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**Global gyrokinetic simulations with kinetic electrons in LHD and W7-X** JAVIER H NICOLAU, ZHIHONG LIN, University of California, Irvine, HONGYU WANG, JINGYUAN FU, Peking University, GYUNGJIN CHOI, PENGFEI LIU, XISHUO WEI, IHOR HOLOD, University of California, Irvine, JIAN BAO, Chinese Academy of Science, Beijing, DONALD SPONG, Oak Ridge National Laboratory, YONG XIAO, Zhejiang University, GUILLAUME BROCHARD, University of California, Irvine — Global gyrokinetic particle simulations of electrostatic ion temperature gradient (ITG) instability show that self-generated zonal flows are the dominant saturation mechanism for the ITG instabilities in both LHD and W7-X. Nonlinear spectra in the W7-X are dominated by low-n harmonics, which can be generated both by nonlinear toroidal coupling of high-n harmonics and by linear toroidal coupling with large amplitude zonal flows due to the 3D equilibrium magnetic fields. Simulations of linear collisionless damping of zonal flows show both damped geodesic acoustic mode (GAM) in LHD and low frequency oscillations (LFO) in both LHD and W7-X. The impact of a radial electric field (self-consistently generated by neoclassical theory) has been also analyzed showing a transport reduction due the associated ExB flow. Kinetic electrons enhance ITG growth rate and ion heat transport. First trapped electron mode (TEM) simulations are observed. The mode structure in W7-X seems to be localized in the toroidal region where the magnetic field is weaker.

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