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THE GLOBULAR CLUSTER NGC 6981: VARIABLE STARS POPULATION, PHYSICAL PARAMETERS AND ASTROMETRY

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RESUMEN

Se presentan los resultados del estudio realizado al cúmulo globular NGC 6981. Dado que el presente cúmulo no disponía de estudios observacionales con fotometría CCD, implementamos un análisis de series de tiempo con fotometría CCD de alta precisión para un grupo de 10 noches de observación, con las cuales se logró clasificar adecuadamente las estrellas variables presentes en nuestro rango de observación. Reportamos 11 nuevas variables tipo RR Lyrae, 3 nuevas SX Phe, y descartamos como variables a 20 estrellas previamente clasificadas como variables o sospechosas de serlo. Confirmamos la variabilidad de 29 estrellas ya reportadas en la literatura y calculamos nuevas efemérides. Por medio la descomposición de Fourier de las curvas de luz de estrellas RR Lyrae y calibraciones semiempíricas disponibles en la literatura, determinamos los parámetros físicos de estas estrellas y por lo tanto los valores medios de metalicidad y distancia del cúmulo y obtuvimos los valores [Fe/H]$= -1.48 \pm 0.03$ en la escala de Zinn & West (1984) y una distancia de $\approx 16.73 \pm 0.36$ kpc.

ABSTRACT

We present the results of time-series CCD photometry of the globular cluster NGC 6981 for which no previous CCD photometry exist. Accurate photometry was achieved by the technique of difference image analysis. This allows to correctly classify the known variable stars, corroborate their variability and to discover new variables. In this paper we report 11 new RR Lyrae stars, 3 SX Phe. We show that 20 stars previously classified as variables are in fact non-variable and confirm the variability of 29 stars. News ephemerides are provided for all the variables in the cluster. By using the Fourier decomposition of light curves and semi-empirical calibrations available in the literature for RR Lyrae stars, we determined the physical parameters of these stars and hence the mean metallicity and distance of the cluster as [Fe/H]$= -1.48 \pm 0.03$ in the Zinn & West (1984) scale; and $\approx 16.73 \pm 0.36$ kpc.

Key Words: blue stragglers — globular clusters: individual (NGC 6981) — stars: evolution — stars: variables: RR Lyrae

1. INTRODUCTION

The study of globular clusters is very important in astronomy because they are the oldest objects in the Galaxy, thus they are useful indicators of the early formation, structure and evolution of the Galactic system. In the present study we focus on the globular cluster NGC 6981, because it has never been studied before using CCD photometry and with the new technologies numerical approaches to data reduction, high precision can be achieved even for faint stars in the crowded central regions of the cluster. Thus a good census and the properties of the variable star population in the cluster are on reach. Thus, the variable stars can be used to determine the mean metalicity and distance to the cluster.

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2. DATA AND PHOTOMETRY

For this project we use a sample of 103, 110 y 3 CCD images in the filters V, R and I respectively. These images were taken in the Indian Astronomical Observatory, at the Indian Himalayas in Hanle, India with a 2.0 m telescope which is equipped with a 2048×2048 pixels CCD camera. The images cover 10.1×10.1 arcmin^2.

For the data reduction and astrometry we used the pipeline `DanDIA`[4], which includes a new algorithm that models the convolution kernel matching the point-spread function (PSF) of a pair of images of the same field as a discrete pixel array (Bramich 2008).

[4]`DanDIA` is built from the DanIDL library of IDL routines available at `http://www.danidl.co.uk`.