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Magnetorotational dynamo instability in statistical models of shearing box turbulence[1] JONATHAN SQUIRE, AMITAVA BHATTACHARJEE, Princeton University — A large scale dynamo generating a strong azimuthal field is a fundamental component of the turbulence induced by the magnetorotational instability (MRI). The dynamo appears to be inherently time-dependent, producing well-defined butterfly diagrams, and is never kinematic even in its earliest stages, since without the magnetic field the MRI does not exist. In this talk we consider the dynamo in MRI turbulence in its simplest possible form, studying the zero net-flux unstratified shearing box. With the aim of isolating the core dynamo process, we remove as much of the nonlinearity as possible from the system, studying the statistics of driven linear fluctuations in a vertically dependent mean-field that evolves self-consistently due to Reynolds and Maxwell stresses. We find that homogeneous background turbulence becomes unstable above some critical parameter to a mean-field dynamo instability with a strong dependence on magnetic Prandtl number. This instability saturates to either time-independent or time-periodic states with characteristics that strongly resemble features of fully developed MRI turbulence. We discuss the driving and saturation terms in this MRI dynamo and the relation of these to the underlying nonmodal linear dynamics.

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