John Evershed: The Instrument Builder

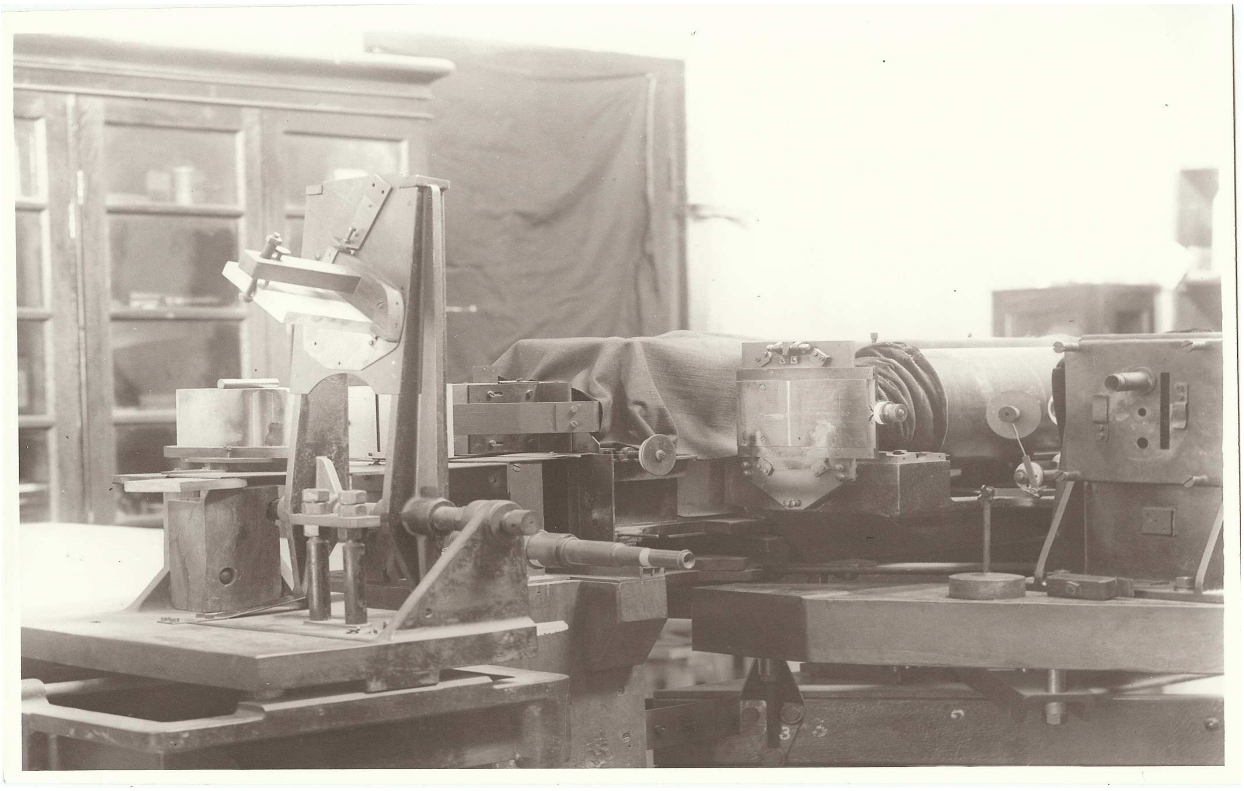
John Evershed (1864-1956) is well known in astrophysics, particularly in the area of solar physics, for his discovery of the radial motion in sunspots, an effect which bears his name. What is less known though is that Evershed was a designer and builder of instruments, especially spectroscopic instruments. While he was still at school and aged thirteen, Evershed constructed a telescope with odd lenses and used it through a plate glass window to observe Mars in near opposition. Later, with a spectroscope made out of two lenses from an old disused pair of opera glasses and a small but perfect prism given to him by his brother, he was thrilled to see the sodium D line of the solar spectrum split into its fine structure components. This experience probably gave the final direction to his scientific activities which followed and shaped his entire career. The early training in workshop practice that he had obtained from his brother served him well, not only in these early teenage days, but also throughout his whole life, especially in India. Instrument building remained, for Evershed, a lifetime passion (Stratton, 1957).

