

The 1995 Total Solar Eclipse : An Overview

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As we know, we owe the discovery of solar corona to the observation of total solar eclipses. In spite of all that has been learned, coronal studies still remain the most important aspect of scientific investigation during the occurrence of a total solar eclipse.

We know that corona is made of plasma at very high temperature and has structures. The photospheric magnetic fields are responsible for the large scale structures in the corona. We do not know for certain how the plasma gets heated to such high temperatures. A number of theories have been put forward to explain the heating of the solar corona but no single theory explains the observations made.

Let us look at the kind of observations that have been made to study the solar corona. Apart from doing the photometry and spectroscopy of the solar corona during eclipses, the invention of coronagraph in 1930 has contributed a lot towards our understanding of the physical and dynamic nature of the solar corona. Observations in X-ray, soft X-ray and EUV radiations from the sun using space telescopes have opened up new chapter in the coronal physics. Presently soft X-ray and hard X-ray telescopes at YOHKOH are providing high quality data on coronal structures. Coronal jets covering large distances on the sun have been discovered. Three coronagraphs on recently launched SOHO satellite will enhance our knowledge on coronal physics and probably provide us the answer to heating mechanism of coronal plasma. In spite of these advances, there are number of open questions for which we can find answers by making observations during total solar eclipses e.g. Whether the width of emission line has contribution due to non-thermal broadening processes apart from thermal contribution? What are the differences in 'open' and 'closed' field structures in terms of temperature, density and micro-turbulence? Is there dust ring around the sun? Is there reddening of the solar corona due to scattering process in the corona? Are there short-period intensity or velocity oscillations in the solar corona? What are the factors those contribute to the origin of solar wind? Detailed temperature and velocity structure of the solar corona need to be investigated. The variations in the solar diameter if any can be determined accurately by observing large number of total solar eclipses. Also eclipses provide excellent opportunity with minimum of photospheric light scatter to study the solar corona and remain less expensive means of observations.

Keeping these questions in view, a number of experiments were conducted during the total solar eclipse of October 24, 1995. The major scientific activity was concentrated at three regions in India, namely Nim ka Thana, Dundlodh Castle and Mukandgarh Fort in Rajasthan, western part of totality path in India; Kalpi, Iradatganj and Meja Khas in Uttar Pradesh, middle part of totality path; and Diamond Harbour near Calcutta, eastern part of totality path (Figure 1) in India. Indian Institute of Astrophysics had established two camps, one at Nim ka Thana and the other at Kalpi. Physical Research Laboratory, Ahmedabad, Slovak Republic, Brazilian, Russian, Japanese and German teams performed their experiments alongwith IIA team at Nim ka Thana. A part of IIA team and Udaipur Solar Observatory team were stationed at Kalpi. Scientists from Uttar Pradesh State Observatory, Nainital and Inter-University Centre for Astronomy and Astrophysics, Pune were at Meja Khas and at a location close to Agra respectively. A number of groups located themselves at Iradatganj and Diamond Harbour. Jay M. Pasachoff and his team of Williams College, USA conducted their regular experiment to detect the coronal oscillations and other experiments at Mukandgarh Fort and a large team of 38 members led by Bijiro Hiel of Japan was present at Dundlodh castle during the eclipse.

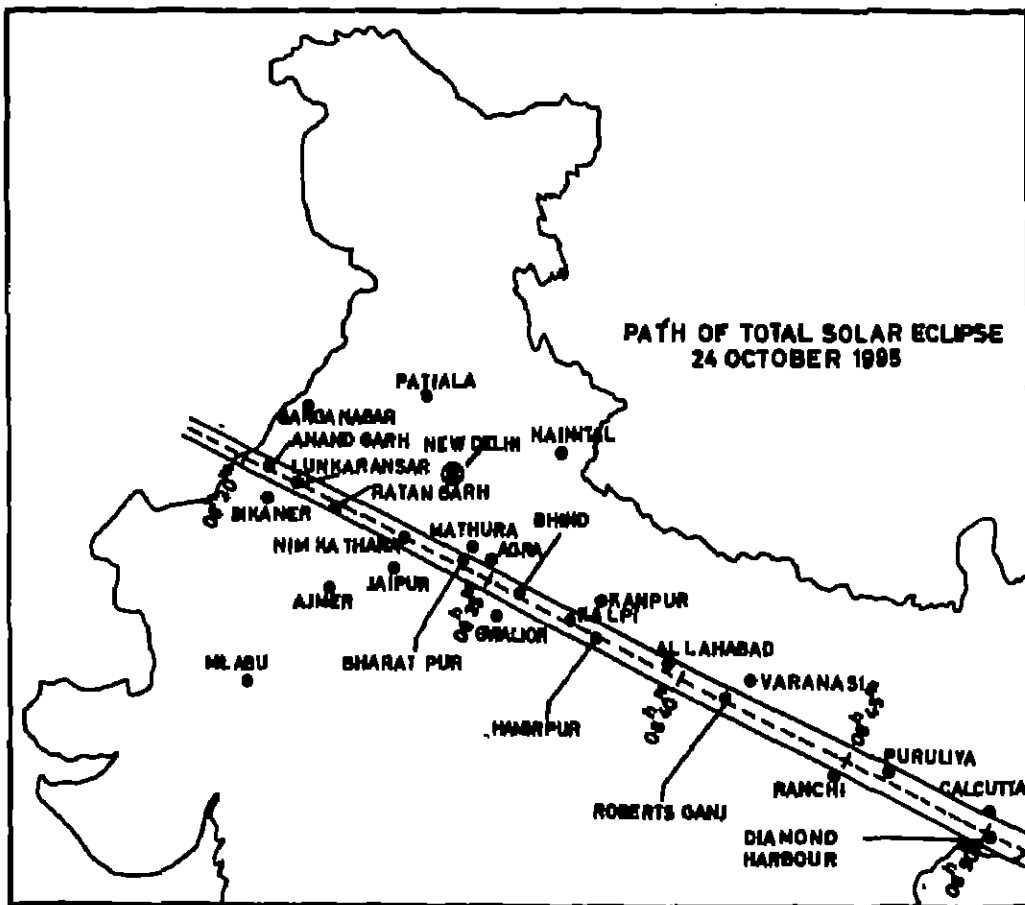


Figure 1. The figure shows the path of totality in India during the total solar eclipse of Oct. 24, 1995.

During this eclipse, first time efforts were made to photograph the solar corona using IAF jet aircrafts and transport planes and hot air balloons. The students of IIA and amateur astronomers coordinated to photograph the solar corona from various places along the path of totality and to provide information to the general public about this event.

The sky conditions were excellent during the eclipse along the whole length of path of totality. More than 90 percent of the experiments were successfully conducted. Some data have already been analysed and new results obtained. For example, short-period intensity oscillations in the corona have been discovered during this eclipse. How these are related to solar surface and how these change in corona with solar radii and direction need to be investigated. As more data get discussed, as we exchange our views, some outstanding questions will be answered and in the process some new question may arise to be answered by obtaining new sets of data at future eclipses.

I hope, we will share our findings in detail during this meeting and work out our future plans for the 1998th and 1999 eclipses.