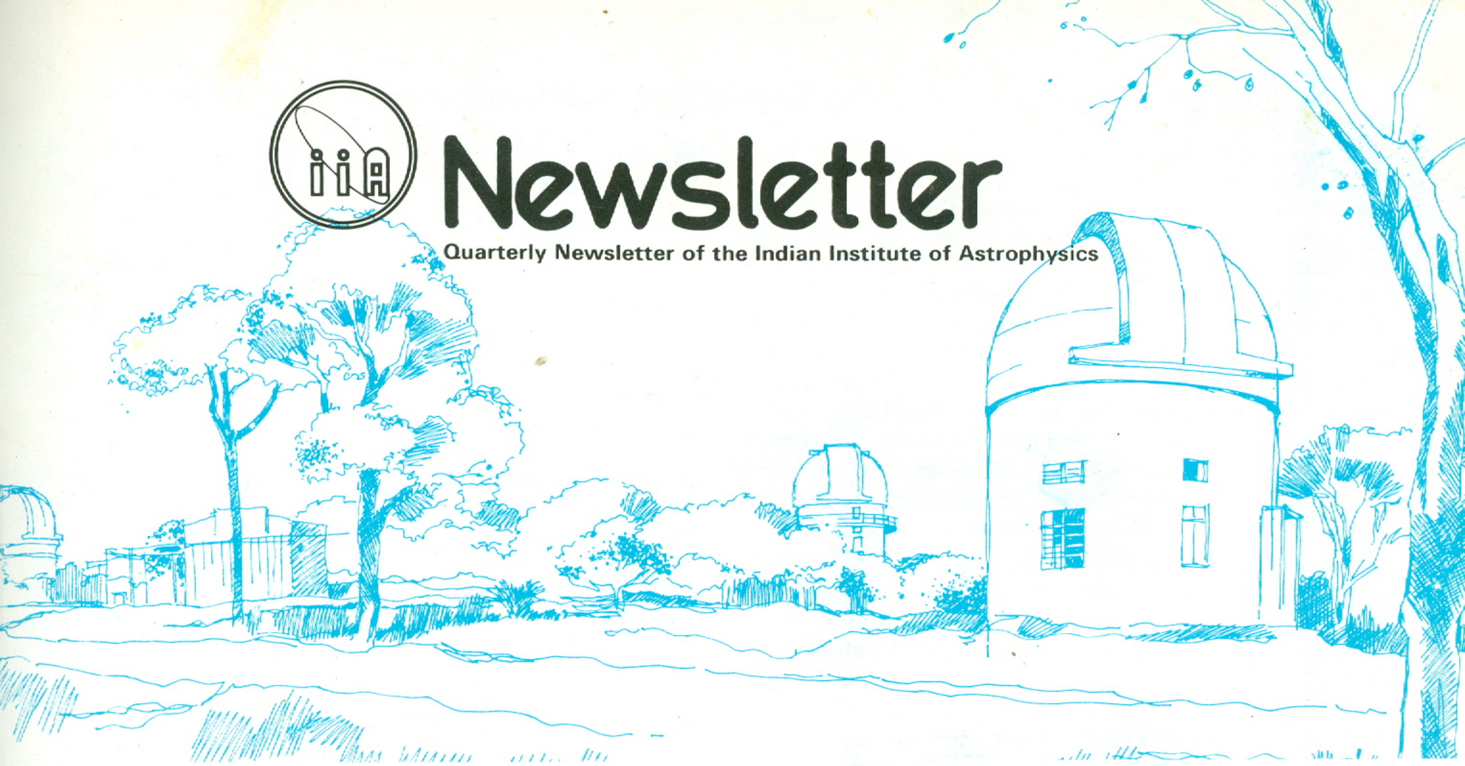
Newsletter

Quarterly Newsletter of the Indian Institute of Astrophysics



Volume 3 | Number 1 | January 1988

1986 March 20

Photograph of Comet Halley obtained with the 45-cm Schmidt telescope at the Vainu Bappu Observatory, Kavalur on 1986 March 20. The Comet had a well-developed coma and long ionic tail superimposed on a weak dust tail. The ray structures are quite striking. Notice the kink in the ionic tail which is an indication of the onset of a disconnection event.

