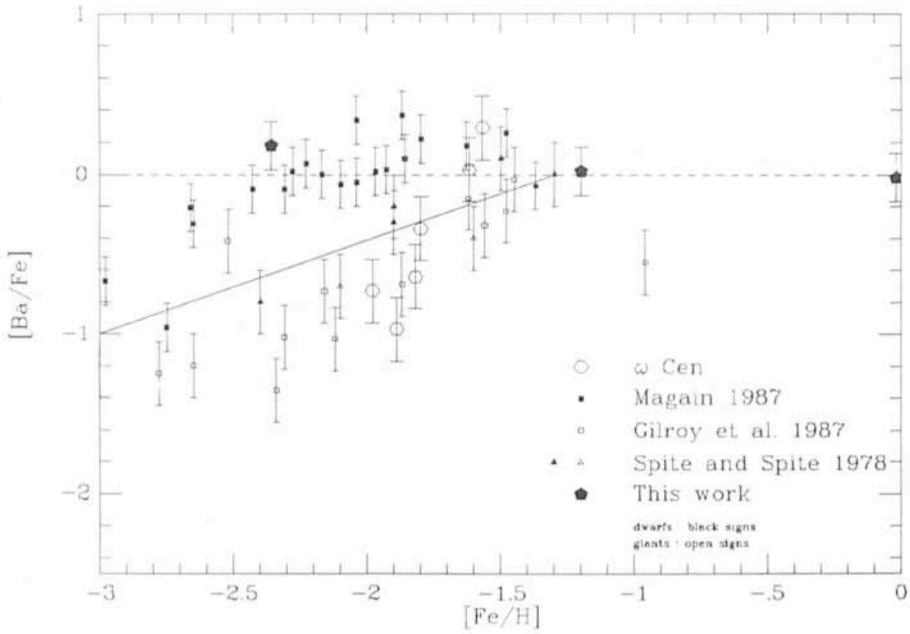

Figure 2.

laborators have observed only giants. Figure 2 shows that, for a given metallicity, the [Ba/Fe] ratio is lower when measured in giants than in dwarfs. In the same figure we have also drawn the line representative of the [Ba/Fe] versus [Fe/H] relation deduced by Spite and Spite (1978) from observations of a sample of dwarfs and giants. It is noticeable that this line separates data obtained from giants and data obtained from dwarfs. This is not surprising because this line has been deduced from a mixed sample of stars. We are quite confident that these results show that there is a systematic difference in the [Ba/Fe] determination between dwarfs and giants when we consider stars with a metallicity lower than [Fe/H] = −1.5. The difference in abundance determination can be as high as 1 dex, and this cannot be explained by stellar evolution theory.

These results are very important if one wants to compare abundances in metal poor globular cluster giants and metal poor field dwarfs. To stress this last consideration we have also plotted (in Fig. 2) the abundance determination of Ba in six ω Cen giants (François et al. 1987). These data are distributed in the "giant part" of the diagram and are a good demonstration of the importance of understanding the origin of this systematic effect. In fact, we should remember that all the detailed abundance determinations in globular clusters come from spectroscopic analysis of giant stars. For this reason we plan to go deeper into this problem, with more extensive and systematic observations of giants and dwarf stars (other elements could follow this [Ba/Fe] behaviour), and we also intend to investigate the theoretical explanations of this kind of behaviour (non-LTE effects?).

Acknowledgement

We wish to thank G. Raffi, G. Kraus and M. Ziebell for having made remote control possible and for introducing us to this new mode of working for astronomers. We are also grateful to F. Matteucci for reading the manuscript.

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CCD Observations of Comet Wilson at the ESO 1-m Telescope with a Focal Reducer

K. JOCKERS, Max-Planck-Institut für Aeronomie, Katlenburg-Lindau, F.R. Germany
E.H. GEYER, Observatorium Hoher List, Daun, F.R. Germany

Comet Wilson 1986f was discovered in early August 1986 on plates taken with the 1.2-m Schmidt telescope at Palomar in the course of the new Palomar Sky Survey. Preliminary orbital elements published by the Central Bureau for Astronomical Telegrams as early as August 11 indicated that the comet had a nearly parabolic orbit and would reach perihelion only in April 1987, more than 9 months after discovery. Therefore this comet belonged to the as yet very small group of non-periodic comets, for which it was possible to propose observations in time for the proposal deadlines. This gave us the unexpected opportunity to study, besides Comet Halley (1), yet another comet with different characteristics.

