Sunspots revealed

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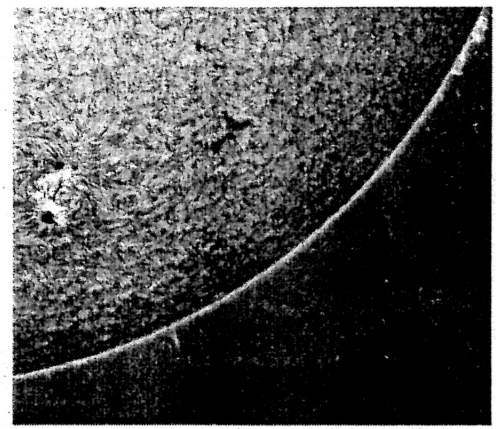

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One normally associates astronomy with night-time observing. The star-studded night sky indeed provides the astronomer with many challenges and opportunities. But even in daytime there is some work cut out for the observer. For right at our doorstep is the one star whose light dominates over all the rest...and that is our Sun. Special telescopes are needed to view the surface of the Sun. Four centuries ago, even through his primitive telescope Galileo was able to observe the Sun and show that the solar surface is not uniformly bright: that it has a few dark spots distributed all over. The spots indicate regions of lesser temperature than the rest of the surface.

Theoreticians can give reasons for this phenomenon. In fact, for a theorist to explain why the spots occur, it is necessary to have fair amount of details regarding the spots: their nature and composition. So observers have been observing the Sun over many years. Perhaps nowhere else is the Sun under daily surveillance as regularly as in Kodaikanal where the Observatory takes a picture of the Sun almost daily. The photographs are catalogued in the solar archives. Who knows, but sometime in future a scientist may need minute information about the solar surface. Situated in the picturesque hill station in Tamil Nadu, Kodaikanal was the site chosen by the British in 1893, for shifting the old Madras Observatory. The site has telescopes both for observing the Sun and stars. The observatory got a real boost when John Evershed took over as Assistant Director in 1907. Evershed made Kodaikanal into a world class observatory. Himself a solar observer, Evershed made an important discovery in January, 1909, that there is a radial flow of gas across the sunspots, moving radially outwards. This is known as the Evershed effect and it played a significant role in our understanding of the structure of sunspots.



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Thanks to such findings today scientists are able to say why spots appear on the fair skin of the Sun. There are intense magnetic fields in the spot region and they prevent the hot plasma from coming to the surface. Normally the plasma floats outwards from the centre, carrying heat which the Sun radiates. This flow is by convection, much like the heat carried up by water being boiled on a gas stove. What the magnetic field does is to stop the convection, thereby making the region on the surface cooler than its surroundings. Being less hot, the region looks dark. A large sunspot may be as much as 50,000 kilometres in diameter, about four times the size of the Earth!

Evershed was good at making instruments and constructed a spectroheliograph to get a spectrum of the Sun. Now the Sun could be photographed in different coloured light. Such photographs are important in determining the elemental composition of the solar surface.

In 1923 Evershed retired and left the Kodaikanal Observatory. His tenure had brought lustre to the observatory. Unfortunately those golden days were not to be repeated as the later work carried out at Kodaikanal sank to routine observations.

Astrophysician Jayant Narlikar and Thanu Padmanabhan, theoretical physicist, will contribute to **DNA**'s *special series through 2009, designated the International Year of Astronomy. This is the second article in the series*