

# Botanists turn solar sleuths

Events within the sun stamp their traces in the rings in the barks of trees that grow down on the earth, says S.Ananthanarayanan.

If a tree is cut across the trunk, we find that the trunk is marked by a series of concentric rings. These rings show how the tree has grown each year and are called growth rings. By counting the rings we can tell how old a tree is. The edge of each ring marks the winter, when growth stops. We can tell whether a summer was good or bad for tree growth from how wide each ring is.

## Sunspots

The surface of the sun is all gas, mainly hydrogen and so hot that the atoms are stripped of electrons. A gas of charged particles like this is called plasma and the way it behaves is quite different from ordinary gases, because of the mutual electric forces and also magnetic effects of the particles in motion. The temperature on the sun's surface is a searing 6000°C.

Sunspots are dark spots on this surface, some as large as 50,000 miles in diameter and moving across the surface of the sun, contracting and expanding as they go. The spots are dark because these places are cooler than the surroundings, and this is thought to be because of changes in magnetic activity below the outer layer of the sun.

## Sunspot records

Sunspots have been clearly observed and recorded since the 17<sup>th</sup> century, after Galileo invented the telescope. The record shows that intense sunspot activity follows cycles, of 11 years. This cyclic intensity has been a subject of study and it is found that apart from the cycles, the overall level of activity also rises and falls. The level saw a lull in the later half of the 17<sup>th</sup> century and is now peaking.

Periods of intense activity are marked by surges in the emission of charged particles, called the solar wind. The solar wind, deflected by the earth's magnetic field, forms a charged envelope around the earth and blocks out the high-energy cosmic rays that stream in from outer space. It is this change in the current of high-energy particles striking the earth that leaves a mark on the earth

## Radioactive Carbon

High-energy cosmic rays react with components of the atmosphere to generate a variety of carbon, whose atoms are different from normal carbon atoms in the nucleus, and this kind of carbon is radioactive. Normally, the level of such carbon on the earth is stable, with the rate of production being balanced by the rate of decay, which is through

radioactivity. But during periods of high solar activity, the solar wind would block out cosmic rays and the production of radioactive carbon and the level of radioactive carbon would drop.

Now, all living things, including the barks of trees, contain carbon and this content has the same proportions of normal and radioactive carbon as the atmosphere. Except that the barks of trees formed during the periods when the level of radioactive carbon was low would mark particular rings in the bark with this low content.

Studies show that the level of sunspot activity, as recorded in tree barks agrees with observation, which has been going on since 1610. As tree bark records are there from much before that, scientists have been able to work out the level of sunspot activity for the last 11,000 years. The present level of activity, it is found has been the most intense since about 800 years ago!

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