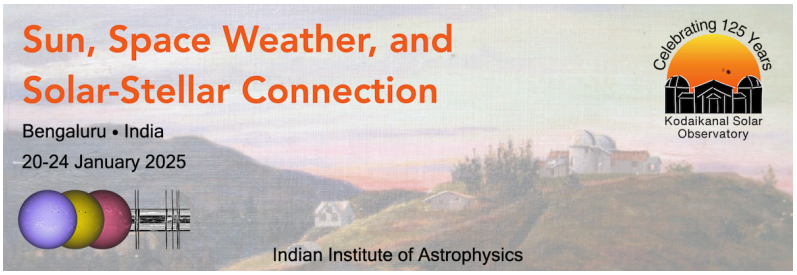

Contribution ID: **136** Type: **Contributed talk**

The role of meridional flow in the generation of solar/stellar magnetic fields and cycles

Thursday, January 23, 2025 9:25 AM (15 minutes)

Meridional flow is crucial in generating the solar poloidal magnetic field by facilitating the poleward transport of
the field from the decayed Bipolar Magnetic Regions (BMRs).
As the meridional circulation changes with the stellar rotation rate, the properties of stellar magnetic cycles are expected to be influenced by this flow.
In this study, we explore the role of meridional flow in generating magnetic fields in Sun and sun-like stars using STABLE [Surface flux Transport And Babcock–LEighton] dynamo model.
We find that a moderate meridional flow increases the polar field by efficiently driving the trailing polarity flux toward the pole. In contrast, a strong flow tends to transport both polarities of BMRs poleward, potentially reducing the polar field. Our findings agree with what one can expect from the surface flux transport model. Similarly, the toroidal field initially increases with moderate flow speeds and then decreases after a certain value. This trend is due to the competitive effects of shearing and diffusion.
Furthermore, our study highlights the impact of meridional flow on the cycle strength and duration in stellar cycles.
By including the meridional flow from a mean-field hydrodynamics model in STABLE, we show that the magnetic field
strength initially increases with the stellar rotation rate and then declines in rapidly rotating stars, explaining the observed variation of the stellar magnetic field with rotation rate.

Contribution Type

Theme

Solar - Stellar Connections

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