762. M. Bersanelli, P. Bouchet and R. Falomo: JHKL' Photometry on the ESO System: Systematic Effects and Absolute Calibration. *Astronomy and Astrophysics.*
763. Bo Reipurth: Herbig-Haro Objects. Review presented at the NATO Advanced Study Institute "Physics of Star Formation and Early Stellar Evolution", held in Crete, June 1990.
764. Non-Thermal Excitation of Helium in Type Ib Supernovae. *Astrophysical Journal.*
765. B.J. Jarvis and R.F. Peletier: The Core of M87: New High Spatial-Resolution Kinematic Measurements. *Astronomy and Astrophysics.*
766. E.J. Wampler, J.-S. Chen and G. Setti: Has Interstellar [Fe x] been Detected in the Spectrum of SN 1987 A? *Astronomy and Astrophysics* (Research Notes).
767. F. Bertola, M. Vietri, W.W. Zeilinger: Triaxiality in Disk Galaxies. *Astrophysical Journal, Letters.*
768. S. Djorgovski, G. Piotto, E.S. Phinney and D.F. Chernoff: Modification of Stellar Populations in Post-Core-Collapse Globular Clusters. *Astrophysical Journal* (Letters).
769. W.C. Saslaw and P. Crane: The Scale Dependence of Galaxy Distribution Functions. *Astrophysical Journal.*
770. P.A. Shaver: Radio Surveys and Large Scale Structure. To be published in *The Australian Journal of Physics.*

Technical Preprint

27. J.M. Beckers: Blind Operation of Optical Astronomical Interferometers: Options and Predicted Performance. *Experimental Astronomy.*

The Striking CMD Features of the Very Metal-Rich Globular Cluster Terzan 1

S. ORTOLANI, Osservatorio Astronomico di Padova, Italy
E. BICA, Universidade Federal do Rio Grande do Sul, Brazil
B. BARBUY, Universidade de São Paulo, Brazil

The region of the Galactic centre is known to have some high metal-content globular clusters (e.g., Ortolani, Barbuy and Bica, 1990, OBB90). Recently, we have started a programme to study such peculiar, generally obscured clusters, interested mostly in the high-metallicity effects on the colour-magnitude diagrams (CMDs) morphology. Such studies can bring valuable information on the evolutionary paths of metal-rich stars, blanketing effects, and to establish their connection with metal-rich populations in bulges of galaxies.

Only little information is so far available for these clusters because, for such studies, it is necessary to observe under excellent seeing conditions, due to the crowding of fields. The extension of the photometry to long wavelength bands, such as I and Gunn z, is required in order to minimize the absolute, as well as the differential reddening influence.

In our previous study of NGC 6553 (Barbuy, Bica and Ortolani, 1989; OBB90), we already revealed peculiar features in the CMDs, as for example the turn-over of the red giant branch (RGB) and its faint tip, due to high opacity in the cooler giants. Now the study of the globular cluster Terzan 1 (ESO 455-SC 23) at only 2.6° from the direction of the Galactic centre reveals a more extreme case. Terzan 1 is a compact cluster, as shown in a V CCD frame taken at the Danish telescope (Figure 1). The

