Resolving the Fornax Globular Clusters with the NTT

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We have obtained high spatial-resolution CCD images in a night of excellent seeing of two of the five globular clusters (Clusters No. 2 and No. 3) in the Fornax dwarf-spheroidal galaxy using the NTT with the aim of extending their colour-magnitude (C-M) diagrams into their cores. The images, shown in Figures 1 and 2, were obtained with a high resolution RCA CCD (0.129″ pixel^{-1}) using EFOSC2. The average seeing (FWHM) for Cluster 3 was 0.″46 while that of Cluster 2 was 0.″58 in the Johnson V band. B band images were also taken. All exposures were of five minutes duration.

Figure 3 shows our instrumental C-M diagram for Cluster 2 based on preliminary reductions using DAOPHOT. This cluster has been resolved by NTT in both the B and V images for the first time right into the core. These data will be further improved by additional image processing to correct for regions of poor charge transfer. Even though our exposures are of only five minutes, already three times as many stars have been resolved and measured compared to the most recent published photometry by Buonanno et al. (1985) and nearly 10 times as many measured by Verner et al. (1981), both based mainly on a mixture of photographic and CCD photometry.

Our C-M diagram is sufficiently deep to reach the base of the horizontal branch and confirms the morphology of the metal-poor C-M diagrams obtained by both these authors but with a much higher degree of accuracy. Cluster 3, although observed in considerably better seeing than Cluster 2, was still not resolved to the core, but still yields a considerably better C-M diagram than has been previously done.

But what is so interesting about the Fornax galaxy globular clusters? Well, firstly, the Fornax galaxy is a dwarf spheroidal, and the only dwarf spheroidal known to contain a globular cluster system. It is therefore probably the least massive galaxy known to contain globular clusters. Five such clusters have definitely been identified (Hodge, 1961); a remarkably large number for such a low-mass galaxy. Secondly, Fornax is one of seven dwarf companions to our own galaxy and an obvious laboratory for comparing their chemical evolutions with both our own galaxy and those of the LMC and SMC.

Figure 2: *Fornax globular cluster No. 3 taken in the Johnson V band. The seeing (FWHM) was 0.″46 and the exposure 5 min. S is approximately up and E is approximately to the right. The cluster is not resolved to its core!*

