Predictions

The orbital computations indicate that Comet Austin appears to be a "new" comet, now approaching the Sun for the first time ever. The behaviour of "new" comets is much more difficult to predict than that of "periodic" comets who move in closed orbits and regularly pass near the Sun, like Comet Halley.

It is believed that new comets are covered by a thin layer of ices which begins to evaporate, already at a large distance from the Sun. Some of them may therefore be rather bright while still far from the Sun. However, when the deposit of ice is all gone, the brightness stalls; this is the most likely explanation for Comet Kohoutek's performance.

It remains to be seen how comet Austin will behave. In the best case it could reach magnitude −1 to −2 and rival the last bright comet, Comet West in 1976. It is perhaps more likely that it will reach magnitude 0, that is the same brightness as the brightest stars. In late April, when it is best visible from the northern hemisphere, it would then have magnitude 2, about as bright as the Polar Star. Presently, the most pessimistic predictions would put it at magnitude 2 at maximum, and 3.5 in late April.

This photographic image of comet Austin was obtained with the 40-cm double astrograph (GPO) at La Silla on February 26.0 UT. The 12-minute guided exposure shows the diffuse central area in which the cometary nucleus is surrounded by a dense dust and gas cloud. A diffuse dust tail points towards southeast (left, downwards) and the beginning of an ion tail can be discerned above it. Observers: H. Debehogne and R.M. West.

The best guess, based on the recent ESO observations, is the middle way. If that holds true, Comet Austin will indeed become a grand spectacle with a fine tail on the morning sky in late April. Since it approaches the Earth it will only fade slowly and we should be able to enjoy it all through the month of May.

But, of course, comets are notoriously unpredictable . . .!

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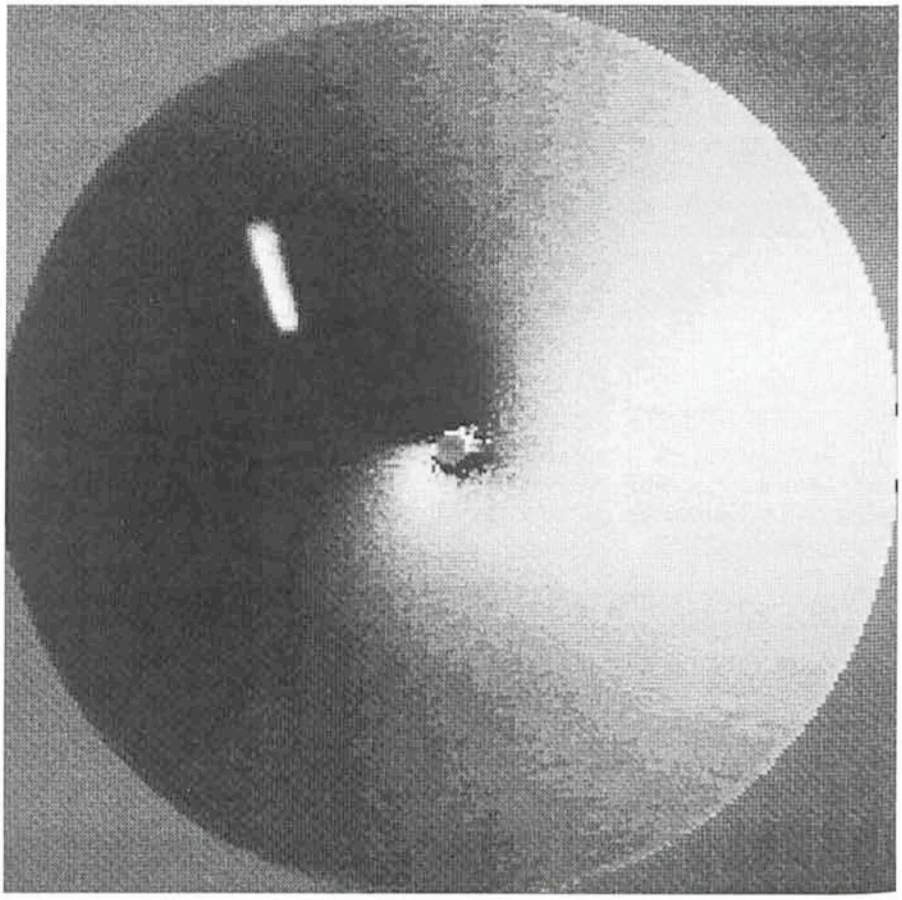
A Dust Jet From Comet Austin

On January 23, the ESO NTT was used during a short period of mediocre seeing (1.2 arcsec) to image Comet Austin. The direct, isophotal picture is shown on page 19 in this *Messenger* (where the image data are also given).

Image processing with the IHAP system at ESO Headquarters removed the symmetrical component of the cometary coma by means of the so-called radial renormalization method. The residual image, that is the asymmetrical component, clearly shows the presence of a comparatively bright, anticlockwise jet, emanating from the overexposed nucleus. It begins on the side which is facing the Sun and consists of dust particles which are released from the surface of the nucleus into space due to the heating effect of the Sun. The dust jet reflects the sunlight and can therefore be seen. On the date of exposure, the comet had not yet developed a real tail.

At this time, the comet was nearly 300 million kilometres from the Earth and at heliocentric distance 1.71 A.U. (255 million kilometres). The total magnitude was about 9.

Discrete structures have been observed in several comets at comparable or even greater heliocentric distances,



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.

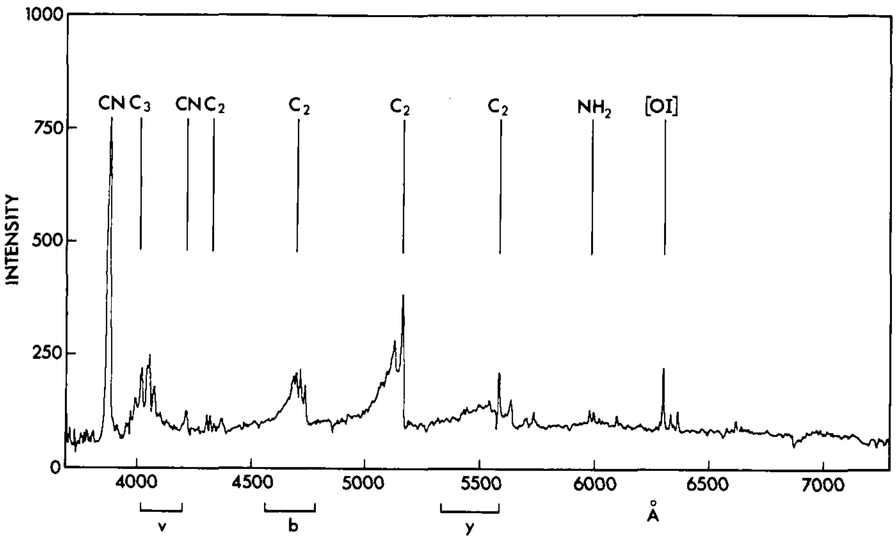


Figure 1: *Low resolution spectrum of Austin (1989 c1) obtained with the 1.52-m ESO telescope on February 16. The major spectral features are indicated. The passbands of the Strömgren v, b and y filters are shown below.*