sun (the so-called Pol Swings effect), and to a lesser extent on other secondary phenomena. The presence of "chemically" very unstable molecules such as CN, C_2, C_3, NH_2, etc. in the head of comets suggests that the cometary atmospheres are regions of very low density where collisions between particles are very rare. This spectroscopically established result may also be visually confirmed by close inspection of Figure 6; indeed, it is because of the very tenuous nature of the cometary atmosphere (typically 10^5 molecules/cm^3 at a distance of 10,000 km from the centre) that trails of very distant stars can be seen through Halley's coma. The OPTOPUS spectra also clearly show that the brightness decrease of molecular bands as a function of the projected radial distance is not the same for different molecules (see for instance CN and C_3 in spectra I, II and III). We are convinced that a more detailed analysis of the presently obtained data will contribute to a better understanding of the physics of Halley's comet. These results will soon be reported elsewhere.

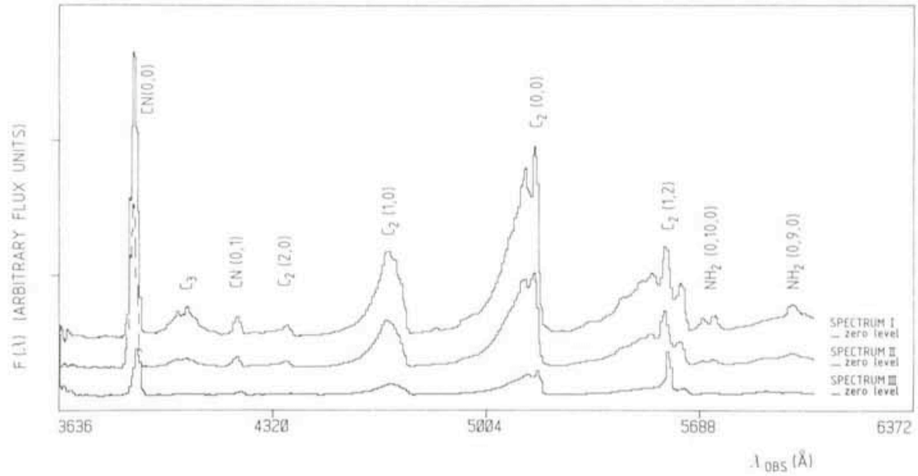

Figure 7: *Averaged OPTOPUS spectra of Halley's comet, observed at the approximate projected radial distances of 47,000 km (spectrum I), 88,000 km (spectrum II) and 240,000 km (spectrum III) from the centre of the coma (see text).*

Observations at La Silla of Comet Halley after Perihelion

R. M. West, ESO

Comet Halley passed through its perihelion on 9 February. At that moment it was only 8 degrees from the sun and it could therefore not be observed with optical telescopes. However, radio and infrared observations, which started in late 1985, continued to be made during daytime.

The first observations of the comet after perihelion were performed at La Silla on 15 February in the bright morning sky, when Halley still was only 15 degrees from the sun. Here, ESO astronomer R. M. West and Belgian visiting astronomer H. Debehogne photographed the object with the 40-cm GPO double astrograph, just after it rose above the eastern horizon. A 30-second exposure on a red-sensitive plate, when the comet was only 15 arcminutes above the Cordillera, enabled the astronomers to measure the accurate position. The data were immediately telexed to the spacecraft control centres in Darmstadt, Tokyo, Moscow and Pasadena as well as to the IAU Telegram Bureau in Cambridge, Mass., USA. The ESO observation proved that Halley was very near the orbit which had been predicted on the basis of pre-perihelion measurements. It was good news for the spacecraft navigators that Halley had behaved normally while "behind" the sun. As we witnessed in early March, all five spacecraft en route to Halley indeed managed to pass the comet nucleus within the prescribed distances.

Following the initial observations with the GPO, other telescopes at La Silla and other observatories soon joined in. The full story will only be available after some years, when the archive comprising all Halley observations has been put together by the International Halley Watch. In the meantime, here are some details about the early activities at La Silla.

Here, the GPO continued to deliver astrometric positions until 6 March, the day of the Halley fly-by of the Soviet Vega-1 spacecraft. Other exposures with this telescope showed dramatic changes from morning to morning in the innermost few thousand kilometres of the coma. Thanks to very stable weather and excellent seeing, the rather unique time-series has been continued by P. Monderen. Until the time of writing (18 March), not a single night has been lost since 15 February and it is the intention to continue as long as possible. This observational material will provide a most valuable record of the near-nucleus events, including several violent outbursts during which the innermost part became totally obscured by dense dust clouds. It would be tempting to produce a short movie, once the plates have been digitized and calibrated.

