David H. Hathaway, Ph.D.
Heliophysics Team Lead
NASA Marshall Space Flight Center
Huntsville, AL USA

David Hathaway is the Heliophysics Team Lead at NASA's Marshall Space Flight Center in Huntsville, Alabama. He received his Ph.D. in Astrophysics from the University of Colorado in Boulder, Colorado in 1979 where his thesis work was on the fluid dynamics of Jupiter's interior. During the last 30 years he has done extensive research – observational, theoretical, and experimental – on the dynamics of the Sun's convection zone and the origin of the sunspot cycle. While he is well known for his sunspot cycle studies and predictions he is also recognized as the inventor of VISAR – an image stabilization and registration tool (often used to clarify images from video in criminal cases) which was NASA's Invention of the Year for 2002.

Activity Cycles in Stars

Abstract: Starspots and stellar activity can be detected in other stars using high precision photometric and spectrometric measurements. These observations have provided some surprises (starspots at the poles - sunspots are rarely seen poleward of 40 degrees) but more importantly they reveal behaviors that constrain our models of solar-stellar magnetic dynamos. The observations reveal variations in cycle characteristics that depend upon the stellar structure, convection zone dynamics, and rotation rate. In general, the more rapidly rotating stars are more active. However, for stars like the Sun, some are found to be inactive while nearly identical stars are found to be very active – indicating that periods like the Sun's Maunder Minimum (an inactive period from 1645 to 1715) are characteristic of Sun-like stars.

Predicting the Sunspot Cycle

Abstract: The 11-year sunspot cycle was discovered by an amateur astronomer in 1844. Visual and photographic observations of sunspots have been made by both amateurs and professionals over the last 400 years. These observations provide key statistical information about the sunspot cycle that do allow for predictions of future activity. However, sunspots and the sunspot cycle are magnetic in nature. For the last 100 years these magnetic measurements have been acquired and used exclusively by professional astronomers to gain new information about the nature of the solar activity cycle. Recently, magnetic dynamo models have evolved to the stage where they can assimilate past data and provide predictions. With the advent of the Internet and open data policies, amateurs now have equal access to the same data used by professionals and equal opportunities to contribute (but, alas, without pay). This talk will describe some of the more useful prediction techniques and reveal what they say about the intensity of the upcoming sunspot cycle.