Gyrokinetic particle simulation of ideal and kinetic ballooning modes

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Linear stability properties of kinetic ballooning mode (KBM) and peeling-ballooning mode have been proposed as the mechanisms constraining the width and height of the edge pedestal of H-mode plasmas. KBM turbulence has also been conjectured as one of the candidates for the edge transport. The nonlinear KBM evolution and turbulent transport can be efficiently studied by gyrokinetic particle simulation. Here we report the progress in this direction using the global gyrokinetic toroidal code (GTC) [1] for simulations of ideal and kinetic ballooning modes. As an important step in verifying the GTC capability for the magnetohydrodynamic and Alfven wave physics [2,3,4], we perform GTC linear simulations of ideal and kinetic ballooning modes. In Fig. 1, GTC simulation of the ideal ballooning mode driven by plasma pressure gradients has successfully demonstrated the predicted mode structure and the existence of the instability threshold, and found the linear growth rate close to the results of a fluid code BOUT++ when the kinetic effects is artificially suppressed in GTC simulations. Work supported by SciDAC CPES, GPS, and GSEP centers.

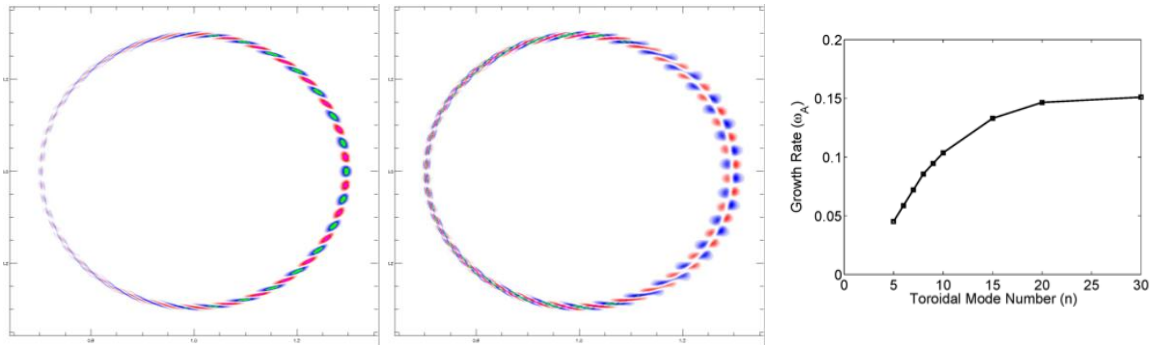

Fig. 1: GTC simulation of ideal ballooning mode: poloidal contour plot of electrostatic potential (left) and vector potential (center), and linear growth rate as a function of n (right).

References:

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