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Synergy of Edge Turbulence and Zonal Flows in the Density Limit RAGHVENDRA SINGH, PREDHIMAN KAW, RAJIV GOSWAMI, Institute for Plasma research, Bhat, Gandhinagar, Gujarat, India, MIKHAIL TOKAR, Institut für plasmaphysik-FZ, Jülich D-52425, Jülich, Germany, PERVEZ GUZDAR, IREAP, University of Maryland, MD, USA — Understanding of the density limit is of great interest, as it will significantly improve fusion power performance. It is well known that there occurs a dramatic deterioration of particle confinement at the edge of tokamaks as one approaches the Greenwald limit. We present a theoretical model on synergy of edge turbulence dominant by DRBM instability and zonal flows in determining the Greenwald density limit. The multiscale interaction of zonal flows with DRBM is presented. The predator-prey model for saturation of ZFs shows that the saturation level of the primary turbulence is determined by the damping of the secondary ZFs. We have determined conditions under which ZFs saturate by different mechanics such as by I) collision damping II) instability to tertiary modes III) nonlinear trapping of DRBM turbulence, giving coherent structures etc. A discussion of the relevant parameter spaces where various mechanisms dominate leading to the observed variety of phenomena will be presented.

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