for instance faint sunward emissions were seen in P/Halley at 1.6 A.U. after perihelion in 1910. There are also reports about jets seen in P/Halley at more than 2 A.U. preperihelion in 1985. In 1955 a distant comet discovered by Baade displayed a sunward fan or streamer (but not a jet) at almost 4 A.U. from the Sun.

The presence of a jet in comet Austin at 1.7 A.U. preperihelion is not a very rare event among comets. Still, it is to be hoped that the activity observed already at this distance will continue through the perihelion passage on April 9, so that we shall have the opportunity to admire a really bright comet this spring.

R.M. West

Photometry of Comet Austin

J. MANFROID, Institut d'Astrophysique, Cointe-Ougrée, Belgium
P. BOUCHET and C. GOUIFFES, ESO

Strömgren photometry of Comet Austin (1989 c1) has been obtained at La Silla with the ESO-SAT 50-cm telescope, between February 12 and February 25, 1990. Two diaphragms were selected, 35 arcsec and 240 arcsec, in an attempt to distinguish between the nucleus and the coma.

Whenever possible, comet photometry is done with a special set of filters isolating molecular or ionic features, or the continuum. Hence different physical and chemical characteristics can be analysed. Our observing run was dedicated to stellar photometry. The SAT telescope is permanently equipped with one of the most appropriate photometric systems for that purpose, the Strömgren one. By design this cannot be changed.

Strömgren (uvby) photometry of comets is not uninteresting, however. Figure 1 shows a spectrum of Comet Austin obtained with the ESO 1.52-m telescope by P.B. and C.G. Superimposed are schematically indicated positions of the v, b and y passbands. The y filter includes a moderately strong feature of C_2. Hence the y magnitude is not too biased towards a special molecular emission or towards the continuum. In fact it is rather well representative of the visual magnitude (V). Studies of other comets (such as P/Halley) show a difference of only a few tenths of a magnitude between y and V. On the other hand, the b and v filters include strong bands of C_3 and C_2 respectively, and can be used in a study of those molecules.

Our main purpose was to monitor the brightness variations of Austin as it neared the Sun, in order to get a more precise idea of its appearance in April and June, when it is most favourably placed for astrophysical observations. The evolution of the apparent magnitude of a cometary coma is usually written as

$$m = M + 5 \log \Delta + 2.5\, n \log r \qquad (1)$$

where M is an "absolute" magnitude (which would be observed if both r and Δ were equal to 1 A.U.). n is a parameter depending on the evolution of the comet. Obviously that law was adopted because n apears to be constant during relatively long time intervals. For most comets this parameter lies between 2 and 6. The precise value is important in order to get accurate predictions, as shown by equation (1).

The origin of the 5 log Δ term is simple. It reflects the apparent size increase of the coma, which is inversely proportional to the square of Δ, assuming no intrinsic variation. This is all right when one integrates the brightness over the whole object. But this is not what we did, we used fixed apertures and equation (1) does not hold. Let us consider two limiting cases. Firstly, the aperture is very large and contains the whole coma. Then we are back in the conditions of relation (1). Secondly, the aperture is so small that we see the peak value of the nuclear surface brightness. This maximum value is of course a constant. Hence it would show no Δ dependency. The relevant equation would be

$$m = M + 2.5\, n \log r \qquad (2)$$

We are somewhere between those two cases. Applying relation (1) we find values of 2.6 and 2.3 for n (respectively for the 35 and 240 arcsec diaphragms). Applying (2) instead, we find 3.5 and 3.0 (see Fig. 2a and Fig. 2b). We may assume that the small diaphragm magnitudes better follow law (2) (n = 3.5), and that the large diaphragm encompasses most of the coma, so that the derived magnitudes obey law (1) (hence n = 2.3). This is a very crude approximation but it tends to show that the overall integrated brightness does not rise as fast as foreseen. The predicted values around 5 were probably too optimistic. On the other hand the nuclear region seems to brighten more rapidly. This is confirmed by the telescopic aspect during the 13 days interval of our observations.

