



HAO Colloquium Series

(Refreshments served)

Speaker: David H. Hathaway, NASA Marshall Space Flight Center

Time: 1:30 pm

Date: Thursday, May 19, 2011

Location: CG-1, South Auditorium, Room 1210

Title: **The Characteristic Depth of Supergranulation and the Meridional Return Flow**

Abstract: Supergranules rotate faster than the photosphere. Larger supergranules live longer and rotate faster than smaller supergranules. I use a cross-correlation analysis method with increasingly longer time-lags to measure the differential rotation and meridional motion of increasingly larger cells. The observations show a rotation rate that increases and a meridional flow that decreases for increasing time-lags up to 24 hours. Beyond 24 hours the rotation rate begins to slow and the meridional flow reverses direction. This is the first significant (10-sigma) detection of the meridional return flow. Using forward modeling I find that I can reproduce these observed motions with a rotation rate that increases with cell size up to 35 Mm and a meridional flow that decreases with cell size and reverses at 35 Mm. Comparing rotation rate vs. cell size to the helioseismically determined rotation rate vs. depth in the Sun's surface shear layer I find excellent agreement if and only if the cells are anchored at depths equal to their widths. This indicates that "typical" supergranules, with widths of 30–35 Mm, are anchored at the bottom of the surface shear layer. It also indicates that the meridional return flow starts at this depth. The implications for models of supergranulation, meridional circulation, and the Sun's magnetic dynamo will be discussed.



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