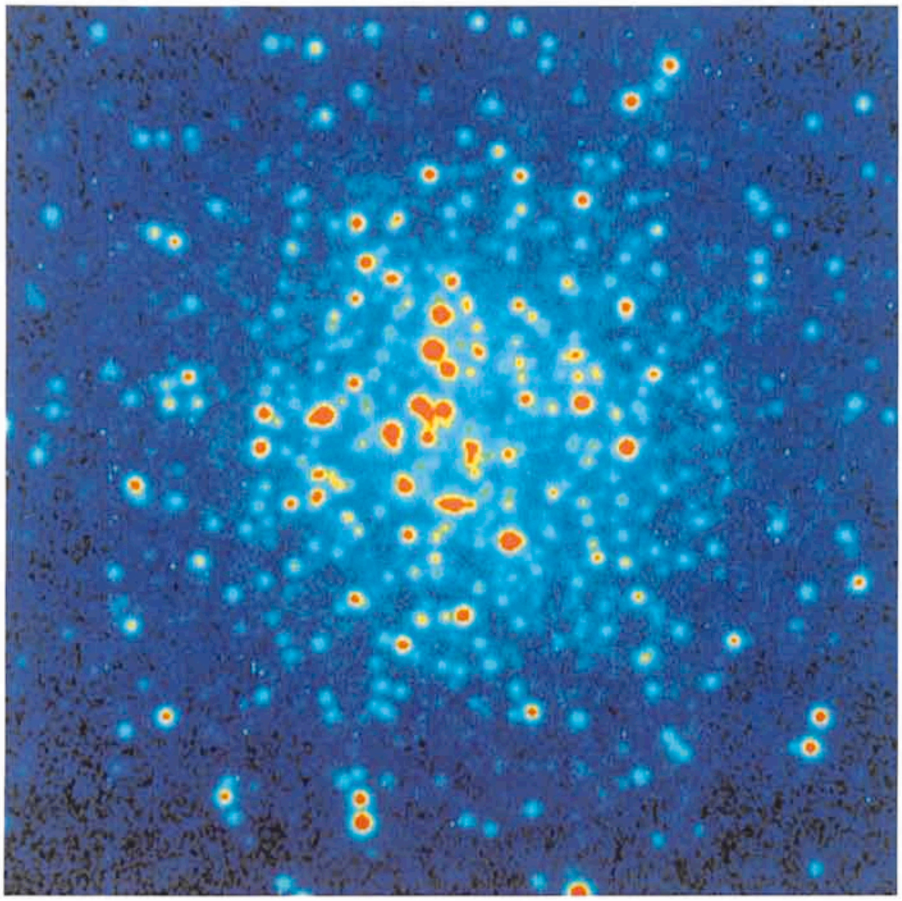

Figure 1: *False-colour CCD image of Fornax globular cluster No. 2 taken in the Johnson V band with EFOSC2 at the NTT. The seeing (FWHM) was 0.″58 and the exposure 5 min. S is approximately up and E is approximately to the right. This globular cluster is resolved to its core for the first time.*

The histories of the Fornax globular clusters are clearly complex since integrated light observations have shown that although their ages seem consistent with those of the galactic globular cluster population, their metal abundances of these clusters vary by a factor of about an order of magnitude (eg. Zinn and Persson, 1981). Moreover, there are significant mean metallicity differences between the Fornax clusters and those of the field stars. These clusters are therefore of interest and importance since they represent a sample all at the same distance but containing a large spread in metal abundance. These images also now enable us to study the structural parameters of the clusters, important for understanding their dynamical histories.

References

Buonanno, R., Corsi, C.E., Fusi Pecci, F., Hardy, E., and Zinn, R., 1985, *Astron. Astrophys.*, **152**, 65.

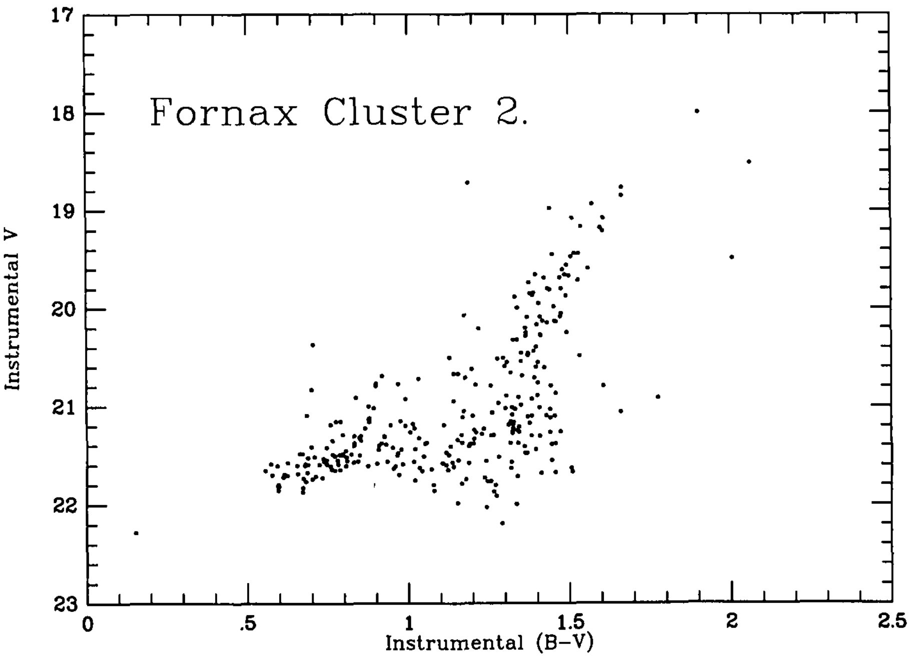

Figure 3: *Instrumental V vs B-V colour-magnitude diagram of Fornax globular cluster No. 2.*

Verner, G., Demers, S., Hardy, E., and Kunkel, W.E., 1981, *Astron. Astrophys.*, **86**, 357.

