

# CCD PHOTOMETRY OF THE YOUNG OPEN CLUSTER NGC 1962-65-66-70

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The group of stars situated in the region of the nebulosities called NGC 1962-65-66-70 (named also N144) was observed photoelectrically at La Silla in *BVRI* with a CCD. The analysis of the data indicates that all stars belong to a unique cluster with a main sequence up to  $V = 12$  mag. The brightest stars are of O spectral type. There are also 2 Wolf-Rayet stars and 2 supergiants of spectral types F and M, respectively. With the distance of the Large Cloud and adjusting the isochrones calculated with mass loss, the age of the group becomes  $\log t = 6.9$ . Its diameter is of the order of 70 pc, three times the extension of the double cluster h and  $\chi$  Persei.

# THE ONSET OF CHROMOSPHERES AND CORONAS AT LATE A-TYPE STARS

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The definition of the spectral type along the main sequence where chromospheres appear is of crucial importance for the study of the stellar structure and the chromospheric heating mechanisms.

We report here new evidences for the presence of chromospheres in late A-type stars and early-F types stars established from high resolution *IUE* observations of Ly  $\alpha$  line cores.

A very careful reduction method was developed and used in our *IUE* observational star program to eliminate the geocoronal Ly  $\alpha$  emission and to improve the very low *IUE* S/N ratio.

The observed emission line cores can be interpreted as chromospheric, through semiempirical chromospheric modelling and spectral line computations. The atmospheric structure for these stars will be the same as for the Sun: photosphere, chromosphere, transition zone and corona.

We compare our results with those of X-ray given by the Einstein and ROSAT satellites to obtain some insights on chromospheric heating mechanisms for late A-type stars.

# PARTIAL REDISTRIBUTION OF RADIATION FOR THE 2 AND 3 LEVEL ATOM PLUS CONTINUUM

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From the statistical equilibrium equations, we deduce the algebraic expressions for the line source function as well as that of the emission coefficient.

In addition, we establish some corrections to the precedent formula in this subject.

Our analysis gives evidence of the complexity of real transfer problems when we approach them by simplified atomic models.

# A NEW FORMULATION OF THE LIMB-DARKENING EFFECT

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The limb-darkening method used to derive a temperature distribution in the solar case is re-examined in view of a new algebraic form of the general solution of the radiative transfer equation (RTE) in the plane parallel case.

We present preliminary results of the  $S_\nu(t_\nu)$  function for some wavelengths in the visible range and we compute the LTE  $T(t_\nu)$  distribution. Then we compare and discuss our results in relation to other solar temperature distribution in the literature.

# METALLICITIES OF OLD OPEN CLUSTERS LOCATED IN THE THIRD GALACTIC QUADRANT

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One hundred and thirty six stars associated with nine old open clusters located in the third galactic quadrant have been investigated with the Washington system. The data yield a luminosity

class, temperature and metal abundance for each star. Definitive membership status is available for virtually the entire sample and mean metal abundances for an average of twelve member giants per cluster are determined to an accuracy of 0.2 dex. For the five clusters in common with the recent spectroscopic study by Friel & Janes (1992, A&A, in press), agreement is generally good, although our metallicities are  $\sim 0.1$  dex lower, on average. Two of the other four clusters, NGC 2324 and NGC 2660, are found to be surprisingly metal-poor, with  $[\text{Fe}/\text{H}] \sim -1$ . A third cluster, NGC 3960, has a galactocentric distance of only 8 kpc but a metallicity of  $\sim -0.7$ . Such clusters indicate substantial scatter actually exists in the tight relation found by Friel & Janes between the metallicity of an open cluster and its current galactocentric distance. The outer disk clusters have a metallicity at a given age that is much more like that of their LMC counterparts than that of solar neighborhood disk field stars or clusters. These latter two populations appear to have distinct age-metallicity distributions, with the solar neighborhood open clusters more metal-poor by  $\sim 0.15$  dex than local disk field stars of the same age, except for the oldest clusters. An offset in metallicity scales is the most likely explanation for this effect. This paper will appear in the November issue of the *Astronomical Journal*.

#### ABUNDANCES FROM HIGH DISPERSION SPECTRA OF METAL-POOR GLOBULAR CLUSTER GIANTS

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We have determined abundances for a variety of important elements, including O, Na, Mg, Si, Ti, and Fe, for 1 – 3 giants in each of the extremely metal-poor globular clusters M68, M30, M55, M15 and NGC 6397, and in the moderately metal-poor clusters NGC 4833, NGC 6144, and NGC 6752. The data are derived from high resolution, high signal/noise ratio echelle spectra obtained with the CTIO 4-m. The low end of the metallicity scale for globular clusters is now well established. The  $\alpha$  elements are enhanced with respect to Fe, in agree-

ment with other cluster and halo field star analyses. However, about 1/4 of the cluster giants are not enhanced in O. Most of these stars show  $\text{H}\alpha$  wings in emission. The new accurate chemical compositions enable us to improve on age estimates derived from main-sequence photometry. The relatively low O and Fe abundances we derive indicate that the ages cannot be reduced below  $\sim 15$  Gyr.

#### PHOTOELECTRIC PHOTOMETRY OF BLUE STRAGGLERS IN SOUTHERN OPEN CLUSTERS

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Forty eight blue stragglers in intermediate to old-age open clusters have been studied by means of *UBV* photoelectric photometry. One of them in NGC 2354 has been discovered to be variable; its light curve shows the typical features of a close binary. The period is 0.6388 days and the amplitude of the principal minimum is 0.36 mag. We present a preliminary analysis of the light curve by means of the Wilson-Devinney code, which defines a near-contact configuration. Among the remaining observed blue stragglers seven are classified as possible variables, and forty as non-variables.

#### TiO BANDS IN EARLY TYPE GALAXIES

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We have calculated TiO and total spectra, in steps of 0.02 Å, using the code by Barbuy (1989, Ap&SS, 157, 111) in the red and near-infrared regions. The employed model atmospheres are interpolated in the grids of models by Bell et al. (1976, A&AS, 23, 37) and by B. Gustafsson (p.c.). The photospheric parameters used are:  $T_{\text{eff}} = 4000, 4500, 5000, 5500$  K;  $\log g = 0.0, 1.0, 2.0, 3.0, 4.0, 4.5, 5.0$ ; and  $[\text{M}/\text{H}] = -3.0, -2.0, -1.0, 0.0, +0.5$  dex.

The intensity of TiO bands ( $\alpha$ ,  $\gamma$  and  $\gamma$  prime Systems), at  $\lambda\lambda 614.5 - 627.5$  nm, are dependent on metallicity and effective temperature, and become stronger in cool metal-rich stars. There is no dependence on gravity. The absorption of  $\text{C}_2$  (Swan Systems) is very weak in these spectral regions, and that of CN (Red Systems) presents similar behaviour to TiO.

We have computed a grid of synthetic spectra at  $\lambda\lambda 614.0 - 648.0$  nm and  $\lambda\lambda 705.0 - 728.0$  nm for 10