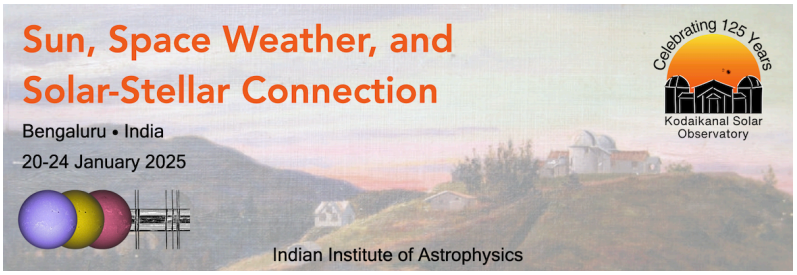

Contribution ID: **62** Type: **Poster**

On the origin of near surface rotational shear layer : Evidence of mass accretion during early history of solar system formation

Helioseismic inferences show that sun's rotational gradient increases and is positive from base of convection zone to 0.935 radius of the sun. Whereas near surface (from 0.935 to 1.0 sun's radius) rotational gradient is decreasing and is negative.
First question arises why present day sun adopted two regions of positive and negative rotational gradients. Hence, any theoretical work should not only explain correctly rotational isocontours but also whether both the positive and negative rotational gradients are dynamically stable or not.
Present study examines stability of both the regions of positive and negative rotational gradients. It is found from the MHD stability criterion that positive rotational gradient satisfies such a stability criterion, whereas negative rotational gradient and hence near surface rotational shear does not satisfies unless there is a large-scale toroidal magnetic field structure. Hence, it is concluded that if one accepts negative rotational gradient and toroidal magnetic field structure to coexist near surface, inevitable explanation is probably co-moving planetary mass accretion would have occurred on the sun's surface during early history of solar system formation during when large-scale poloidal magnetic field structure of primordial origin might have wound up as a toroidal magnetic field structure that might have survived upto present epoch near the surface. Evidence of mass accretion and implication especially for solution of "Faint Young Sun Paradox" are presented.

Second question to be answered is why near surface (0.935 radius to 1.0 radius) rotational isocontours are different compared to rotational isocontours in the positive rotational gradient. Although questionable, most of models invoke observed Reynolds stresses and temperature difference between equator and both the poles for maintenance of differential rotation and reproduce isorotational contours. In order to reproduce near surface isorotational contours, with appropriate boundary conditions at the surface and at 0.935 radius of the sun, Chandrasekhar's MHD equations are analytically solved and isorotational contours are reproduced.

Contribution Type

Poster

Theme

Solar Magnetism over Long-Time Scales

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