Spectrophotometry and Direct Imaging of Comet P/Halley

K. R. Sivaraman

The present apparition of Halley's Comet in 1985-86 stimulated a degree of scientific activity unmatched in the history of this or any other comet. This comet was seen by more people than any time before. Professional astronomers looked at the comet from every telescope possible in the world. The amateur astronomers' activity rose to an unprecedented level. The unique opportunity offered by Comet Halley has been used by astronomers to gather a wealth of data. Added to this, the spacecraft missions to the comet have collected original data which have brought in new information concerning these objects in the solar system. This apparition also witnessed an international cooperation in the implementation of scientific observing programme which has been very successful. In India, a coordinated programme of observations was framed jointly by astronomers from the Indian Institute of Astrophysics, Bangalore; Astronomy Department, Osmania University, Hyderabad; Uttar Pradesh State Observatory, Nainital; Physical Research Laboratory, Ahmedabad and Positional Astronomy Centre, Calcutta. This Indian Halley Observation Programme (IHOP) was jointly funded by the Department of Science and Technology and the Indian Space Research Organisation.

The Indian Institute of Astrophysics played an important role in this enterprise. The Kodaikanal Observatory, was one place where Comet Halley was observed extensively—both photographic and spectroscopic studies—by Michie Smith and John Evershed in 1910 (Michie Smith 1913). Some of the photographs in this collection are of excellent quality. The NASA, during their hunt for photographs from observatories all over the world, to compile an atlas of the 1910 apparition of Comet Halley, found the Kodaikanal collection most useful and have used a few of them for the atlas. The keen interest in cometary studies was revived at Kodaikanal by the late Dr. Vainu Bappu. His observations of Comet Arend-Roland and Comet Mrkos in 1957 (Bappu & Sinvhal 1960) mark the beginning of the present epoch in this field of study in this country. Most of the bright comets since 1960 have been studied by him and his group through photographs and spectra at Kodaikanal. With the expansion of facilities at the telescopes at the Kavalur station of the Institute, it became possible to plan spectrophotometry, spectroscopy and direct photography of Comet Halley.

Spectrophotometry

The principal aim of our programme was to derive information on some of the important physical characteristics of the cometary atmosphere, like the law of distribution of densities for the different molecular species and the dust; their production rates; life-times of the molecular species—both the parent and daughter molecules; from an analysis of the spectra of the comet.

We made spectrum scans on 6 nights in 1985 November and December and on 11 nights in 1986 March, April and May, with the scanner on the 1-m reflector at

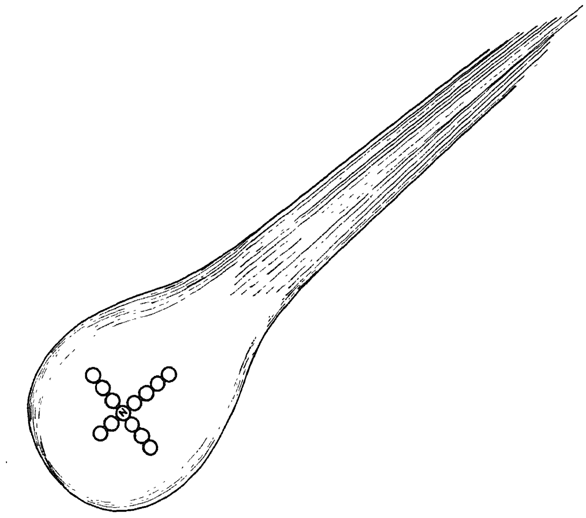


Fig. 1. Schematic diagram showing the positions of the entrance circular diaphragm of the scanner ($\sim$26 arcsec diameter) when it sampled different regions on the coma of Comet Halley. Position N represents the position of the nucleus. The entrance diaphragm was systematically displaced by known amounts along the tail direction as well as normal to it and scans were obtained at each position. These observations provided the data for mapping the spatial distribution of the molecules and dust in the coma of the comet.

