A New Large Arc Revealed by Early NTT Images

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The international effort devoted to the search for gravitational arcs has recently been reviewed by B. Fort (1991) in Hamburg. About 10 clusters with at least one "large" arc (length > 10") are reported.

The cluster presented here was detected as an X-ray source of $3.16 \cdot 10^{-13}$ ergs $cm^{-2}s^{-1}$ by the Imaging Proportional Counter on board of *Einstein Observatory*, and was identified with a faint cluster of galaxies by Gioia et al. (1984, Second Medium Sensitivity Survey). Its optical position is RA = 03 02 44.6, Decl. = +16 58 28.0. Images show a very rich cluster with two large galaxies, a morphology which is roughly similar to that of Abell 370. I reobserved this cluster between November 1989 and January 1990 with the NTT. Such a northern cluster was observed from La Silla because at that time the NTT field rotator was still under testing.

Eight images were obtained in V and R, with two different CCDs mounted on EFOSC 2 (Melnick et al., 1989): the RCA No. 5 which has pixels of 30 μm giving a scale of 0.26 arcsec/pixel and a Thomson low-noise CCD with pixels of 19 μm. Images were taken at various position angles. They were corrected for flat field using master flats built up with images taken during the same night, aligned, rescaled and coadded at fractional pixel value. The central part of the final image is shown in Figure 1. There is a faint halo, well visible in R, around the two brightest galaxies. Approximately at mid-distance from these objects is a faint filament. Perhaps the first idea when looking at this image is that of a shock surface between the halos of two large colliding galaxies. Another possible explanation is gravitational lensing of a faint (V > 24.5) background object. Simple gravitational models with two potentials predict well the orientation of a nearly straight arc at this location. If this is a genuine gravitational arc, the amplification would be of the order of 15, presenting a rather unique chance to obtain a spectrum of an otherwise ~25th magnitude galaxy.

Rich clusters are slowly starting to play a role of gravitational telescope for the investigation of the remote population of galaxies. They discriminate the gravitationally lensed arclets from other extragalactic faint objects, although any arclet may be an elongated cluster member. Assuming that the arclets are amplified objects, the exposure time for acquiring a spectrum is shorter than for the source object. Most of the arclets, however, are still beyond reach of present-day spectroscopy. Finding large arcs, i.e. with large amplification, is probably a unique way of shortening by a factor of 5 or more the exposure time needed for spectroscopy of these otherwise very faint objects.

Deep photometric surveys of galaxies have shown that the number-galaxy counts in I are close to non-evolution models (Tyson, 1988). Counts in B and U, however, have a much steeper slope that can only be accounted for with some form of evolution (Shanks et al., 1984, Metcalfe et al., 1987, Tyson, 1988, Majewsky, 1989). At faint magnitudes the difference in slope between number counts in B and I translates into an increasing fraction of blue objects. In the past three years, interest in this population has increased enormously, but the redshift distance of these objects and the nature of the blue population are still unknown. An open question is why this blue population seems to have disappeared today. Were they compact AGNs? Extended objects with nuclear or extranuclear star formation? Mergers? Did they disappear after an initial starburst (Cowie et al., 1991)? Did they merge to form the present-day giant galaxies (Guiderdoni and Rocca-Volmerange, 1991)?

Very good deep images, selected among the best taken during the commissioning period of the NTT, show that at magnitudes between V=22 and V=24, the very blue objects do not belong to a single population (Giraud, 1991); there is (a) a class of compact objects surrounded by a nebulosity, (b) a class of irregular objects with probable isophote distortions at the limit of reso-

