Project Details

ROSES ID: NNH08ZDA001N
Selection Year: 2009
Program Element: Focused Science Topic

Topic: Measure the properties of the solar dynamo that affect solar irradiance and active region generation.

Project Title:
Determination of the large-scale and meridional flows in the deep convection zone by time-distance helioseismology

PI Name: Alexander Kosovichev
PI Email: sasha@quake.stanford.edu
Affiliation: Stanford University
Project Member(s):
- Scherrer, Philip H.; Co-I/Institutional PI; HEPL
- Zhao, Junwei ; Collaborator; null
- Hartlep, Thomas ; Collaborator; NASA Ames Research Center
- Parchevsky, Konstantin ; Collaborator; Stanford University
- Mansour, Nagi Nicolas; Consultant; NASA Ames Research Center

Summary:
We propose a focused investigation with the main goal of

detecting the return meridional flow and measuring the

properties of deep large-scale flows associated with formation

of active regions. Determination of the large-scale and

meridional flows in the solar convection zone is crucial for

understanding and modeling the solar dynamo and making sort-

and long-term predictions of solar activity. There is no doubt

that the large-scale and meridional flows play a significant

role in the dynamo operation and in the generation of active

regions. The local helioseismology inferences have revealed a

complicated dynamics associated with the meridional flux

transport and evolution of active regions in the upper

convection zone. It has been shown that these inferences have a

profound effect on the flux-transport mechanism. However, the

effects of these flows on the properties of the solar dynamo

and active region formation are far from understanding. For

this it is particularly important to determine the structure

and dynamics of these flows in the deep convection zone

including the tachocline where the solar magnetic fields are

believed to be generated and organized. This problem is

difficult because the deep flows are relatively weak, and their

helioseismic signals are difficult to extract from the noisy oscillation data contaminated by the surface magnetism effects. For tuning of the helioseismic measurements and verification and testing of the results we propose to use numerical simulations of stochastically excited acoustic waves in 3D MHD models of the whole Sun, and use the simulation data for developing, the helioseismic techniques. This work includes a thorough investigation of systematic errors and uncertainties, including potential contamination by the surface magnetism effect.

Publication References:

Summary: no summary

Reference: Pipin, V. V.; Kosovichev, A. G.; (2011), Mean-field Solar Dynamo Models with a Strong Meridional Flow at the Bottom of the Convection Zone, The Astrophysical Journal, Volume 738, Issue 1, article id. 104, 8 pp. (2011), doi: 10.1088/0004-637X/738/1/104