Kavalur. These scans generally cover the region 3900A–6200A and on some occasions 4500A–7200A. Using a reasonably small circular entrance diaphragm (26 arcsec diameter) for the scanner, in addition to the scan around the nucleus, we were able to obtain spectrum scans for several regions sampled within the coma in the direction of the tail and normal to it, reaching out to $\sim$ 2 arcmin from the nucleus (Fig. 1). A typical scan at the nucleus as well as those for other positions at different projected distances (ρ) from the nucleus are shown in Fig. 2. Our scanner observations directly provide the two-dimensional map of the brightness distribution. We have evaluated the spatial distribution of the dust and the column densities $N(\rho)$ of the molecular species and also the emission gradients within the coma. We find from the plot of the emission flux vs ρ that the emission gradients differ from one direction to another and this asymmetric pattern itself changes from night to night (Sivaraman *et al.* 1987). This is the first time the asymmetries in the brightness within the coma have been brought out and evaluated quantitatively showing that the spherically symmetric coma is a very crude approximation. This is an information most essential for constructing realistic models of cometary atmospheres.

Another interesting feature of the spectrum of Comet Halley was the striking presence of NH_2 emission. The NH_2(0, 13, 0) emission which can be detected in our 1985 December scans, became unusually intense by March and is seen very conspicuously in all the scans of March both at the nucleus as well as at locations away from the nucleus. By April, the NH_2 emission fell to the December levels.

Advent of Solar Physics in India—II

In a letter written to Lord Salisbury on 1877 June 26, Lockyer suggested using the photoheliograph already in India for daily photography of the sun.

Lockyer suggested employment of his assistant Sapper M. Meins for a period of two years and offered to 'receive reports from him and this way test and control his work. . . .'

On Lockyer's suggestion, the tube of photoheliograph was replaced by a new one from the Astronomer Royal. The other instruments in India were sent to South Kensington for use by Norman Lockyer. These were a small transit instrument; a standard and two journeymen clocks; a chronograph; and a 6 inches aperture equatorial telescope by T. Cooke & Sons. There were also two spectroscopes by Adam Hilger, a stellar spectroscope, and a 3 prism solar spectroscope. These spectroscopes do not appear to have been used by Tennant at all. They were presumably bought by the India Office for use by Lockyer for eventual spectroscope work in India.

Meins started his work 1878 beginning at Dehra Dun under the superintendence of Col. J. T. Walker, the surveyor general of India. Meins died 1879 March 31, and the continuity of daily photography was broken till its resumption 1879 December.

In 1878 November the Duke of Devonshire as Chairman of the Royal Commission on Scientific Instruction and the Advancement of Science wrote to the Lord President of the Committee of Council on Education, who in 1879 appointed a Committee on Solar Physics, composed of Professor (later Sir) George G. Stokes, Professor Balfour Stewart, Mr J. Norman Lockyer, Captain (later Sir) William de W. Abney, General Richard Strachey, Mr (later Sir) W. H. M. Christie, Colonel (later Sir) John F. D. Donnelly, and (as Secretary) Mr Frank Rede Fowke. One of the tasks of the Committee was to reduce the Indian solar photographs.

Mr Meins was succeeded by Sgt White 1879 December, and to avoid risk of further interruption solar photography was made a part of operations of Great Trigonometrical Survey of India, solar pictures being despatched to Solar Physics Committee, South Kensington, every week.

In 1880 a 6 inches aperture photoheliograph, giving solar pictures of 12 inches diameter on 15 inches square plates was sent to Dehra Dun. Also the smaller photoheliograph was modified to produce 8 inches diameter solar image on 10 inches square plates.

Daily solar photography continued at Dehra Dun till 1925.

Actinometry

In 1879 the newly formed Solar Physics Committee urged the India Office to send two actinometers to India for measuring solar radiation received at the surface of the earth. An actinometer newly-designed by Professor Balfour Stewart was sent in 1880 to Mr Henry F. Blanford, Meteorological Reporter to Government of India. One of these was set up at Alipore Observatory, Calcutta, and the results for the period 1880 April–1881 March sent to the Committee.

