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JOURNALISM OF COURAGE

125 years of Kodaikanal Solar Observatory: How the Great Drought of 1876 led to its establishment

The Madras Observatory was merged with the KoSO following the reorganisation of all Indian observatories on April 1, 1899. The hilltop observatory helped in making some key scientific discoveries over the years.

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The Kodaikanal Solar Observatory. (Via Wikimedia Commons)

Since ancient times, seafarers, mathematicians, astronomers and physicists have all extensively studied and followed the Sun and its activities. In 1792, the British East India Company **established the Madras Observatory** , a first of its kind in this part of the world.

Here, astronomical observations of the Sun, the Moon, bright stars and planets recorded during 1812-1825 were preserved in two large data volumes. The first dedicated solar observations were recorded later in 1878 from the Trigonometrical Survey Office in Dehradun.

Back then, astronomy was largely limited to special events like eclipses or planetary transits that drew huge interest from foreign astronomers to visit India. Some of these visitors later settled here and laid a foundation for observatory-based astronomy in the country.

The Kodaikanal Solar Observatory back in the day. (Via 'Hundred Years of Weather Service', IMD)

Several important observations were made here – the spectroscopic observations taken during the August 18, 1868, total solar eclipse from Guntur in Andhra Pradesh led to the discovery of helium, the Universe's second-most abundant element after hydrogen.

For the first time, celestial and solar photography were attempted from the Madras

Observatory during the total annual solar eclipse on December 12, 1871. Here is its story.

Scanty rainfall over south India during the winter monsoon of 1875 triggered one of the worst droughts the country had experienced till then. Multiple failed crops over the famine-stricken peninsular India killed 12.2 to 29.3 million people across the Madras and Mysore Provinces during 1875-1877.

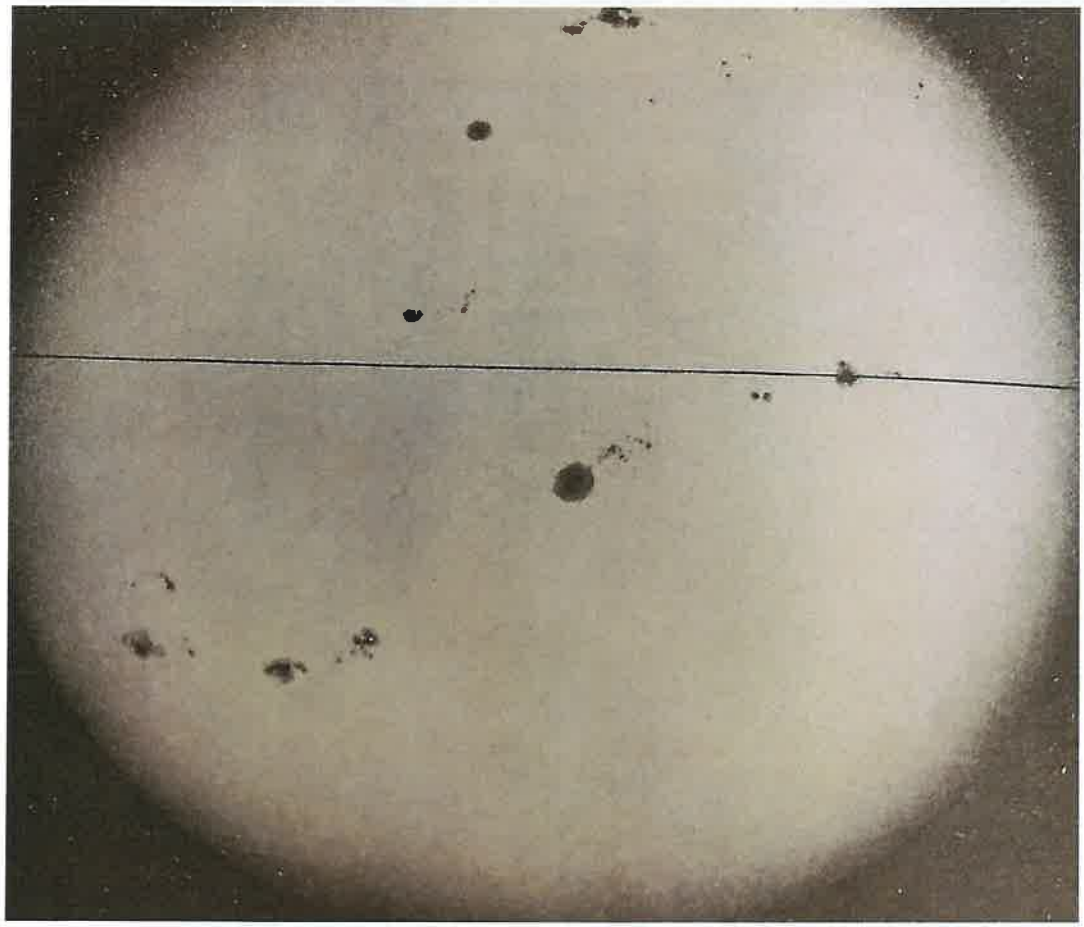
Halley's comet photographed from KoSO on May 13, 1910. (Via 'Hundred Years of Weather Service',IMD)

India, along with China, Egypt, Morocco, Ethiopia, southern Africa, Brazil, Columbia and Venezuela, suffered concurrent multi-year droughts during 1876-1878, later named the Great Drought, and an associated global famine that killed nearly 50 million.

