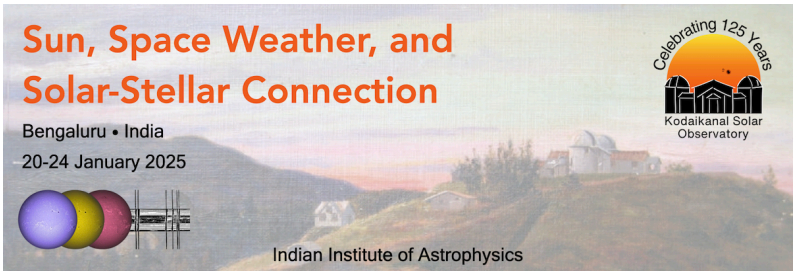

Contribution ID: **162** Type: **Invited talk**

Observational Constraints for Dynamo Modeling & Active Region Flux Emergence Patterns

Monday, January 20, 2025 3:10 PM (20 minutes)

I describe some of the defining observations of the solar cycle that provide insights into the dynamo process, including the basics such as Hale and Joy's law, the spatio-temporal emergence of active regions that creates the butterfly diagram, and large-scale flows including zonal, meridional, etc. I also discuss new research on activity nests and active region flux emergence patterns. Locations where active regions repeatedly emerge are known as nests, of interest because they commonly host flares and CMEs but also because they inform us about the origins of sunspots. Why do ARs cluster spatially to form nests and is the bursty activity observed in quasi-biennial oscillations and Rieger periodicities related to nesting? The physical mechanism that causes nests is unknown but could be due to instabilities acting on the interior magnetic field or flow fields such as giant convection or inertial modes. We report on activity nests observed during Solar Cycle 24 as studied using HMI/SDO magnetic synoptic maps. Using a traditional definition of nests and searching the data with a narrow range of allowed rotation rates similar to the Carrington rate, we find that one-quarter of ARs and one-third of AR magnetic flux participate in nesting behavior. Using wavelet and Fourier analysis, we find hemispheric asymmetry in nesting behavior. We discuss these issues as well as report on the average characteristics such as lifetimes, rotation rates and amount of magnetic flux contained in the observed nests.

Contribution Type

Theme

Solar Magnetism over Long-Time Scales

Primary author: NORTON, Aimee (Stanford University)

Presenter: NORTON, Aimee (Stanford University)

Session Classification: Dynamo Models and Observations