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Fusion Turbulence without a Toroidal Magnetic Field[1] M.E. MAUEL, Columbia University, J. KESNER, MIT Plasma Science and Fusion Center — Three decades since Surko and Slusher[2], fusion scientists have achieved tremendous progress understanding driven turbulence and turbulent transport in tokamaks. Nonlinear gyrokinetic theory provides a workable formalism for simulating gradient-driven turbulent transport, and recent validation studies in high-power reactor-relevant regimes show important areas of agreement. The new application of nonlinear gryokinetic theory to toroidal magnetic confinement without a toroidal magnetic field is an important opportunity to extend the reach of turbulence models used for magnetic fusion to different geometries, to higher beta plasmas ($\beta \sim 1$), and to plasma confined in magnetospheres. Magnetic geometry strongly influences turbulent mixing, and low-frequency fluctuations are enturely field-aligned for a toroidal plasma confinement by a purely poloidal field. Fusion turbulence without a toroidal field eliminates coupling between parallel streaming and perpendicular decorrelation, drives either a particle pinch or a thermal pinch[3], and exhibits 2D dynamics and the inverse energy cascade[4]

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[2]Surko and Slusher, *Science* **221**, 817 (1983).
[3]Kesner, *et al., Phys Plasmas* **18**, 050703 (2011).
[4]Grierson, *et al., Phys Plasma* 16, 55892 (2009)

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