The drought was thought to be due to multiple reasons – solar activity; cool Pacific Ocean conditions followed by a record-breaking El Nino (1877-1878); strong Indian Ocean Dipole and warm North Atlantic Ocean conditions.

Why study the Sun?

Being the primary source of energy, life on Earth is supported by the Sun. Any change on the solar surface or its periphery could significantly affect the Earth's atmosphere. Powerful solar storms and solar flares can be potentially harmful to Earth's satellite-based operations, power grids and navigational networks.



Photograph of the Sun taken in white light on April 2, 1958. (Via 'Hundred Years of Weather Service', IMD)

The KoSO (Kodaikanal Solar Observatory), which has been imaging the Sun for over a century now, has a rich repository of data. This is extremely useful not only to reconstruct the Sun's historic past but also to link its behavioural changes to better understand and predict its future and its impact on life on Earth and Space weather.

Solar Physics Observatory in Palani Hills

Based on the evidence that solar activity was linked to the seasonal rainfall distribution over India, the specially constituted Famine Commission of the British Raj recommended that the Government of India take regular solar observations.

Thus was born the idea for an Indian solar observatory, 'for carrying out systematic examinations and the study of changes in progress in the Sun and their co-relations with the larger features of Indian meteorology'. ('Hundred Years of Weather Service', IMD)

Scotland-born Charles Michie Smith, a Professor of Physics at the Madras Christian College, was entrusted to locate an ideal site for setting up this solar observatory in undivided India.

Explained | How the Kodaikanal Solar Observatory took pictures of the Sun every day, for more than 100 years

The hills of Leh, Mussoorie and Shimla were rejected for being dusty and cloudy and the atmosphere around them being unstable. Smith then conducted regular astronomical observations on southern India's hilltops, which were found to be better.

Later, Smith surveyed hill stations located over 2,000 metres above the mean sea level in Tamil Nadu – Kodaikanal in the Palani hills and Kotagiri in the Nilgiris. The survey of rainfall, cloud cover and sky transparency, haze, atmospheric stability, humidity, fog and mist was completed and Kodaikanal was chosen as the ideal location for the observatory.

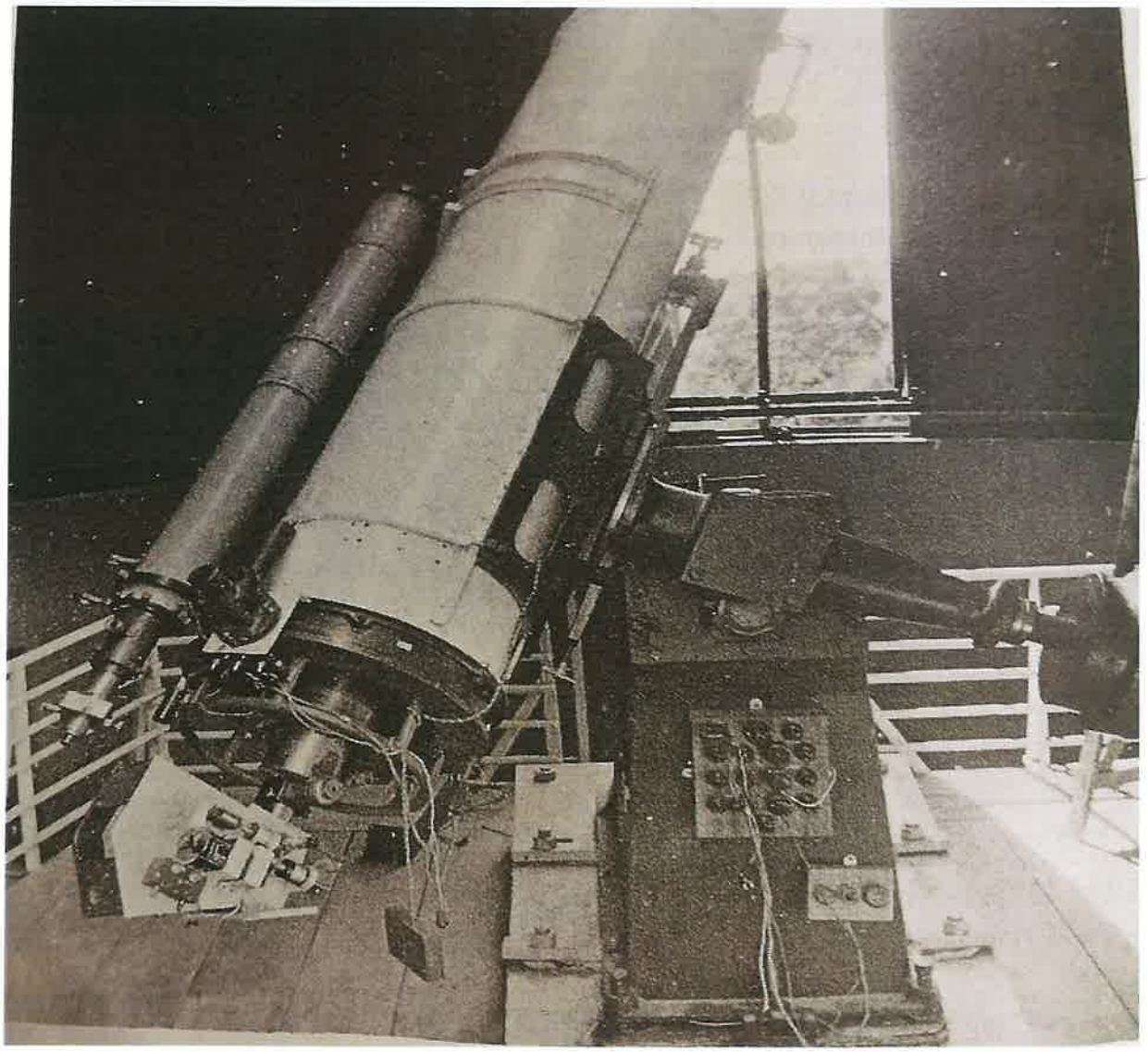
In August 1893, the Government of India sanctioned a Solar Physics Observatory under the meteorological budget.