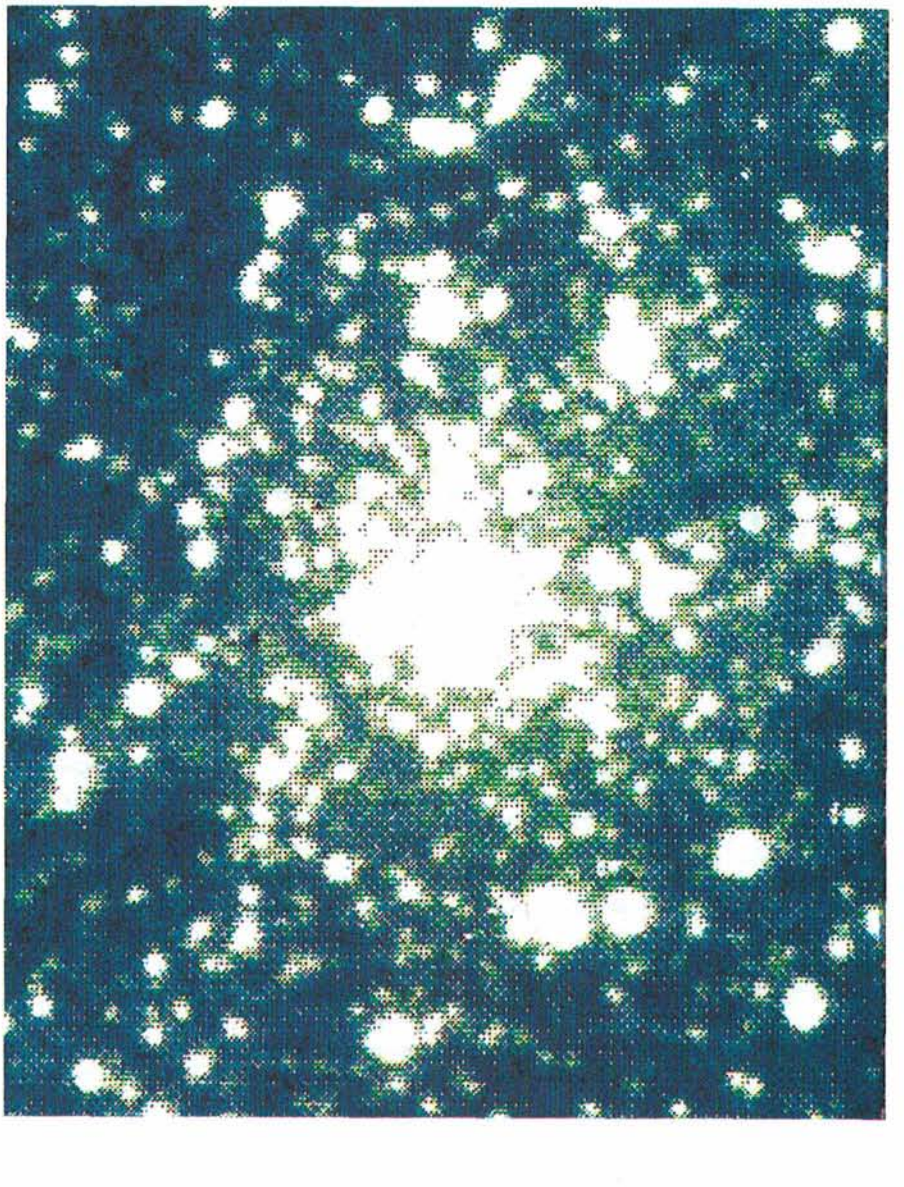

Figure 1: *V CCD frame of Terzan 1.* ▶

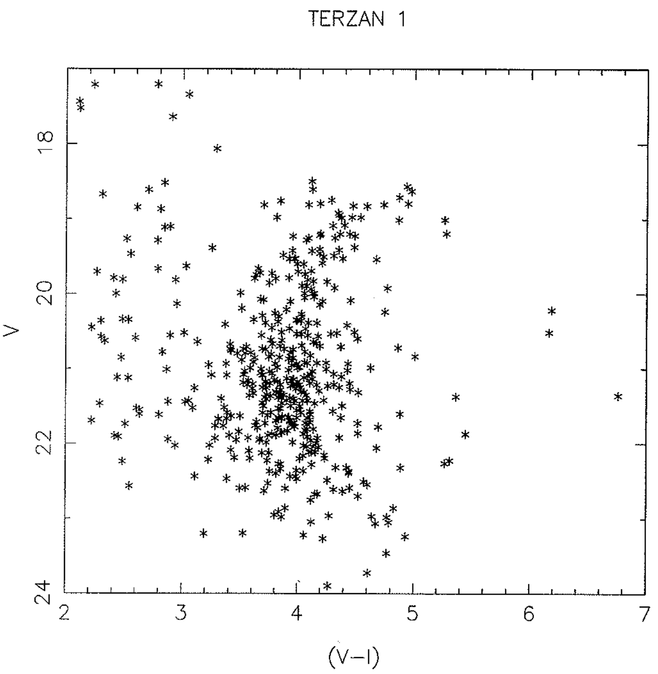

Figure 2: *Whole frame CMD in V vs. (V-I).*

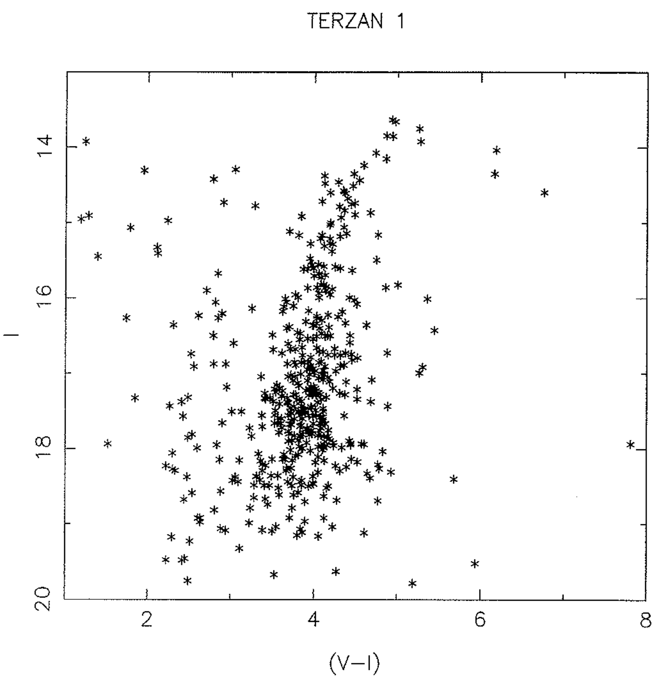

Figure 3: *I vs. (V-I): circular extraction of 0.8 arcmin.*

only information available for this cluster is based on the integrated infrared photometry of Malkan (1982), which suggests a very high reddening and very high metallicity.

Colour-Magnitude Diagrams

We observed Terzan 1 in June 1990 at the Danish 1.54-m telescope, under good seeing conditions (≈ 1″) in BVRI and Gunn z colours. The CCD was the RCA ESO # 5, which has a high sensitivity in the near-infrared. We show in Figure 2 the whole frame CMD in V vs. (V-I). Notice the pronounced blue main sequence on the left part of the diagram. This corresponds to projected disk stars on the cluster direction, since the cluster is located less than 1° from the Galactic plane. The concentration of points on the right side of the diagram defining a tilted strip appears to be an extreme case of Horizontal Branch (HB) morphology in metal-rich globular clusters.

This diagram V vs. (V-I) shows a Red Giant Branch (RGB) turn-over which is more pronounced than that of NGC6553 (OBB90). The RGB tip goes below the HB level, clearly fainter than in the case of NGC6553, indicating a stronger blanketing due to a higher metal content. The "horizontal" branch itself is very peculiar: it is tilted, quite elongated crossing over the RGB.

In the following figures we present CMDs from a circular extraction of 0.8 arcmin around the cluster centre, in order to minimize field contamination. The I vs. (V-I) diagram (Fig. 3) shows a more compact HB which, however, still extends beyond the RGB on the red side. The RGB in Terzan 1 has a more pronounced curvature than that of NGC6553, and is as well more extended, although this extension relies on few stars. Also the above evidences point toward a higher metallicity for Terzan 1 with respect to NGC6553. There