The first exposures with the specially designed Wide-Field CCD Camera were made already on 17 February. This instrument uses a 640 × 1,024 pixel RCA CCD chip as detector behind a 100 mm Canon lens at aperture f/2.8. The field is 5.5 × 9 degrees and each pixel measures 31 arcseconds on the sky. Until the full moon started to seriously interfere on 23 February, exposures were made through a GG 495 filter, i.e. covering the 5000–11000 Å spectral interval. Of particular interest was the spectacular tail structure, that was first seen on 18 February. At least seven tails emerged from the coma which could be theoretically explained by consecutive outbursts in the period when Halley was nearest to the sun.

During the moon period, which lasted until 8 March, this camera explored the ion tail(s) by means of narrow interference filters, which suppress the sky background light. The observations, which were made by ESO astronomer H. Pedersen with the help of R. Vio and B. Gelly, documented in detail the development of a more than 15 degrees long CO^+ tail, necessitating two shifted exposures to cover most of it. Daily changes were recorded and on 5 March the first of several disconnection events was seen. As Halley moved higher in the sky, exposures in other filters could be made as well, corresponding to other major constituents of the ion tail(s). Also these observations were blessed by the marvellous weather and now provide a unique record of the tail changes.

Infrared observations at ESO started already in late 1985. From 16 February to 3 March only one night was lost and ESO astronomer Th. Le Bertre recorded the comet's brightness in the standard filters out to 5 microns. There were very large daily variations which correlated well with the outbursts seen on the GPO pictures in the sense that when the comet was brighter in infrared light, then there was also more dust around the nucleus.

The ESO Schmidt telescope, which for safety reasons cannot point close to the horizon, started observations on 2 March. As soon as possible, a daily routine consisting of two exposures was adopted, one red and one blue. Whereas the red plates showed less and less detail (reflecting the decreasing amount of cometary dust as Halley moved away from the sun), the 30-minute blue plates are probably among the most spectacular ever taken of a comet. The motion in the ion tails, driven by the variable solar wind, becomes apparent and a major disconnection event on 9 March can be traced to plasma instabilities one day before. By mid-March, H.-E. Schuster and his night assistants G. and O. Pizarro had more than two weeks of uninterrupted observations. The calibrated plates will now be measured and analyzed by the ESO image processing systems in Garching. Taken together with the GPO plates and the wide-field CCD images, the post-perihelion development of comet Halley can be studied, all the way out from the innermost regions near the nucleus to the distant tail areas.

Observations of Halley were also made at La Silla by a team of astronomers from the Ruhr University at Bochum, FRG, by means of a multi-camera mounting, employing different filters which separate the various ions in the tail.

During a 16-night period from late February, close-up CCD images of the nuclear region were obtained by Danish astronomer S. Frandsen, in collaboration with B. Reipurth at the Danish 1.5-m telescope equipped with the Aarhus CCD camera.

Starting early March, more teams arrived at La Silla to use other ESO telescopes for the study of Halley. It is expected that articles about these activities will appear in the June issue of the *Messenger*.

Rapid Changes in Comet Halley's CO^+ Tail

Regular observations of Comet Halley were undertaken at the European Southern Observatory at La Silla from mid-February 1986. However, since the comet was seen in a moon-lit sky in the period 23 February – 8 March, special measures had to be taken to suppress the adverse influence of the bright background. Therefore, observations with the Wide-Field CCD Camera were made through narrow optical filters centred at wavelengths near the spectral emissions of the major constituents in the gaseous tail(s). The picture shows two such exposures made on 3 and 4 March through a 7 nm wide filter near 426 nm in violet light which record emission from carbon monoxide ions (CO^+). In order to show the full extent of the tail, each picture consists of two 40-minute exposures. Pixels are indicated along the edges; each pixel measures 31 arcseconds. The distance from the comet to the sun was 114 million kilometres and the comet was 182 million kilometres from the earth. The length of the CO^+ tail is more than 15 degrees or 50 million kilometres.

Major changes in the tail structure have occurred during the 24-hour interval. Note also the presence of sub-tails in the March 4 picture, pointing towards north (left). This phenomenon which was first found at ESO on 18 February is believed to be caused by matter which has been released from the comet nucleus during a series of outbursts after the perihelion passage on 9 February 1986.