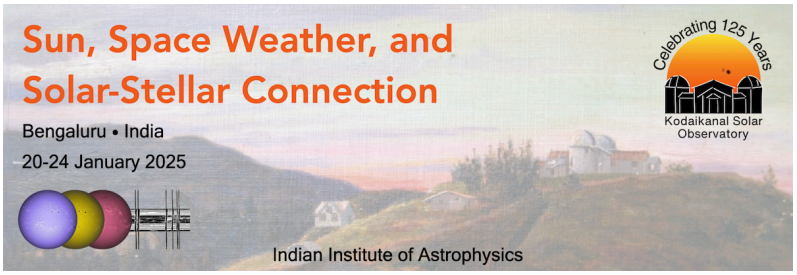

Contribution ID: **201** Type: **Invited review talk**

Global Nonlinear MHD of Solar Tachocline and Implications for Surface Magnetism

Monday, January 20, 2025 5:10 PM (20 minutes)

The tachocline, a thin shear-layer located in a subadiabatic region at/near the base of the solar convection zone, can be modelled using a 3D thin-shell shallow-water type formalism. In such models the Sun's global differential rotation and toroidal magnetic fields undergo nonlinear dynamical interactions by exchange of energies among differential rotation and toroidal magnetic fields, and unstable MHD Rossby waves that are longitude-dependent perturbations of the global system. Major features produced include: (i) clam-shell opening of broad toroidal fields; (ii) tipping or deformation of narrow toroidal bands; (iii) Tachocline Nonlinear Oscillations or "TNOs", most likely responsible for short-term, quasi-annual bursts of solar activity; (iv) 'teleconnections' that cross-equatorially link the two hemispheres, as well as high and low latitudes within a hemisphere; (v) formation of organized, global patterns in the toroidal bands. If active regions observed at the surface are the manifestations of magnetic flux rising from the convection-zone base to the surface, their global-scale, spatio-temporal distribution could be originating from the nonlinear MHD of the tachocline. After describing these results, we will close by discussing our recent efforts to connect the bottom tachocline dynamics with surface magnetograms.

Contribution Type

Invited talk

Theme

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Session Classification: Solar Cycle Variations in the Interior