

# 国台学术报告 NAOC COLLOQUIUM

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## Solar dynamo models with multi-cell meridional circulation

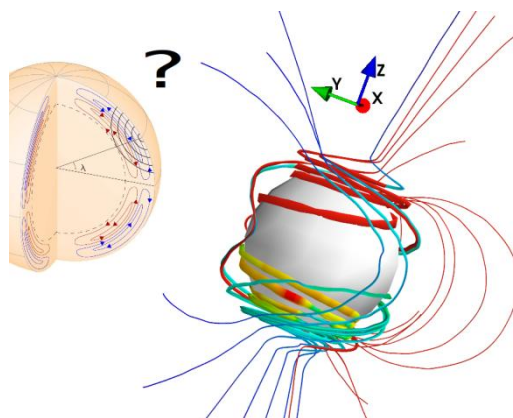


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Dr. Valery Pipin is a senior researcher at the Institute for Solar-Terrestrial Physics, Irkutsk, Russia. He got his Ph.D. in 1996, and in 2004 he became a Habilitated Doctor. His main research interest is the nature of global magnetic activity and differential rotation on the Sun and other cool stars.

### Abstract

It was long assumed that the meridional circulation on the Sun is represented by a single cell occupying the whole convection zone, with poleward flow at the top and with the return equator-ward flow at the bottom. However, recent helioseismology observations and numerical simulations provided clear evidence that the meridional circulation has a double-cell structure with a return equator-ward flow in the middle of the convection zone. This discovery requires to re-examine the solar dynamo models. We discuss the properties of a new mean-field solar dynamo that is coupled with the double-cell meridional circulation pattern. It is found that such dynamo model (which also includes the subsurface rotational shear layer, turbulent pumping and other turbulence effects) can robustly reproduce the basic properties of the solar magnetic activity within the wide range of the dynamo parameters and amplitudes of the circulation speed. We discuss the results of the dynamo models for the triple-cell circulation pattern as well. The properties of the simulated sunspot activity migration are discussed and compared with observations. It is found that the best agreement with observation is achieved when the surface speed of circulation is about 12 m/s. Interesting that for this amplitude of the circulation speed the simulated sunspot activity show the pretty good synchronization with the polar magnetic field activity. Such synchronization was indeed observed during the past Cycles 21 and 22. We compare our findings with these observations.



*All are welcome! Tea, coffee, biscuits will be served at 2:15 P.M.*

You are welcome to nominate speakers to Weimin Yuan ([wmy@nao.cas.cn](mailto:wmy@nao.cas.cn)), Mei Zhang ([zhangmei@bao.ac.cn](mailto:zhangmei@bao.ac.cn)), Licai Deng ([licai@bao.ac.cn](mailto:licai@bao.ac.cn)), Xuelei Chen ([xuelei@cosmology.bao.ac.cn](mailto:xuelei@cosmology.bao.ac.cn)), Shude Mao ([smao@nao.cas.cn](mailto:smao@nao.cas.cn))