

Validation of nonlinear gyrokinetic simulations of L- and I-mode plasmas on Alcator C-Mod

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New validation of global, nonlinear, ion-scale gyrokinetic simulations (GYRO) is carried out for L- and I-mode plasmas on Alcator C-Mod, utilizing heat fluxes, profile stiffness, and temperature fluctuations. Previous work at C-Mod found that ITG/TEM-scale GYRO simulations can match both electron and ion heat fluxes within error bars in I-mode, suggesting that multi-scale (cross-scale coupling) effects may be less important in I-mode than in L-mode. New results presented here, however, show that global, nonlinear, ion-scale GYRO simulations are able to match the experimental ion heat flux, but underpredict electron heat flux (at most radii), electron temperature fluctuations, and perturbative thermal diffusivity in both L- and I-mode. Linear addition of electron heat flux from electron scale runs does not resolve this discrepancy. These results indicate that single-scale simulations do not sufficiently describe the I-mode core transport, and that multi-scale (coupled electron- and ion-scale) transport models are needed. A preliminary investigation with multi-scale TGLF, however, was unable to resolve the discrepancy between ion-scale GYRO and experimental electron heat fluxes and perturbative diffusivity, motivating further work with multi-scale GYRO simulations and a more comprehensive study with multi-scale TGLF.

“Here we show...”

State what you specifically did to solve the problem. Example statements might include: “We simulated/measured XYZ...”

Motivating background

Start with something that everyone in your audience cares about. The background should provide context for your problem or knowledge gap.

Problem statement or knowledge gap

What central question are you trying to answer? Focus in on the specific need that your research addresses; this is the primary motivation for your work.

Results

Briefly summarize your main results or conclusions that address the problem statement or knowledge gap. You can include key data but save the fine details for the main document.

Implications

Explicitly state the implications of your findings by linking back to the motivating background. What impact do your findings have on this area of research? Try to answer “so what?” and “now what” questions.