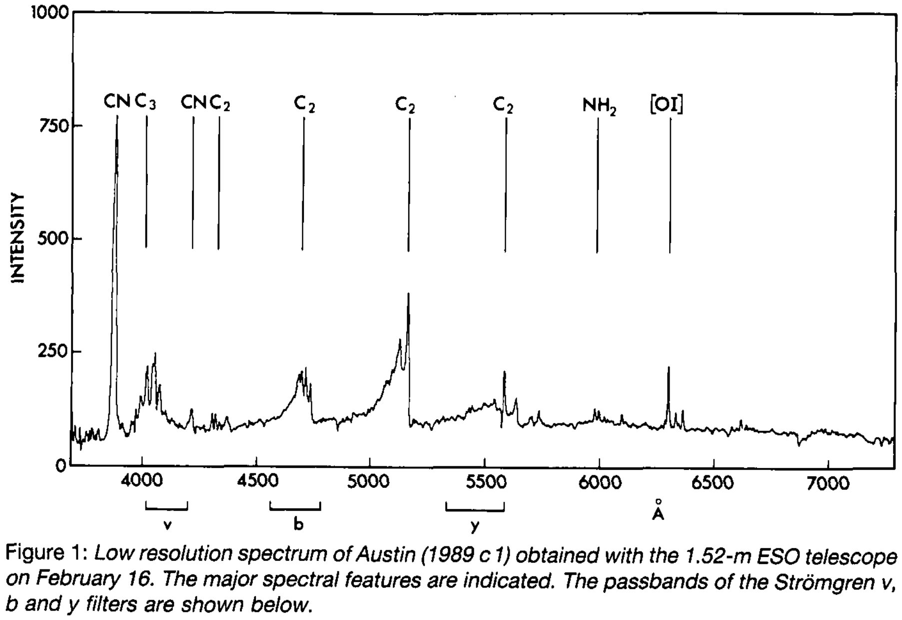


Figure 1: *Low resolution spectrum of Austin (1989 c1) obtained with the 1.52-m ESO telescope on February 16. The major spectral features are indicated. The passbands of the Strömgren v, b and y filters are shown below.*

TABLE 1. Strömgren photometry of Austin (1989 c1)

Date	u	v	b	y
Diaphragm 240 arcsec.				
Feb 13.0	10.95	10.11	8.83	8.61
15.0	10.54	10.01	8.73	8.55
16.0	10.21	9.84	8.55	8.44
17.0	10.52	10.01	8.63	8.50
18.0	10.43	9.98	8.56	8.40
21.0	10.41	9.88	8.40	8.24
22.0	10.27	9.79	8.33	8.17
23.0	10.16	9.75	8.26	8.09
24.0	10.22	9.69	8.20	8.04
25.0	10.11	9.62	8.18	8.03
Diaphragm 35 arcsec.				
Feb 12.0	12.36	11.56	11.03	10.75
13.0	12.64	11.69	11.05	10.76
15.0	12.32	11.72	10.87	10.59
16.0	12.05	11.37	10.79	10.53
17.0	12.30	11.34	10.73	10.46
18.0	12.12	11.29	10.65	10.39
21.0	11.91	11.16	10.57	10.31
22.0	12.21	11.22	10.51	10.27
23.0	11.86	11.03	10.33	10.08
24.0	11.97	11.09	10.35	10.11
25.0	11.95	10.98	10.28	10.05
Accuracy:	.15	.10	.06	.03

