

Kinetic Energy Principle since Newcomb

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Energy principle is an elegant and efficient method for addressing global plasma stability contained in toroidal device. Since William A. Newcomb derived a cylindrical Euler-Lagrange equation in ideal MHD, its extension to include kinetic guiding-center motions of particles has been proposed and developed by Kruskal-Oberman, Rostocker-Rosenbluth, Taylor-Hastie, Antonsen-Lee, and again by Newcomb with one that is cited to be most precise but unpublished. Recent formulations show how these models are interconnected across non-axisymmetric neoclassical theory and 3D force balance, and enable precise calculations and predictions in full toroidal geometry. A subtlety arises due to dissipation represented by toroidal torque, which may not disappear even in the absence of collision, as will be briefly introduced.