

Abstract Submitted  
for the DPP09 Meeting of  
The American Physical Society

**Construction of momentum theorem using cross moments** T.S. HAHM, Princeton University, Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08543, USA, LU WANG, School of Physics, Peking University, Beijing 100871, China, P.H. DIAMOND, Center for Astrophysics and Space Science, U.C.S.D., La Jolla, CA 92093, USA — Charney-Drazin theorem has been extended to Hasegawa Wakatani system for zonal flow problem in magnetic fusion [P.H. Diamond, et al., Plasma Phys. Control. Fusion **50**, 124018 (2008)]. For this model, the guiding center density is the potential vorticity and zonal flow is influenced by the particle flux. In this work we construct momentum theorems in terms of a hierarchy of cross moments  $\langle n_G^2 \rangle$ ,  $\langle u_\phi n_G \rangle$ , and  $\langle p_i n_G \rangle$ . Then we show that the particle flux, momentum flux, and heat flux influence the zonal flow for each system respectively. This work was supported by U. S. Department of Energy Contract No. DE-AC02-09CH11466 (TSH, LW), China Scholarship Council (LW), U. S. DOE SciDAC center for Gyrokinetic Particle Simulation of Turbulent Transport in Burning Plasmas, and the U. S. DOE SciDAC-FSP Center for Plasma Edge Simulation (TSH).

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Date submitted: 17 Jul 2009

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