Hodge, P.W., 1961, *A.J.*, **66**, 83.

Zinn, R., and Persson, S.E., 1981, *Ap.J.*, **247**, 849.

Preparing for Comet Austin

Professional and amateur astronomers all over the world are excited about the prospects of seeing a really bright comet during the coming months. A newly discovered comet, known by the name of the amateur who first saw it, is now getting brighter each day. Observations are made almost every night at the ESO La Silla Observatory and elsewhere in order to follow the development of the comet and also to try to predict the maximum brightness which the comet will reach by mid-April this year.

Comet Austin – a Very Large Comet

When Comet Austin was discovered by New Zealand amateur Rodney R.D. Austin on December 6, 1989, it was already obvious that it must be an unusually large object. At that time the comet was still more than 350 million kilometres from the Sun and yet it was so bright that it was seen as an 11th magnitude object (that is, 100 times fainter than what can be perceived with the unaided eye).

More observations were soon made, establishing the comet's orbit and it was found that it will pass through its perihelion (the point of its orbit where it is closest to the Sun) on April 9, at a distance of about 53 million kilometres, inside the orbit of Mercury, the planet closest to the Sun.

Thereafter it will move outwards again and, by good luck, it will come within 36 million kilometres of the Earth on May 25. It will be well situated in the sky for observation from the northern hemisphere after April 20, when it can be seen low above the north-west horizon, just after sunset, and even better above the north-east horizon, shortly before sunrise. It is expected that Comet Austin will then have developed a tail which should be easily observable and provide spectators with a grand celestial view.

How Bright Will Austin Become?

One important question worries the astronomers. How bright will Austin actually become? Will it – according to the most optimistic predictions – become as bright as the brightest stars in the sky? Or will it "stall", much short of this goal, like the ill-famed Kohoutek comet in 1974?

At the centre of a comet is a "nucleus", a big chunk of ice and dust, with a diameter from a few hundred metres to several tens of kilometres. The diameter of the nucleus of Comet Halley was about 15 kilometres and that of Austin appears to be even larger. When cometary nuclei come close to the Sun, their surface ices evaporate due to the intense solar light. A surrounding cloud is formed – it is known as the "coma" – and also a tail that points away from the Sun.

A comet's brightness is determined by the amount of gas and dust in this cloud which in turn depends on the rate of evaporation from the nucleus. This rate is very unpredictable and accordingly, so is the comet's brightness. When theoretical predictions are uncertain, only observations can (perhaps) yield an answer.

Observations at ESO

For this reason, observations of Comet Austin have been carried out by ESO staff astronomers at the La Silla Observatory during the past months.

In concordance with observations elsewhere, a preliminary conclusion is that Comet Austin does have a good potential to become bright, but also that its current brightening, as it comes closer to the Sun, is "running slightly behind schedule". This is based on accurate photometric observations, carried out with the automatic Danish-SAT 50-cm telescope, accurately measuring the rate of brightening from night to night (see the article on page 55).

On the other hand, spectra of Comet Austin, obtained with the 1.52-m spectrographic telescope at ESO in mid-February, already show the strong emission of many different gas molecules in the coma cloud around the nucleus. Direct images from the 3.5-m New Technology Telescope in late January also showed a strong jet of dust particles, emanating from the nucleus. These observations clearly indicate that the evaporation process is well under way.

Finally, and rather significant, is the recent detection of a long tail of ions (electrically charged atoms) stretching more than 2 degrees in the direction away from the Sun. It was first seen on a photographic plate obtained with the ESO 1-m Schmidt telescope on February 25 under difficult observing conditions in the evening twilight, low above the horizon. A reproduction of this plate is shown on page 56.

However, another Schmidt photograph, obtained the day after, showed a much shorter tail. Thus the one seen on the photo was of brief duration and was probably caused by momentary interaction with a burst of rapid particles in the solar wind, not unusual at this time of maximum solar activity.