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Nonlinear gyrokinetic simulations of improved confinement RFP plasmas[1] DANIEL CARMODY, M.J. PUESCHEL, J.K. ANDERSON, P.W. TERRY, University of Wisconsin - Madison — The reversed field pinch (RFP), a device dominated by global tearing modes in standard modes of operation, has been able to achieve reduced transport and increased energy confinement time through the use of pulsed poloidal current drive (PPCD), a current profile control technique. To evaluate the potential contributions of microinstabilities to transport fluxes in the PPCD regime of the Madison Symmetric Torus, we use the gyrokinetic code GENE and experimental profile data. Linear results from 200 kA and 500 kA PPCD discharges show the dominant instabilities to be an ion temperature gradient mode and a density-gradient-driven trapped electron mode, respectively. Nonlinear simulations of the 500 kA case show strong zonal flow activity that results in a significant Dimits-like shift, with a nonlinear threshold about a factor of three larger than the linear critical value. We find magnetic shear to play an important role in determining the nonlinear saturation levels, with lower shear resulting in the reduction of zonal flow shearing rate and the enhancement of linear growth rates. The nonlinear threshold occurs at roughly the experimental value, suggesting that microturbulent processes may be an important factor in determining experimental transport levels.

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