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**Gyrokinetic Simulations of Multi-scale Microturbulence in Tokamak Plasmas** HAOTIAN CHEN, YANG CHEN, SCOTT PARKER, University of Colorado, Boulder — Microturbulence driven by drift-wave instabilities is expected to be a dominant contributor to the anomalous transport processes. The coherent treatment of multi-scale nonlinear dynamics of coupled ITG-CTEM-ETG microturbulence is presently a challenging open issue, especially for the real ion-electron mass ratio. This study aims to apply the  $\delta f$  particle-in-cell gyrokinetic simulation code GEM to investigate the coupled ITG-CTEM-ETG microturbulence in tokamak plasmas. Optimization of GEM code will be carried out to reduce the numerical cost, then we focus on the multi-scale interplay of microturbulence and zonal structures, and the associated turbulent transport at different scales.

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