We observed Comet Wilson at the ESO 1-m telescope from April 24 until April 30, 1987. At this time the comet had just passed perihelion and was located at a declination between −70° and −77°. Being circumpolar, the comet was visible all night but it was in conjunction with the sun, i.e. went through lower culmination around midnight. Therefore the comet was always at elevations between 10° and at most

Figure 1: *The 1-m telescope with focal reducer in its unusual position to observe Comet Wilson. Two small wide-field photographic cameras are mounted on the front ring.*

40° above the southern horizon, by far not an ideal observing position. Given the fact that the comet was observable all night it seemed possible to tolerate the large zenith angle.

For the observations the focal reducer of Hoher List Observatory and the Max-Planck Institute for Aeronomy was used. This system is similar to EFOSC and consists of a lens collimator of 760 mm focal length corrected between 360 and 660 nm and, depending on the wavelength range, a blue (360–500 nm) or red (420–660 nm) camera lens system of 140 mm focal length. Instead of the previously used image intensifier we employed a CCD camera built by C. McKay, Astromed, Cambridge, UK, and a GEC 8603/B chip which had been coated for UV sensitivity with a fluorescent coating at ESO Garching (2).

The scale of the reduced image on the CCD is about equal to the scale of the ESO Schmidt telescope but, instead of the Schmidt plate of 300 × 300 mm size we are limited to the size of the CCD chip of approximately 8 × 12 mm (the optics provide a corrected field of 25 mm diameter). The effective f-ratio is f/2.8. One pixel of the GEC chip of 22 μm width corresponds to 1.6 arcsec on the sky. Two grisms of 300 and 600 grooves/mm can be placed into the parallel beam for spectral work in the visible and UV spectral ranges. Because of the small size of the CCD-chip we could not use a slit mask as with Comet Halley but had to restrict ourselves to a single long slit of 10 arcmin length across the chip. The grisms can be replaced by interference filters to provide direct images. In the blue spectral range, where most of the interesting cometary emissions are located, the interference filters serve as an order selector for a narrow-gap tunable etalon which provides images with a spectral bandwidth of 15 Å. The CCD is controlled by an HP 300 computer with a small colour terminal and 3 MByte memory. Figure 1 shows the 1-m telescope in its unusual position to observe Comet Wilson. In the telescope fork the CCD controller is visible. The optics of the focal reducer and the CCD dewar are on the "wrong" side of the telescope fork and therefore hidden from view. On the wheeled table the etalon controller can be seen. As in our Comet Halley run, two small cameras were mounted on the telescope front ring to provide overview images of the comet and slitless wide-field spectra on IIa-O plates. As we were told this was the first time that a CCD was used at the 1-m telescope.

As compared to comet Halley, Comet Wilson was a rather weak object. This is demonstrated in Figure 2 where wide-field images of Comet Halley and Comet Wilson are compared which were taken with identical equipment and exposure times. In the figure the heliocentric distances of both comets are about 1.2 A.U., but Comet Halley was at a geocentric distance of 0.45 A.U. as compared to 0.64 A.U. for Comet Wilson. During our observations Comet Wilson always displayed a thread-like ion tail and a short dust tail strongly curved towards west. Because of weather conditions only three of the six nights awarded to the project turned out to be useful. The first night was devoted to getting UV-spectra to derive ion compositions in Comet Wilson's coma. The spectra are very weak. At the end of the night we obtained a well-exposed interference filter image of the comet tail in the light of CO_2^+ at 367.4 nm. Therefore it was decided to use the etalon in the second night to study the CO_2^+ tail and the nearby continuum with increased spectral resolution as had been done