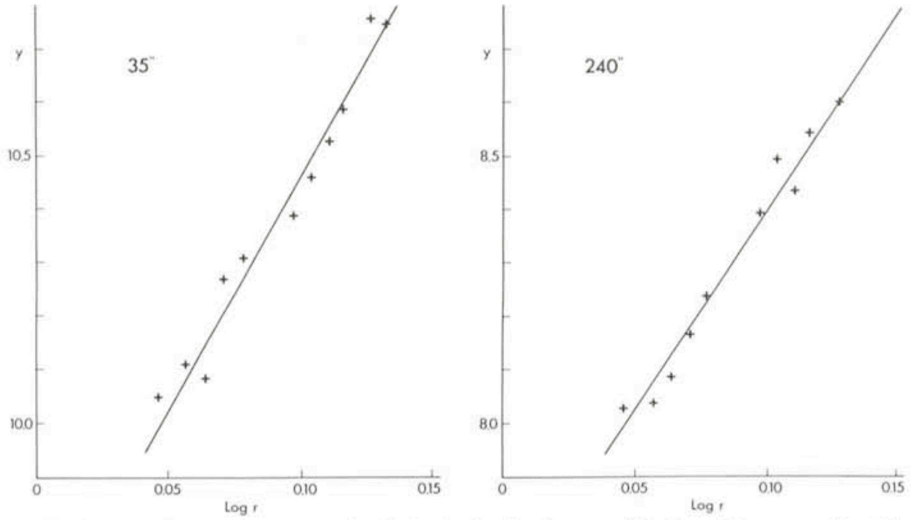
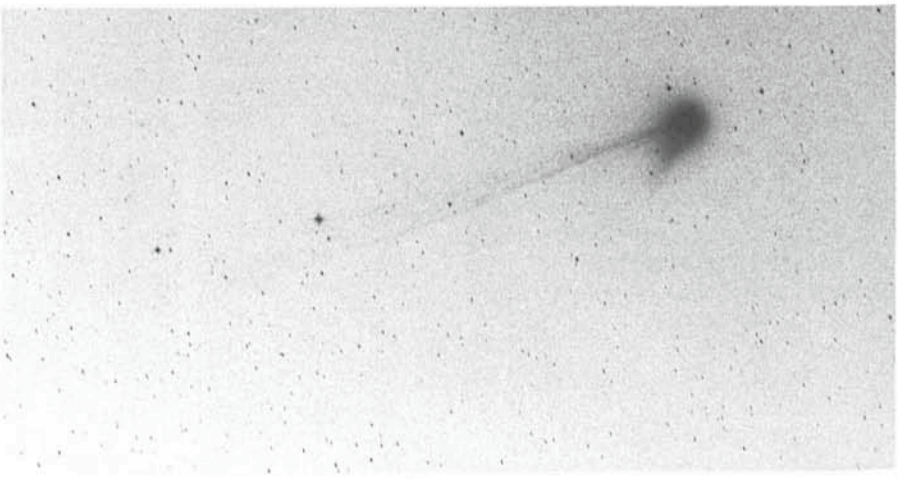


Figure 2: *Variation of the y magnitude in both diaphragms (Fig. 2a, 35 arcsec, Fig. 2b, 240 arcsec) as a function of log r. These graphs allow to derive the values of n according to law (2).*

Those conclusions are still uncertain. During that time lapse the distance comet-Sun (r) decreased from 1.36 to 1.12 A.U. while the distance comet-Earth (Δ) decreased from 1.83 to 1.69. Those relatively limited ranges do not permit a reliable extrapolation. Moreover we are neither in case (1) nor in case (2). An elaborate model of the coma would be needed to derive more appropriate laws. Unfortunately Austin will now cease to be measurable during several weeks, and we will have to wait until mid-April, when the comet moves into the morning sky, to see if it really becomes a Great Comet.

Comet Austin Develops an Ion Tail



The upper photo is a reproduction of a photographic plate, exposed 6 minutes with the ESO Schmidt telescope at La Silla in the evening of February 24, 1990 (Feb. 25.0 Universal Time). It was made on blue-sensitive emulsion during evening twilight, only 15° above the horizon. The telescope was set to follow the comet's motion; this is why the images of stars are trailed. The reproduction has been photographically amplified to bring out better the details in the faint tails.

There are two tails. The short, stubby one consists of dust particles reflecting the light from the Sun; it measures about 20 arcmin. The narrow ion tail mostly shines in the light of CN and CO_2 molecules; it is more than 2° long. It has the appearance of a double helix with at least two cross-over points and several wiggles. The shape is determined by the deflection of the electrically charged ions in the interplanetary magnetic field which is in turn influenced by the intensity of the solar wind.

The photo below was obtained one day later, on February 26.0 UT. The exposure time was now 12 minutes, but the ion tail is shorter. This indicates that the event which caused the long tail the day before, must have been transitory. Probably Comet Austin encountered a "magnetic border zone" in interplanetary space, where the magnetic field, carried by the solar wind, abruptly changed intensity and/or direction.

The plates were obtained on IIa-O emulsion behind a GG 385 filter, the observers were Hans-Emil Schuster and Guido Pizarro, and the photographic work was made by Herbert Zodet.