Paleoclassical H-Mode Pedestal Modeling*

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At the recent IAEA Chengdu meeting, the paleoclassical model [1] of radial electron heat transport was compared [2] with experimental results from a number of toroidal plasma experiments, including H-mode edge pedestals. This presentation will: 1) review comparisons [2] of the paleoclassical model with H-mode pedestal data from DIII-D, 2) present some additional recent comparisons, and 3) highlight areas where additional work is needed. Specific comparisons to be presented include:

1) Ratio of the electron temperature to density gradient between the pedestal symmetry point and separatrix for which the paleoclassical prediction is $\eta_e \equiv L_{n_e}/L_{T_e} = 2$.

2) Comparison [3] of the paleoclassical radial electron heat diffusivity $\chi_e^{\rm pc}$ to the transport analysis χ_e, which both scale roughly as $T_e^{-3/2}$ near the separatrix.

3) Predictive transport analysis of the edge T_e profile in the pedestal region using the ASTRA code [4] with $\chi_e^{\rm pc}$ dominating for $\rho \gtrsim 0.9$.

4) Pedestal height prediction determined from balancing the collisional (Alcator-scaling) paleoclassical $\chi_e^{\rm pc}$ [1] against gyroBohm scale transport: $\beta_e^{\rm ped} \equiv n_e^{\rm ped} T_e^{\rm ped}/(B^2/2\mu_0) \simeq (0.032/f_{\#} A_i^{1/2})(\bar{a}/\bar{R}q)(\eta_\parallel^{\rm nc}/\eta_0)$, in which $f_{\#} \sim 1$ is a gyroBohm multiplier for T_e transport.

Extensions of the paleoclassical transport model to particle and ion heat transport will also be discussed. Finally, some additional theory, modeling and experimental tests needed for further testing and validation of the paleoclassical model will be discussed.

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[3] W.M. Stacey and R.J. Groebner, Phys. Plasmas **13**, 072510 (2006); **14**, 012501 (2007).

[4] A.Y. Pankin, G. Bateman, D.P. Brennan, D.D. Schnack et al. Nucl. Fusion **46**, 403 (2006).