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A Study of T Tauri Stars and Li-Rich Giant Star Candidates

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We have recently started a programme to analyse low veiling T Tauri stars. Earlier work was done on the basis of data obtained in 1986 by U. Finkenzeller (Finkenzeller and Basri, 1987) at the 3.6-m ESO telescope, while we computed synthetic spectra of molecular bands (Batalha, Gregorio-Hetem and Barbuy, 1992).

We are now studying T Tauri stars listed in the paper by Gregorio-Hetem et al. (1992) who used the IRAS Point Source Catalogue to select candidates to be T Tauri stars by means of special colour criteria. These candidates were systematically observed in the Laboratório Nacional de Astrofísica (LNA), Brazil, in the Hα + Li wavelength region. We also used the 1024×640 ESO # 9 CCD and the short camera at the 1.4-m CAT telescope to observe a few T Tauri stars in various wavelength ranges. In particular, we observed Henize 1, a high galactic latitude T Tauri star, located far from any star-formation site; one of the interests of the LNA survey is to look for isolated groups of T Tauri stars, like the TW Hya group (de la Reza et al., 1989).

In these studies, we intend to compute molecular bands and contribution functions to better understand the atmospheric structure of these stars, to better define stellar parameters and to understand, for example, the reasons for their high Li-abundances (in some cases higher than in the ISM).

Another interesting object we observed is CPD $-55°$ 395, located close to Hen 1, a Li-rich metal-poor giant. In order to learn whether this star, which shows a strong Li line and Hα and [OI] lines in absorption, might be a post T Tauri star or a Li-rich giant, we observed it in several wavelength ranges and carried out a detailed analysis. We have obtained its parameters, [Fe/H] ≈ -1.0 and ^{12}C:$^{13}C \approx 10$, i.e. typical of an asymptotic giant branch (AGB) star. It shows a Li abundance of log ε(Li) $\approx$ 1.3. If its AGB nature is confirmed, then this Li abundance must be considered very high. H. Lindgren measured the radial velocity with Coravel and found V^r = 71 km s^{-1}, at the lower limit of what can be considered a halo star.

In order to better understand Li-rich giants, we have plotted the IRAS colours of the Li-rich giants given in the literature: the result is that they are indeed confined in a small range of colours. Further studies may indicate the possible cause of the Li enrichment in these stars, and the evolutionary stage where this occurs. This might allow us to understand the Li-enrichment in our Galaxy. We recall that a controversy exists concerning the identification of the cosmological lithium abundance and the population I or population II stars measurements. If the population II value of log N(Li) ≈ 2 (Spite and Spite, 1982) represents the cosmological value, a model is necessary to explain the values of log N(Li) ≈ 3 found in disk population I stars (Boesgaard and Steigman, 1985), which means an enrichment of a factor 10 between the two populations. These Li-rich giants are perhaps the Li enriching agent in the Galaxy.

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IR Stellar Photometry in Globular Clusters Using IRAC2

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1. Introduction

Globular clusters represent the *oldest, simple* population in galaxies. Hence, the study of their properties yields crucial information on the early evolutionary phases of the parent galaxy. Moreover, they are the best *laboratory* to study stellar evolution and one of the most powerful tools to grasp basic cosmological problems, like for instance the definition of the distance and time scales.

In fact, on the one hand, the detailed comparison between stellar evolutionary tracks and observed colour-magnitude (c-m) and colour-colour (c-c) diagrams allows us to check the reliability of the theoretical models (which actually are the engine of the *stellar clock*) and, on the other, the correct measure of the turn-off luminosity of the main sequence in individual clusters which is the crucial item to determine precisely their ages and, thus, to put significant constraints to the age of the Universe.

The availability of infrared (IR) magnitudes may be extremely useful in this task, particularly if combined with optical data. For instance, the V-K colour is an excellent indicator of effective temperature (T_{eff}), being relatively insensitive to metallicity and having a long wavelength baseline. Besides, extinction is much lower in the IR than in the optical bands. Finally, in the IR the contrast between stars to measure and the unresolved background is different and in particular, for stars populating the giant branch, is greater than in any optical region.

Though the significant advantages of observing individual globular cluster stars in the near IR are well known for many years (see for references Frogel et al., 1983), the technical limits intrinsic to the available detectors (single-channel aperture photometers) have unfortunately restricted in the past the observations to a few bright stars in the external regions of a small sample of clusters (Frogel et al. 1983, Arribas *et al.* 1991 and references therein).

The recent introduction of the IR arrays has opened new perspectives. In particular, the availability of new cameras, based on 256 × 256 arrays having pixel sizes and performances close to those of optical CCD's, will surely exploit soon the great potential impact of IR observations of large samples of globular cluster stars.

We present here the main outlines of our global project and the first results of a photometric survey of Galactic globular clusters started with IRAC2, the new

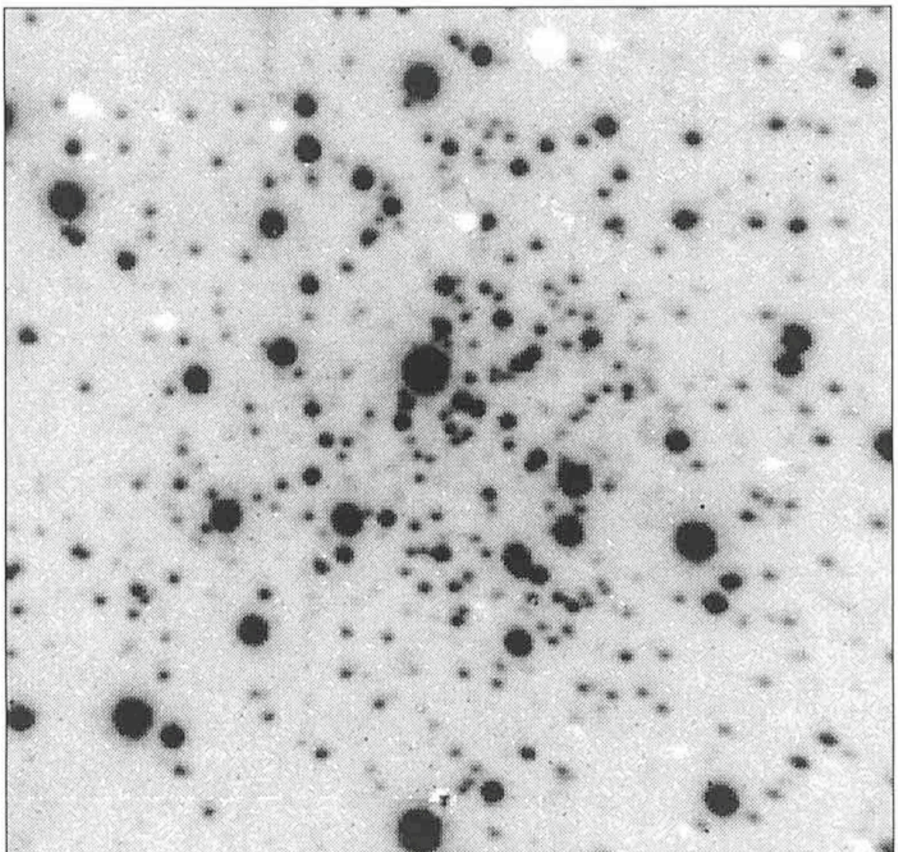

Figure 1: *M69 Central Region as observed with IRAC2, 0.27"/px mode, field size ~70×70".*