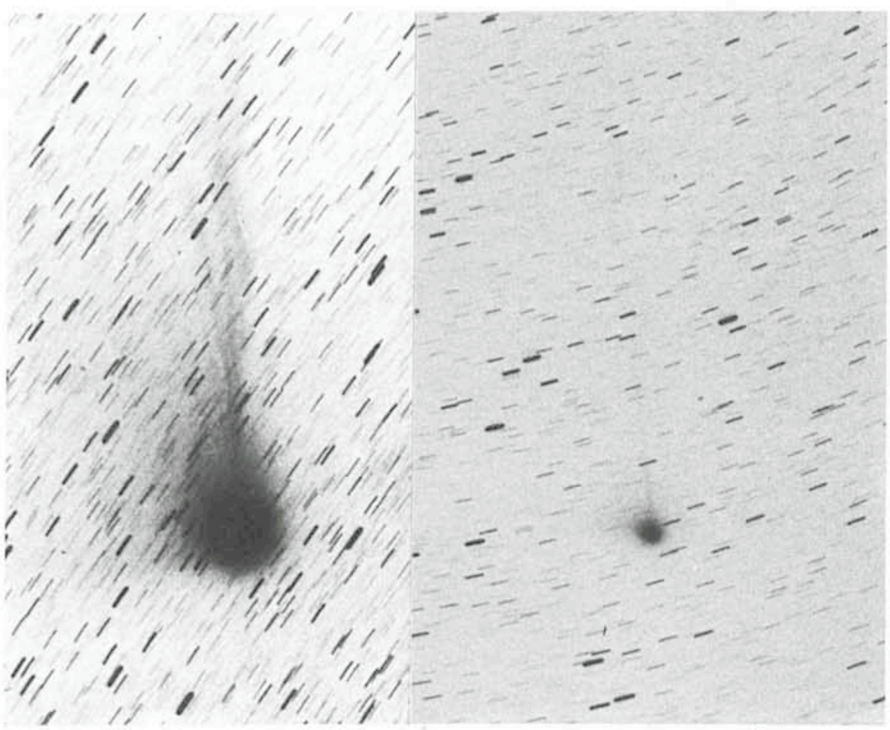

Figure 2: *Comparison of images of Comet Halley (left) and Comet Wilson (right) taken through an old Zeiss Tessar lens (f = 180 mm, f/4.5). Exposure 60 min on unsensitized IIa-O plate. Comet Halley: April 11, 1986. Comet Wilson: April 28, 1987.*

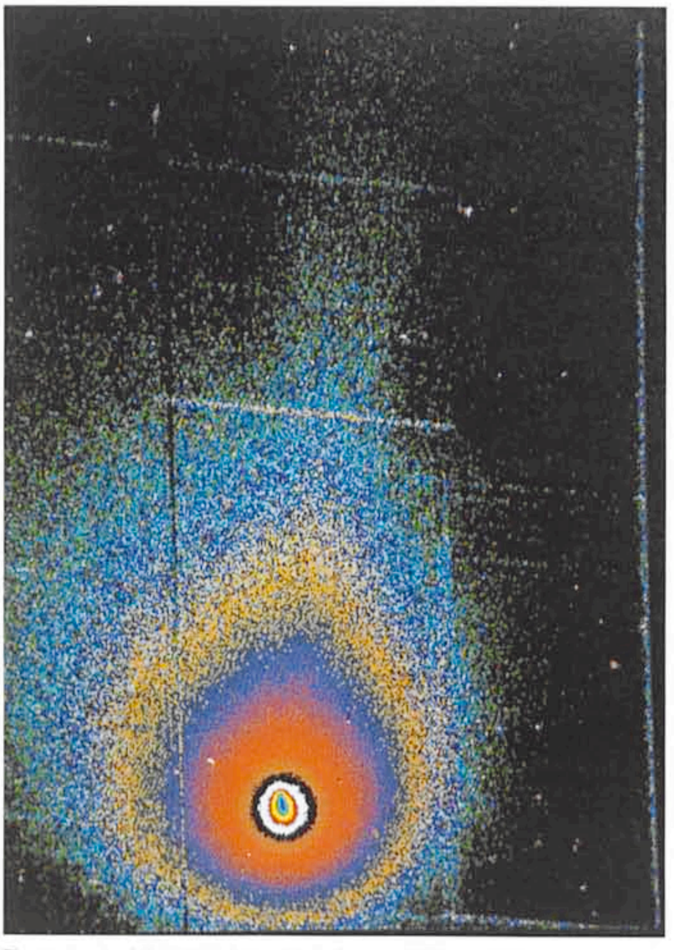

Figure 3: *A CCD raw image of Comet Wilson taken through an interference filter of 10 nm bandwidth centred at 426 nm (CO^+, N_2^+, CH^+). Exposure 30 min, April 29, 1987.*

