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Towards an Analytical Model of Differential Rotation in the Solar Convection Zone LEE GUNDERSON, AMITAVA BHATTACHARJEE, Princeton Plasma Physics Laboratory — The Solar Convection Zone (SCZ) is a region of turbulent convection in a rotating stratified plasma. Helioseismology and numerical models have provided mean flow profiles of this region, showing characteristic differential zonal rotation and meridianal circulation (Thompson et al. 2003). Numerical simulations have reproduced these profiles, including in the hydrodynamic limit (Fan and Fang 2014). However, the theoretical underpinnings are still being debated. Balbus (2009) proposed the following ansatz: the isentropic and isorotational contours coincide. Indeed, with this assumption, the resulting solutions to the thermal wind equation gave profiles of remarkable similarity to observations. We have developed a Grad-Shafranov treatment of axisymmetric equilibrium in the hydrodynamic case, however the result suggests that entropy should be a function of angular momentum, which give profiles that are not characteristic of the SCZ. We attempt to improve on this formulation by introducing a mean-field model of the Reynolds stress and testing Balbus' ansatz, and will report on the progress towards an analytical model of differential rotation in the SCZ.

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