The other actinometer meant for Leh was supplied to Mr. J. B. N. Hennessey of the Great Trigonometrical Survey of India, and Sergent Rowland, specially trained at South Kensington for the purpose was sent to India 1882 end. After making trial observations at Mussourie under the supervision of Hennessey, Sgt Rowland along with an assistant observer Mr Shaw reached Leh 1883 summer. Regular observations were made for 18 months (or two years?), but it was found that a large amount of dust was present in the atmosphere.

The actinometer was then brought to Mussourie and observations were made by Mr Shaw, Sgt. Rowland having been transferred to the survey department. Mussourie was found unsuitable on account of large amount of clouds in the cold weather and rains, and the frequent prevalence of dust in summer.

The Leh observations were sent to the Solar Physics Committee, and a note was prepared on them by Professor Balfour Stewart, but it is not clear what became of them.

The Committee suggested that an (improved) chemical actinometer designed by Professor Roscoe (which continuously measured solar radiation through its effect on silver chloride) be tried at Leh, but the proposal was discarded when Mr Blanford could not ensure a continuous record.

After the rejection of Leh and Mussourie, actinometric observations were started at Simla.

Spectroscopy

The six inches Cooke telescope and the 3-prism spectroscope by Hilger were sent to Elphinstone College, Bombay, after more than seven years of use by Norman Lockyer at South Kensington. It is not clear why Elphinstone College was chosen, but the instruments were not put to any use there. Nor were they used at their next destination, College of Science, Poona.

Finally the telescope and the spectroscope were sent to Madras 1893 December for use at Kodaikanal which they reached 1898 (The mounting of the telescope is now at Kavalur, supporting a 15-inch telescope). Thus astronomical spectroscopy could not take off in the 19th century at all, and had to wait for the solar physics observatory at Kodaikanal.

References

1. Lockyer, T. M. & Lockyer, W. L. (1928) *Life and Work of Sir Norman Lockyer*, Macmillan and Co., London.
2. *Reports by the Committee of Solar Physics* (presented to both Houses of Parliament: 1882, 1889), Her Majesty's Stationery Office.
3. Tennant, J. F. (1887) *Report of Transit of Venus as seen at Roorkee and Lahore on December 8, 1874*, Office of the Superintendent of Government Printing, Calcutta.

R. K. Kochhar

Of human elements

The price of a red ant

In the course of a visit to Moscow on the occasion of the 220th anniversary of the foundation of the USSR Academy of Sciences, an elaborate dinner was laid on for the guests by Joseph V Stalin. In the course of this convivial occasion (lasting no doubt a long time) Shapley noticed a rare species of ant crawl out of a basket of fruit with which the table was heavily laden. Shapley promptly caught the uninvited specimen, imprisoned it in a vial ever present in his pocket; and as a conserving liquid used the vodka that was being liberally served out (no doubt 100% proof). Needless to say, this somewhat unusual behaviour promptly caught the eye of those who had to watch for anything unusual in Stalin's presence; and some discrete explanations had to take place before things returned to normal.

Of Stars and Men
Reminiscences of an astronomer
Z. Kopal
Adam Hilger, Bristol 1986, p. 160.

Out of context

We thank . . . and . . . for valuable conservations.

Nature (1987) **330,** 238.

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Elliptical galaxies were great self-gravitating swarms of fast-moving stars, which were often flattened.

Comments Astrophys (1987) **8,** 27.

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The anomalous 408 MHz data point for PKS 1424–419 can be explained by confusion with PKS 1424–421.

Mon. Not. R. astr. Soc. (1979) **187,** 403.

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One Year of SN 1987A in LMC

A workshop on Supernova 1987A in LMC will be held at the IIA auditorium on February 24–25, 1988, one year after the outburst. The workshop aims to take stock of observations obtained so far at various frequencies, and the theoretical development in the understanding of the supernova phenomenon, as also to identify areas of future work. The proceedings of the workshop are planned to be published as a special issue of Kodaikanal Observatory Bulletins. Contact address: *Prof. N. Kameswara Rao, Indian Institute of Astrophysics, Bangalore 34.*

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