In 1895, Lord Wenlock, the then Governor of Madras, laid its foundation stone. Supervised by Smith, who went on to become the first director of the renamed Kodaikanal Solar Observatory (KoSO), the ongoing civil construction picked pace. By the end of the 1900s, the main observatory building and the two adjacent domes were built and ready to accommodate instruments.

The Madras Observatory, where Smith briefly served as the Government Astronomer, was merged with the KoSO following the reorganisation of all Indian observatories implemented by the Government of India on April 1, 1899.

Instruments mainly from the Madras Observatory supplemented the new ones at KoSO, where systematic observations commenced on March 14, 1901.

The Bhavnagar Telescope, named after Maharaja of Bhavnagar, operated during KoSO's nascent years. This 16-inch Newtonian (later Cassegrain) mobile telescope remained India's largest from 1888-1968. It was imported from Dublin, Ireland, and was first established at the Maharaja Takhtasinghji Observatory in Poona (now Pune) around 1888.



The 20-inch reflector telescope at KoSO. (Via 'Hundred Years of Weather Service', IMD)

However, the Poona observatory closed down and the telescope was sent to KoSO in1912. Some of the early solar observations at KoSO included the examination of theSun's disc from spots and faculae; tracing bright lines from the Sun's chromospheres and prominences; visual and photographic observations of brightlines widened in the spectra of sunspots; measuring solar radiations on clear sky days and the direct photography of the Sun in monochromatic lights of calcium and hydrogen.

The radial motion of sunspots, better known as the Evershed Effect, was discovered from the sunspot observations made at KSO by John Evershed, KoSO director from 1911-1922.

Until the end of World War II in 1945, KoSO remained an observatory dedicated to solar physics. Thereafter, it expanded its ambit to study cosmic rays, radio astronomy, ionospheric physics, stellar physics and more areas. The continuous recording of the solar radio noise flux commenced in 1952 is considered the earliest solar radio observations in the country.

The contemporaries – Maharaja Takhtasinghji Observatory, Lucknow Observatory, and Calcutta Observatory – did not stand the test of time.

KoSO @125

The Government of India separated Astrophysics from the India Meteorological Department (IMD) in April 1971. The KoSO was brought under the Indian Institute of Astrophysics (IIA), Bengaluru on April 1, 1971.

From solar data recorded on basic photographic plates or films, the 125-year-old KoSO boasts a mammoth digital repository containing 1.48 lakh digitised solar images of 10 terabytes. These include 33,500 white-light images (showing sunspots) and thousands of other images of the Sun recorded every day since the start of the 20th century.

KoSO is the only observatory offering high-resolution digitised images for such a long period (with coverage of more than 75 per cent).

Today, it houses a spectrum of advanced instruments like the H-alpha telescope to perform full disc imaging, a White light Active Region Monitor (WARM) with calcium and sodium filters to make full disc simultaneous observations of the photosphere and chromospheres layers of the Sun, a solar tunnel telescope and more.

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