plasma regime, with high beta poloidal and high plasma currents, has been studied in DIII-D tokamak discharges [2]. The MMM7.1 anomalous transport model includes a combination of contributions based on different transport theories. It includes the Weiland module for ion temperature gradient modes, trapped electron modes and collision dominated MHD modes, the Rafiq module for drift-resistive-inertial ballooning modes (DRIBM) and the Horton module with the Jenko threshold for anomalous transport driven by Electron Temperature Gradient (ETG) modes.
The role of different modes described by MMM7.1 is investigated. In particular, the temperature profiles for a number of high beta poloidal DIII-D discharges are predicted using only the Weiland and ETG components of the MMM7.1 model. The magnitudes of the predicted temperature profiles are found to be in reasonable agreement with experimental profiles. However, the experimental profiles have an internal transport barrier in temperature profiles, due to strong off-axis ECR heating, which is not reproduced in the predictive MMM7.1 simulations due to significant electron thermal transport from both the Weiland component and from the ETG component of MMM7.1.
The effect of electron thermal transport due to the DRIBM model is also investigated. PTRANSP analysis of the DIII-D discharge 154406 shows that there is a significant transport predicted by DRIBM in the region from 0.3 to 0.7 of normalized minor radius. The electron temperature in this PTRANSP simulation is found below the experimental values. The DRIBM model includes contributions from other MHD modes in addition to the drift resistive ballooning modes that can be unstable in this region. This validation study suggests that the DRIBM predicts a significantly larger level of electron transport than expected. Possible effects that can contribute to stabilization of these modes, for example, effects associated with the large poloidal beta such as the Shafranov shift stabilization in the MMM7.1 model, are discussed.

1. T. Rafiq et al. Physics of Plasmas 20 (2013) 032506.
2. A.M. Garofalo et al. Proc. of 25th IAEA Fusion Energy Conference (St. Petersburg, Russian Federation 13-18 October 2014) 657.

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