Inspired by Norman Lockyer's observations of solar prominences, Evershed built himself a spectroscope with a battery of prisms at his private observatory in Kenley, England. He observed 13458 prominences between 1890 & 1905 and studied their pole-ward migration. In 1891, Evershed read about George Ellery Hale's invention of a new viewing device, the spectrohelioscope, and set about to build one for himself. In 1892, Evershed invented the technique of monochromatic photography of the whole disk of the Sun. He photographed the prominences in the Hβ line. This was independent of Hale's invention of the spectroheliograph in the same year. Actually, Hale is supposed to have stated that Evershed was the only person other than he himself to have built a spectroheliograph (Wright 1994), thus acknowledging the ingenuity and craftsmanship of Evershed in instrument building.

In 1898, Evershed joined the total solar eclipse expedition of the British Astronomical Association to Talni in India, where he used a home-made prismatic camera to secure beautiful spectra extending far into the ultraviolet; he was the first to photograph the emission continuum at the head of the Balmer series. Evershed later took up expeditions to the total eclipses of 1900 (Algeria), 1905 (Spain), 1922 (West Australia), and 1927 (Yorkshire), though without much luck. He always built and used his own instruments; only the prisms were procured, which were of course among his prized possessions. He very successfully used his eclipse prisms to build a prismatic camera for observing Comet Daniel in 1907 and Comet Halley in 1910. He identified the cyanogen bands both in the nucleus and the tail of Comet Daniel. In the case of Comet Halley, he identified the cyanogen as well as the Swan bands in the nucleus and the carbon monoxide bands in the tail.

In 1906, at the initiative of Gilbert Walker, who was the Director General of Observatories in India, and with the support of William Huggins, Evershed was offered the post of Assistant Director of the Kodaikanal Observatory which he gladly accepted and joined in 1907. On their way to India, the Eversheds spent about a month at Mount Wilson where Hale was busy building the famous observatory. Evershed benefited from his scientific interactions there and also brought with him a large Michelson grating.

