Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

A Grad-Shafranov Model of Solar Equilibrium LEE GUNDERSON, AMITAVA BHATTACHARJEE, Princeton Plasma Physics Laboratory — Helioseismology has revealed the internal density and rotation profile of the sun. However, knowledge of its magnetic fields and meridional circulation is confined much closer to the surface, and latitudinal variations in entropy are below detectable limits. Numerical simulations can offer insight into the interior dynamics, and help identify which ingredients are necessary to produce particular features. However, several gross features of the Sun can be understood from an equilibrium perspective, for example the 1-D density profile arising from steady-state energy transport from the core to the surface, or the tilting of rotation contours in the convection zone due to baroclinic forcing. To help answer the question of which features can be qualitatively explained by equilibrium, we propose analyzing stationary axisymmetric ideal MHD flows (i.e. the Grad-Shafranov equation) in the solar regime. We compare our model to that of Balbus (2009), recovering a similar rotation profile in bulk of the convection zone. Furthermore, it includes the effects of poloidal flow, developing a feature reminiscent of the near surface shear layer.

Lee Gunderson
Princeton Plasma Physics Laboratory

Date submitted: 17 Jul 2017 Electronic form version 1.4