EFFECT OF MAGNETIC SHEAR AND THE FINITE BANANA-ORBIT WIDTH ON THE NEOCLASSICAL TOROIDAL VISCOSITY IN PERTURBED TOKAMAKS

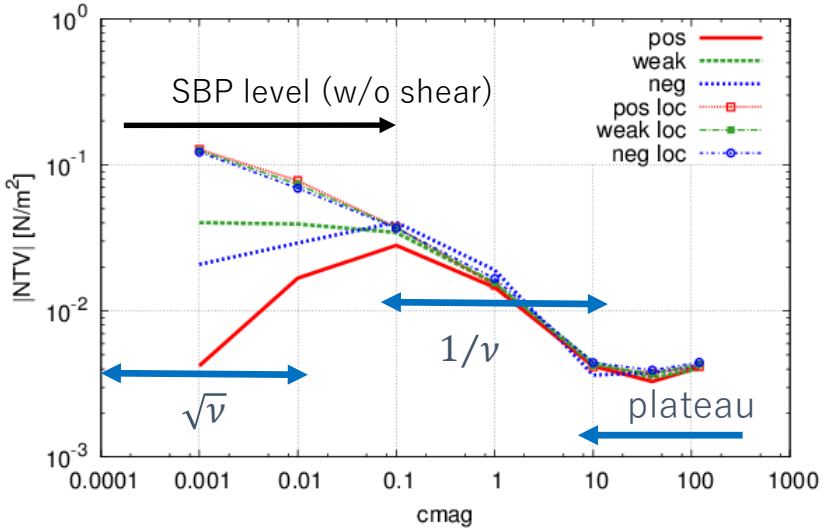
S. Satake et al., TH/P1-3

- In previous studies, local and global NTV simulations showed discrepancy in low-collisionality regime.
- To clarify the reason, two simulation models for NTV calculation are benchmarked.
  - Zero-Orbit-Width model : Radially-local, without the magnetic-shear effect in magnetic precession frequency ω_D.
  - Global model : With magnetic-shear effect and the finite-orbit-width effect.

- Simulation condition : Circular cross-section tokamak, three different q-profiles (positive, weak, negative-shear). Weak, non-resonant magnetic perturbation is applied.

- Results:
  - Local model reproduce the plateau-$1/\nu$-superbanana-plateau (SBP) type dependence of NTV on collision frequency, as predicted from local, bounce-average theory which neglect the magnetic shear effect.
  - Global model shows strong dependence on q-shear. In positive-shear case, the SBP resonance in velocity space at which $\omega_D = 0$ moves to the trapped-passing boundary and the resonance is lost. It results in the reduction of NTV in low collisionality.
  - Finite magnetic drift causes a $\sqrt{\nu}$-type dependence of NTV as collisionality decreases even without $E \times B$ rotation.

electron



← collisionality →

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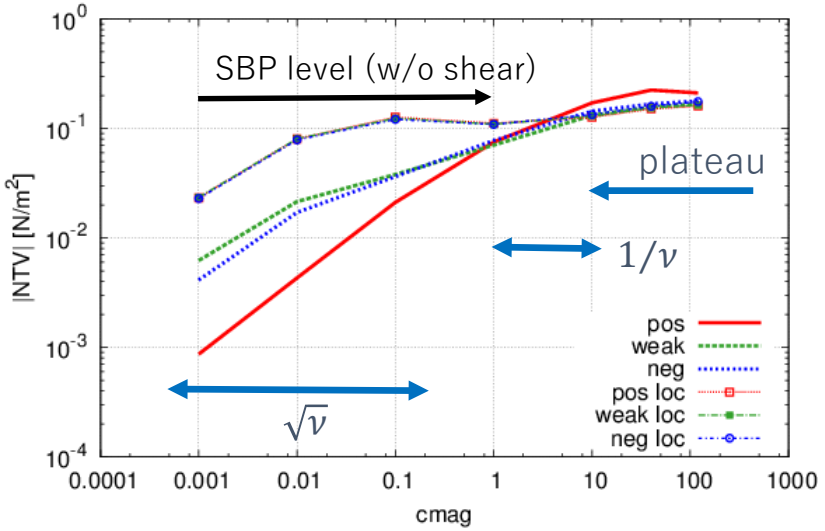

← collisionality →