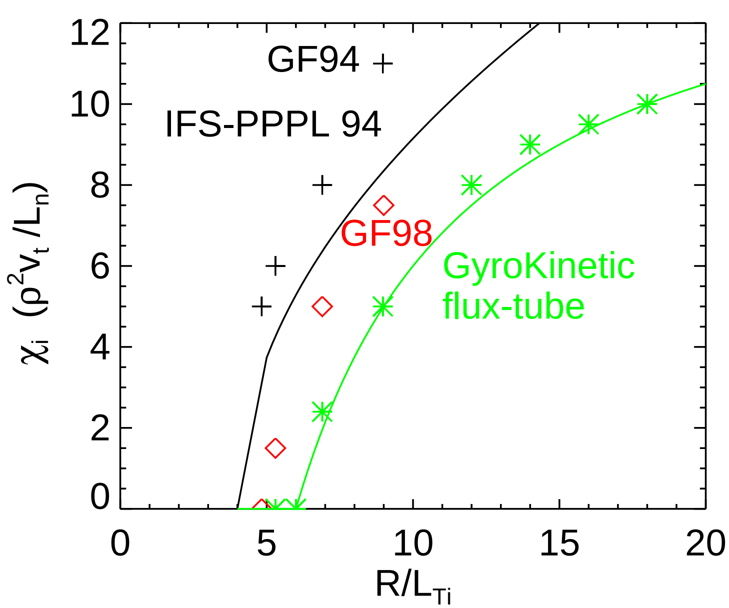
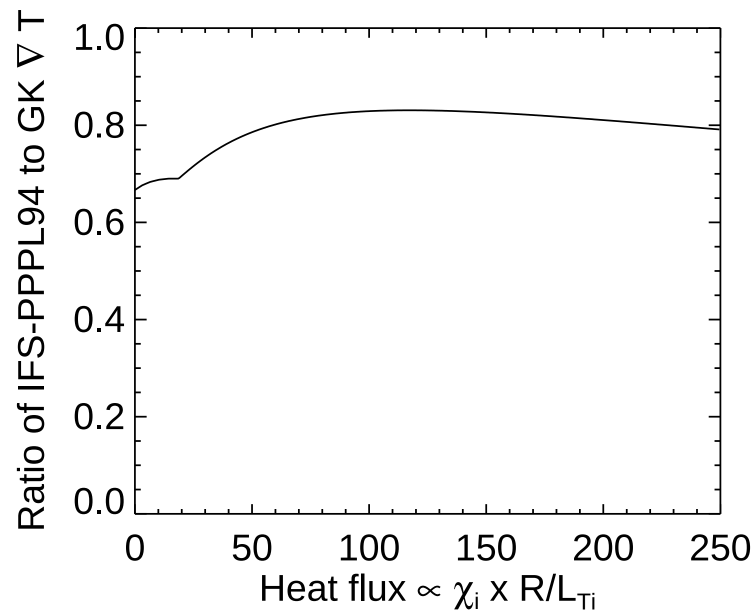
Gyrofluid/gyrokinetic (GF/GK) simulation differences $\rightarrow$ 20-33% change in predicted temperature gradient

Dimits, Bateman, Beer et.al., PoP 7, 969 (2000)





- **Dimits (LLNL): good convergence in his gyrokinetic particle simulations**

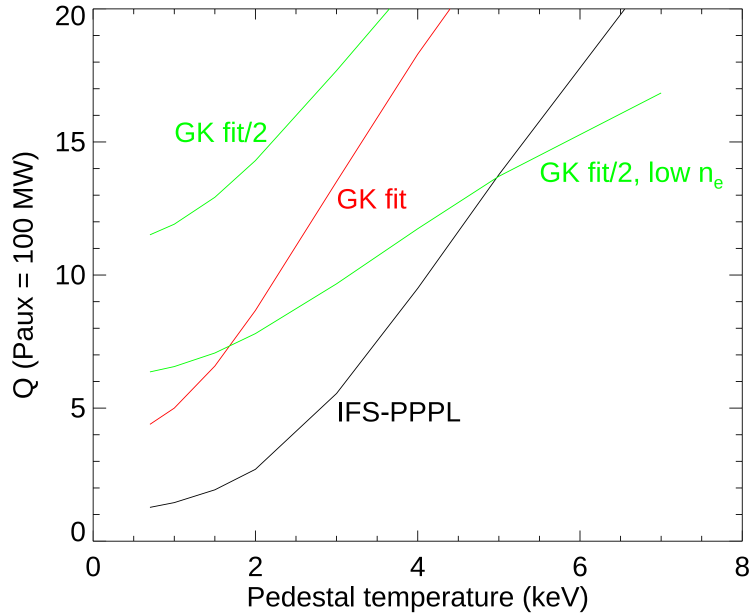
- **New neoclassical gyrofluid closure significantly improves GF/GK comparison.**

- **Turning this plot around, for a fixed amount of heat flux $\propto \chi \nabla T$, the temperature gradient predicted by the original gyrofluid-based IFS-PPPL model is 20-33% low. But $P_{fusion} \propto T^2$, and so may increase by $\times 2$ or more.**

- **Nonlinear upshift in critical gradient may depend on: Rosenbluth-Hinton undamped zonal flows $\uparrow$ with elongation (W. Dorland), $\downarrow$ with weak collisions (Z. Lin), $\downarrow$?? with non-adiabatic electrons [may limit inverse cascade that drives zonal flows (Diamond, Liang, Terry-Horton, Waltz, ...) and $\uparrow$ turbulent viscosity].**

Predictions of Q for ITER-96 from original IFS-PPPL model & from versions fit to gyrokinetic simulations

Dimits, Bateman, Beer et.al., PoP 7, 969 (2000)



- **Gyrokinetic-fit version causes predicted Q to rise some, but the original point remains that the results are sensitive to the assumed edge pedestal temperature, which is uncertain. There is a risk of low Q, particularly at low density.**

- **The uncertainties are large, and it may be that ITER's pedestal temperature and confinement would be acceptable for ignition. Other sources of uncertainty which need better treatment, in addition to a better understanding of the edge transport barrier and the achievable density and density peaking, include the effects of elongation and plasma shaping, plasma rotation, and fully electromagnetic fluctuations with non-adiabatic electrons.**

ITER-96 baseline scenario: $n_e = 1.3 \times 10^{20}/m^3 = 1.5\, n_{\rm Greenwald}$, $\tau_{He*}/\tau_E = 10$.

lower n_e scenario: $n_e = 1.15\, n_{\rm Greenwald}$.