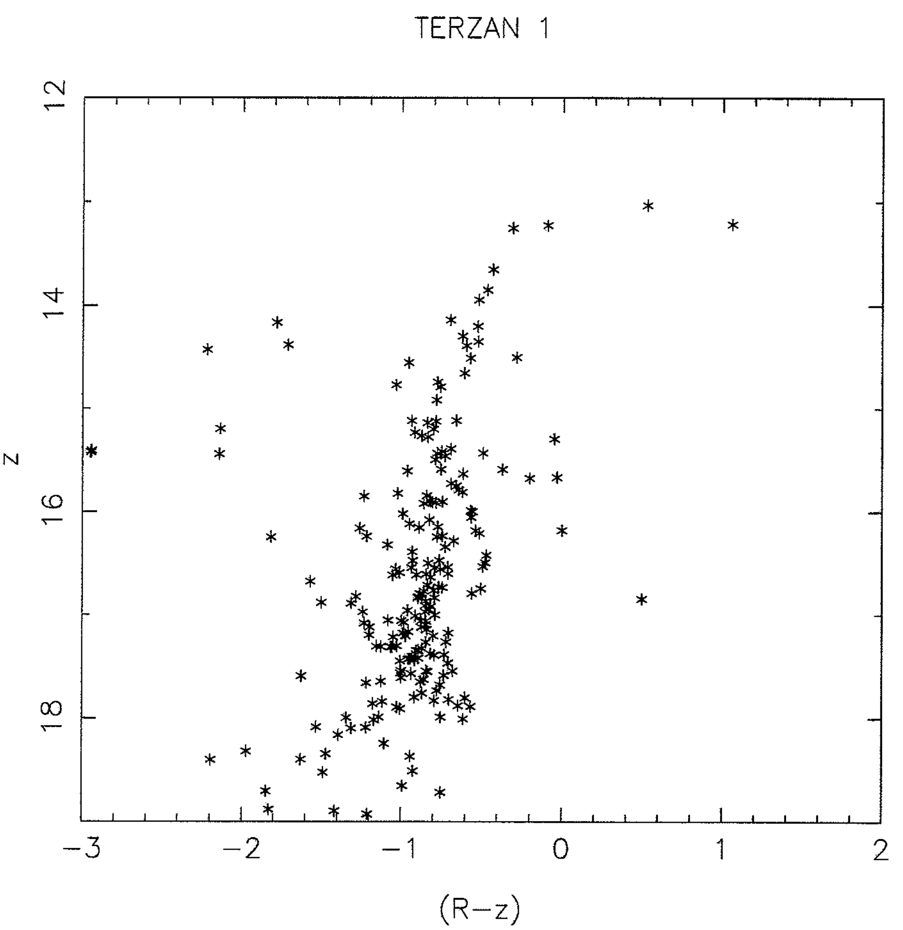

Figure 4: *z vs. (R-z): circular extraction of 0.8 arcmin. The z colour is not calibrated due to a lack of reference data.*

is no other known example of such extreme behaviour. In a corresponding diagram for NGC 6553, the RGB is flat near the tip (OBB90).

A new experiment was attempted using the Gunn z band (effective wavelength λ_e = 8900 Å), which is close to the red limit reachable with the CCD. In this band considerably less blanketing and reddening are expected. The diagram z vs. (R-z) – Figure 4 – shows little spread at the SGB and RGB, and a flat RGB tip. It is interesting to note the peculiar HB crossing the RGB and showing an extension to the red side.

Distance and Reddening

We estimate the reddening using NGC 6553 as reference (OBB90). From the usual position of the HB in metal-rich clusters (the stubby red clump to the left side of the RGB), we derive E(V-I) = 2.38 which corresponds to E(B-V) = 2.04, one of the largest so far found for globular clusters. This implies that the cluster is located at d ≈ 5.2 kpc from the Sun and about 3.6 kpc from the Galactic centre, therefore another genuine bulge (and "disk") globular cluster. This reddening value is considerably higher than that obtained by Malkan (1982) from integrated properties.

These reddening and distance estimates are however conservative values, because we are taking intrinsic values of HB position from nearby solar-metallicity clusters. For the above discussed reasons, we are probably dealing with a more extreme metallicity case, and consequently stronger blanketing effects could play an important role.

Conclusion

The interesting CMD properties of Terzan 1 place this cluster as the best candidate for stellar studies, in order to make the link with the nuclear stellar populations in the massive galaxies.

References

Barbuy, B., Bica, E., Ortolani, S.: 1989, *The Messenger* **58,** 42.

Malkan, M.: 1982, in *Astrophysical Parameters for Globular Clusters,* eds. A.G.D. Philip, D.S. Hayes (Schenectady: Davis), p. 533.

Ortolani, S., Barbury, B., Bica, E.: 1990 *AA* **236,** 362.

Deep Hα Survey of Gaseous Emission Regions in the Milky Way and the Magellanic Clouds

PH. AMRAM, J. BOULESTEIX, Y.M. GEORGELIN, Y.P. GEORGELIN, A. LAVAL, E. LE COARER and M. MARCELIN, Observatoire de Marseille, France

M. ROSADO, Mexico Astronomical Institute, Mexico

1. Introduction

The aim of this survey is to obtain the radial velocities of the ionized gas and the structure of the southern H II regions in our Galaxy and in the Magellanic Clouds.

The spiral structure of our Galaxy can be studied through young stars, individual H II regions and CO molecular clouds; the selection of giant regions similar to those observed in external galaxies allows to draw more precisely the spiral pattern. A first detailed model, with four spiral arms, has been established (Georgelin and Georgelin, 1976) from the distances of exciting stars and from H II regions radial velocities (Hα and radio recombination lines). Recent radio-recombination-line surveys by Downes et al. (1980) and Caswell and Haynes (1987) have confirmed and expanded this four-arm pattern. The CO surveys made by Columbia University, Stony Brook and Sydney teams show that the giant molecular clouds follow the same spiral arms. In spite of all these agreements this large-scale distribution of ionized hydrogen remains imprecise and complementary observational data are needed. Moreover, the distances are a fundamental parameter for physical studies of interstellar matter; they di-

Figure 1: *The 36-cm telescope of the HαSurvey at La Silla. Assembled and tested on the sky at Marseille Observatory in April 1989, it was installed at La Silla in October 1989. Its shelter, built by ESO, has a sliding roof, and an adjacent room has been added to accommodate the data-acquisition and visualization system. Below the main tube one can see two small refractors: one is equipped with a small CCD camera for guiding and the other one with a normal eyepiece for field identification. Prominent at the lower part of the instrument are the bright cryostat containing liquid nitrogen for cooling the photocathode of the Photon-Counting Camera (dry nitrogen circulates inside the pipes to prevent frost formation on the photocathode) and the High-Voltage power supply (black box).*