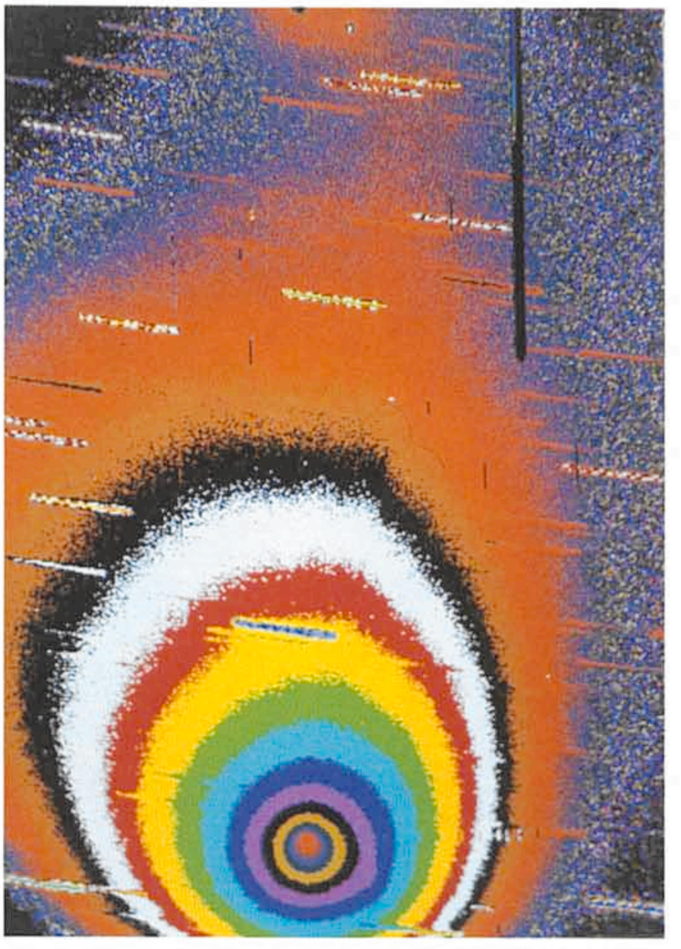

Figure 4: *A CCD raw image of Comet Wilson taken through an interference filter of 20 nm bandwidth centred at 660 nm (H_2O^+, NH_2, C_2). Exposure 5 min, April 29, 1987.*

very successfully with Comet Halley (3). Despite good transparency of the atmosphere in this night, we were unable to obtain any useful CO_2^+ images but, to our surprise, we found an N_2^+ ion tail at 391.4 nm. In the third night we used the "red" camera to record images and spectra in the range 420–650 nm. Figure 3 shows a false-colour image in the light of the CO^+ ion at 426 nm. Some N_2^+ or even CH^+ emission may contribute to the image. In this raw image each new colour represents a factor of 1.4 in the signal. The plasma tail is well visible. The dust continuum is noticeable from the elongation of the isocontours towards west (left side of figure). In Figure 4 we present an image of the comet taken through an interference filter centred at 660 nm with a bandwidth of 20 nm. Again each new colour represents a factor of 1.4. This image shows the H_2O^+ tail (O-7-O band) and a strong dust continuum. In addition, a neutral coma of NH_2 and of the $\Delta v = 3$ band of the C_2 Swan sequence fall into the filter bandpass (notice the strong intensity gradient around the nucleus). In the top of the frame a ghost image of the inner coma (scattered back from the CCD and reflected at the interference filter) appears. The spectra, which were taken with the slit intersecting the tail at right angles 5 arcmin from the nucleus, show the C_2 Swan band and some H_2O^+ lines against the background of an extensive night sky spectrum.

We would like to thank S. Deiries and S. D'Odorico for the coating of our CCD to make it UV sensitive and D. Hofstadt and his crew for their effort to find a possibility to point to the comet with our focal reducer. We appreciate help from P. Sinclaire concerning our CCD camera.

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MIDAS Memo

ESO Image Processing Group

1. Application Developments

The routines for calculating centres of stellar images have been improved by M. Ghigo to take into account the finite pixel size. This gives a significantly better accuracy for undersampled images such as direct EFOSC frames taken with a good seeing. For well exposed images a positional error of less than 0.02 pixels can be reached.

The first MIDAS version of the ROMAFOT photometry package (ref. R. Buonanno) is foreseen for the 88 JAN 15 release. Although the user input to the package differs in some respect from the original version, the MIDAS implementation will provide all basic fea-