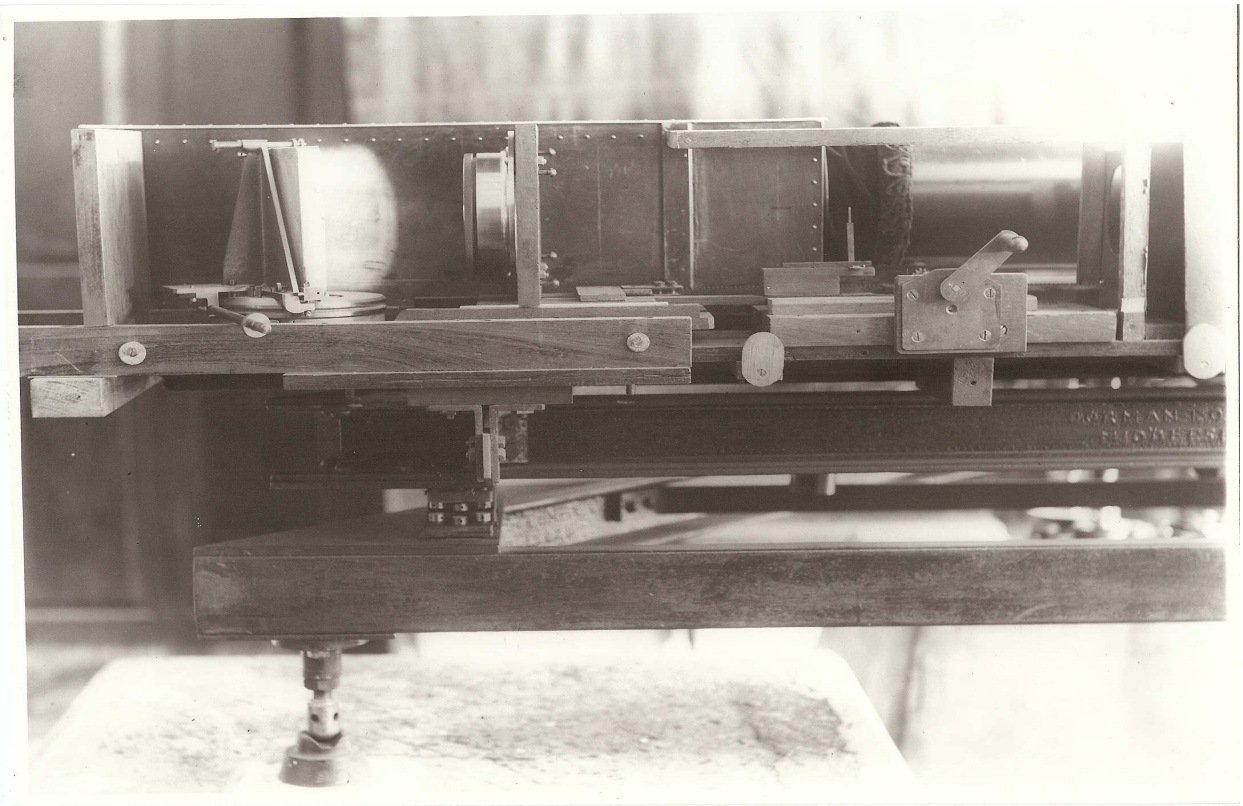
When Evershed arrived in Kodaikanal, there were already several instruments and he set forth to improve them. The main thrust of observations was sunspots and Evershed took a fascination for it, besides continuing his favourite prominence observations. Evershed's skill in designing and building instruments was best made use of during these early days in Kodaikanal. He put to working order the Cambridge spectroheliograph and soon built a large spectrograph using the 6-inch Michelson grating which he had brought with him, and put it to use to observe sunspot



The Cambridge spectroheliograph. (Plate from IIA archives)

spectra. Evershed also evolved a fine technique (the so-called positive on negative method) to measure the small line shifts. He also ingeniously used the image rotation caused by the siderostat to his advantage. In 1909, Evershed published the memoirs in which he summarised his observations on sunspots. The Evershed effect had thus been discovered.

The K line spectroheliograms were being obtained regularly at the observatory since 1904 and Evershed wanted to add an Hα facility for near-simultaneous recording. In order to achieve the necessary resolution, he used the Michelson grating to build an autocollimating spectrograph and bolted it onto the framework of the existing instrument.



Grating and lens of the autocollimating spectroheliograph attached to the side of the Cambridge spectroheliograph. (Plate from IIA archives)

This twin spectroheliograph started working in 1911 (Evershed 1911), and with minimal necessary changes, has been functional until very recent times.

In 1923, Evershed retired from the Directorship of the Kodaikanal Observatory and returned to England where he established a private observatory in Ewhurst. The following remark by him shows his joy in building instruments and using them: 'I began with a prism containing just a cubic centimetre of glass, I end with a prism containing two litres of liquid; instead of barely splitting the D lines, D1 and D2 appear now half an inch apart, with a large number of solar lines between.' Till his death in 1956, at the ripe old age of 92, Evershed continued to observe the solar spectrum whenever conditions allowed. His doctor is said to have stated: 'He was an impossible patient and however ill would always refuse to leave his underground observatory.' (Stratton 1957) After all, it was an eighty year love affair with the solar spectrum!

References:

1. Stratton, F.J.M. (1957) Biographical Memoirs of Fellows of The Royal Society, Volume 3, 41-51.

2. Wright, H. (1994) Explorer of the Universe: A biography of George Ellery Hale, New York, American Institute of Physics.

3. Evershed, J. (1911) The auto-collimating spectroheliograph of the Kodaikanal Observatory, MNRAS 71, 719-723.

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