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Title: *Turbulent Convection Drives Strong Differential Rotation*
Cluster: *Cross-Theme Theory and Data Analysis / SECTP*
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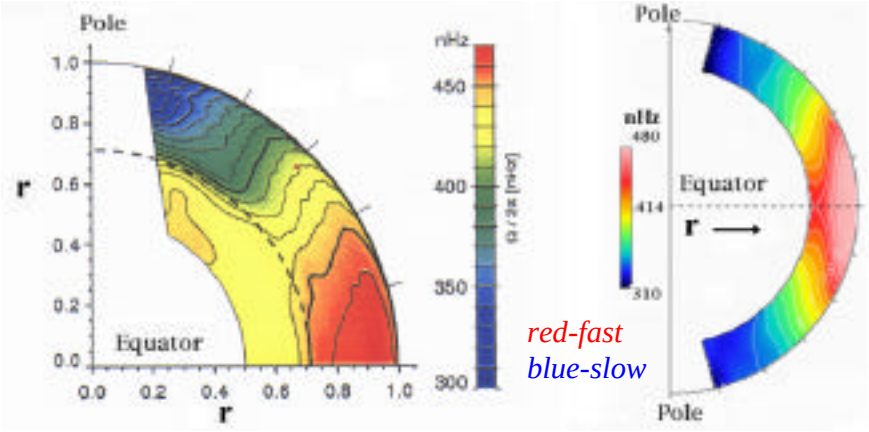
· **Model of Sun's Differential Rotation Begins to Explain Helioseismic Observations.**

Simulations of the interaction between the Sun's turbulent convection and its rotation have begun to yield comprehensive angular velocity profiles as a function of solar latitude and depth for interpretation of helioseismic probing of the solar convection zone. Detailed modeling is now enabled at the U. of Colorado under a Sun Earth Connections Theory Program grant in the form of a new "Anelastic Spherical Harmonic" (ASH) code running on the latest massively parallel supercomputers. Using this code, angular velocity profiles have been obtained from a 3-D simulation of turbulent convection within a deep rotating spherical shell. These differential rotation simulations are the first to begin to make serious contact with helioseismic findings from the "Solar Oscillations Investigation – Michelson Doppler Imager" (SOI-MDI) instrument on SOHO.

Differential rotation plays a key role in the solar global dynamo responsible for the 22-year cycles of activity. Trying to understand the operation of this dynamo involves many elements, but central to them all is the need to achieve rotation profiles from detailed simulations that can explain the underlying physics of the remarkable profiles being deduced from helioseismic observations. This has now been partly accomplished under the SECTP for the bulk of the convection zone. These models are essential for interpreting the complex flows and fields to be studied with the Solar Dynamics Observatory planned within NASA's Living With a Star (LWS) program. Understanding how and why the sun varies is important for predicting the impacts of associated magnetic eruptions on our technological society.

SOLAR ANGULAR VELOCITY CONTOURS



Helioseismology SOI-MDI Data
(dashed curve is the tachocline at the base of the convection zone)

Time Averaged ASH Model

"Turbulent convection under the influence of rotation: sustaining a strong differential rotation", Brun & Toomre, *Ap.J.*, in press, 2001.

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