significant in the innermost regions (Arpigny, 1976). The modelling of the structure of the coma indeed represents a necessary step towards the ultimate goal of the study of comets, namely the determination of the chemical composition of the basic material in the nucleus.

We have selected a number of specific observations or special problems related to this general programme and we shall outline these briefly here, grouping them according to the various instruments we used at La Silla during the post-perihelion phase of Comet P/Halley, essentially from mid-March to the beginning of June 1986.

1.5-m Telescope Coudé Spectrograph

One appreciable advantage offered by this instrument is the possibility to use a rather long slit (approximately 3.5 arcminutes) and hence to study the variation of the spectral intensity distributions over a fairly large projected distance (ϱ), a feature essential to the construction of model cometary atmospheres. Thus, radial profiles B (ϱ), i.e. the distributions of the surface brightness along a diameter of the apparent cometary disk, can be established for the various species. Assuming negligible optical thickness, which is valid in most cases, this gives also the column densities N (ϱ) and these, when compared with the profiles predicted by the models, should yield clues relevant to the production mechanisms of the observed radicals. For the same reason, possible spatial variations of the ionic emissions related to the accelerations of the carriers, OH^+, CO^+, CH^+... ("Greenstein effect") can be searched for, which may throw some light on a long-standing enigma: "bulk versus wave motions in the plasma tail". Besides, observations with this configuration will allow a direct comparison with similar spectra secured with the twin 1.5-m telescope at the Haute-Provence Observatory (HPO) on several comets, notably on Bennett (1970 II). It will also be possible to relate these observations to a series of pre-perihelion spectra of P/Halley taken by some of us at HPO from the middle of November 1985 to the beginning of January 1986.

Approximately three hours exposures, one on each night, from 15 to 18 March produced three good spectra in the blue, and one rather weak in the visual spectral region. The best spectrogramme, covering the range from the NH (0,0) band to the C_2 Swan (0,0) band is reproduced in Figure 1. The orientation of the slit was in the general antisolar direction, while the telescope was guided in such a way as to keep the central part of the comet near the sunward end of the slit. As a result, the tail emissions show up quite well and are seen over about 125,000 km. The extreme weakness of the solar radiation scattered by the dust tail also makes the identification of some of the molecular tail emissions easier than in the case of Comet Bennett, for example. Especially noteworthy are: (a) the well-known CO^+ Comet-Tail bands and several bands due to the Fox-Duffendack-Barker System of CO_2^+, indicating a CO_2^+/CO^+ ratio somewhat higher in P/Halley near r = 0.95 A.U. than in Bennett at comparable heliocentric distances; the CO_2^+ bands are $^2\pi-^2\pi$ doublets and here as in a number of other comets (see Festou et al., 1982), the 1/2–1/2 component is systematically stronger than the 3/2–3/2 component in the various bands, for some unknown reason (we have verified that this peculiar coincidence is not a Swings effect associated with the comet's orbital velocity); (b) the OH^+ (0,0) and (0,1) bands, the latter identified for the first time; furthermore, the (1,0) band of this ion may have some weak contribution near the short-wavelength edge of the NH (0,0) band; (c) the CH^+ (0,0) and (1,0) bands, a few lines of which are also seen for the first time; (d) some fairly strong ionic features at 371.48, 372.79, 410.95, 412.34, 414.59, and 416.01 nm, for which we have not found any satisfactory assignment.

Figure 2 illustrates at higher magnification a particularly rich section, 390–430 nm, from the same spectrum, where we can appreciate the remarkable spectral definition, in the CO^+ and CN bands. The quality achieved undoubtedly pleads for maintaining this instrument, which can still provide quite valuable data indeed. This material will enable us to carry out elaborate studies of the rotational intensity distributions of the various molecular bands.

1.4-m CAT, Coudé Echelle Spectrometer, Reticon

There are quite a few very important problems on which progress is possible only thanks to high-resolution observations (of the order of one hundredth of a nanometer). In this category we have chosen to try and evaluate the isotopic abundance ratio $^{12}C/^{13}C$, which was given high priority in our cooperative project.

This ratio changes depending on the degree of nuclear processing that has taken place and a wide range of values is seen in different astrophysical sites, from ~89 in the Solar System to ~25 in the Galactic Centre, down to ~5 in some late-type stars. Knowledge of its value in comets is of great interest in connection with the origin of these bodies. Now this question of how, when and where comets were formed is still a matter of animated discussions. Various hypotheses envisage that they originated within the Solar Nebula, just beyond the Uranus-Neptune zone, or further out, 10^3 to 10^4 A.U. from the centre, or at the outskirts, in associated disks or fragments of the Nebula, or else in interstellar clouds from which they were captured by the Sun. Whatever their birthplaces, the determination of their isotopic (and chemical) composition will have implications upon the history of the Solar System, upon the conditions in an interstellar cloud, or eventually even upon some of our ideas concerning star formation. That comets