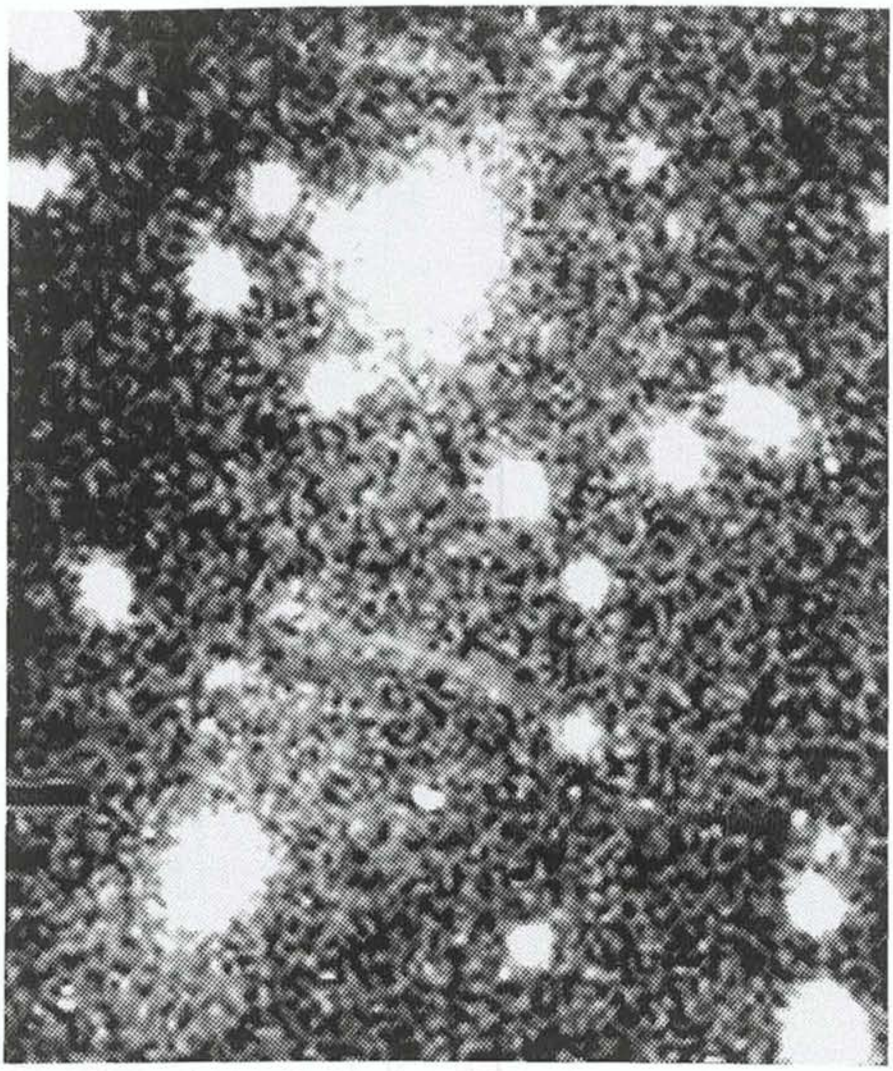

Figure 1: *The central region of the X-ray cluster CL0302+1658 at z=0.4 showing the two main galaxies, a weak halo, and a filament of 20" approximately, which might be either a gravitational arc or a feature related to the intracluster medium.*

lution and (c) double or multiple systems. It is for example possible that nuclear activity, chaotic star formation and merging are responsible for the blue colours in compact, irregular and multiple systems, respectively. Spectra of blue, low-surface-brightness arcs will provide us with the redshift distance of these objects and possibly with some indications of their physics.

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Diffuse Bands and Peculiar Interstellar Clouds

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1. Introduction

The Diffuse Interstellar Bands or DIBs, as they are usually called, are absorption features which are generated in the interstellar medium by a still unidentified set of carriers. The DIBs were firstly mentioned by Heger (1921), while their stationary character and their interstellar origin was confirmed by Merrill (1936). The most extensive survey has been published by Herbig in 1975, on the basis of photographic plate spectra: he reported 39 DIBs in the spectral range 4400–6700 Å, 24 of which were observed for the first time. By now six more DIBs have been discovered beyond 6700 Å.

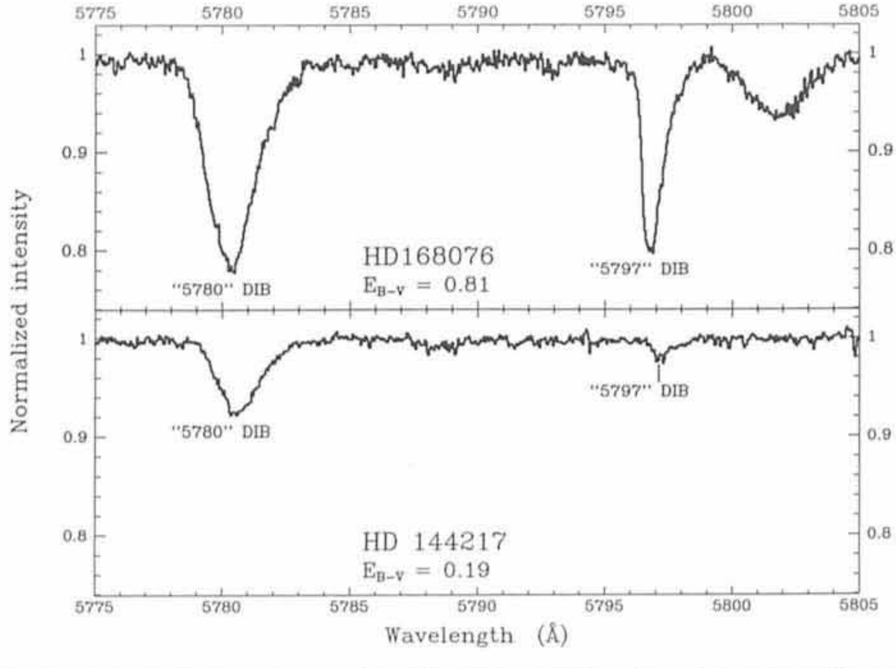
During the past years the interest for the DIBs has grown considerably, particularly because the new observing techniques and the improved quality of the spectra allowed a deeper analysis of their profiles, highlighting more and more details on their behaviour and therefore making them an interesting candidate as markers of the physical and chemical status of the interstellar medium. However, in spite of the higher resolution and the excellent high S/N ratio which can be obtained from modern spectrographs coupled to CCD detectors, the nature of the carriers of the DIBs remains a mistery: their long lasting challenge may indeed be among the reasons for the continuing interest in them. Comprehensive reviews on the DIBs' topic, together with extensive bibliography, have been published by Bromage (1987) an Krelowski (1989).

In this short paper we discuss our approach to the study of these interstellar features and present some of the results we have obtained so far.

2. DIBs: What Do We Know?

The most recent high-quality (high resolving power as well as very high signal-to-noise ratio) observational data (Snell and Van de Bout 1981, Massa et al. 1983, Seab and Snow 1984, Krelowski and Walker 1987, Westerlund and Krelowski 1988, Benvenuti and Porceddu 1989, Crawford 1990, Le Bertre 1990, Porceddu et al. 1991), and the parallel theoretical studies (Douglas 1977, Van de Zwet and Allamandola 1985, Léger and d'Hendecourt 1985, Allamandola et al. 1989, Cossart-Magos and Leach 1990) allow us to define some constraints on the DIBs' problem:

- the presence of DIBs is *related* to the colour excess, in the sense that the lack of reddening implies the absence of the DIBs: but the DIBs' intensity along one line of sight is only loosely correlated to the value of the



Figures 1 a and b: *The intensity ratio of the DIBs 5780 and 5797 and its variation along different lines of sight.*