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CLASSIFYING THE STELLAR ENVIRONMENT AROUND V838 MONOCEROTIS

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RESUMEN

El comportamiento de V838 Mon y la naturaleza de la estrella progenitora no están bien entendidos aún. Recientemente han sido encontradas estrellas de tipo B en la vecindad de V838 Mon y se piensa que ésta podría ser parte de un cúmulo abierto de población estelar joven. Debido a que el cúmulo se encuentra en un brazo espiral de la Galaxia, resulta complicada la identificación de más miembros del mismo; por lo que se hacen necesarios diversos estudios fotométricos y espectroscópicos. Presentamos los resultados preliminares de nuestro análisis fotométrico con imágenes obtenidas por la Cámara Avanzada de Rastreo (ACS) del Telescopio espacial Hubble (HST).

ABSTRACT

The V838 Mon's behavior and the nature of the progenitor object are not well understood. Type B stars recently have been found in the vicinity of V838 Mon and it is thought that they may be part of a young open cluster. Since the cluster is in a spiral arm of the Galaxy, the identification of additional member stars is complicated; therefore, photometric and spectroscopic studies are necessary. We present the preliminary results of our photometric analyses with images obtained from the Advanced Camera for Surveys (ACS) on Hubble Space Telescope (HST).

Key Words: open clusters and associations: general — stars: individual (V838 Mon) — stars: variables: other — techniques: photometric

1. INTRODUCTION

V838 Mon had an amazing outburst in 2002, which lasted a few months. It is a rare star that became one of the most luminous stars in the whole Local Group. Its behavior can not be explained by the classical theories of novae explosions, because after its outburst it expanded to hypergiant dimensions but with an extremely cool temperature. It may be associated with a young cluster (Afşar & Bond 2007). V838 Mon has a companion star with spectral type B3V. Afşar & Bond (2007) found three more stars also with B spectral type. Using the spectra and photometric main sequence (MS) fitting (using the template of NGC 2362 which has an age of 5.1 Myr and solar metallicity) they determined a distance of 6.2 kpc for this structure that looks like a cluster. Through photometric and spectroscopic studies using Hubble Space Telescope (HST) and WIYN data of the V838 Mon region we hope to identify what type of cluster the star belongs to; this would yield very valuable information for the understanding of events such as the star's eruption (Siegel & Bond 2006). We want to identify more stars that belong to this cluster, so we can better understand the stellar population that V838 Mon came from.

2. DISCUSSION

2.1. *Photometry*

In order to identify additional stars that belong to this young cluster we are doing photometry from HST images. Here we show some preliminary results. We used 3 filters (F435W, F606W, F814W) in the ACS/WFC Vega magnitude system. DAOPHOT and the program written by Anderson & King (2006) were used to obtain magnitudes with the Point-Spread Funtion (PSF) fitting technique. In Figure 1 we have the color-magnitude diagram (CMD) for F606W, F435W-F606W. To fit a MS, we plot a theoretical isochrone from Cassisi et al. (2006) with an age of 30 Myr and solar metallicity, which was shifted by the previously determined distance and reddening of V838 Mon (i.e 0.84 from Afşar & Bond 2007). It is possible to identify a MS. How-

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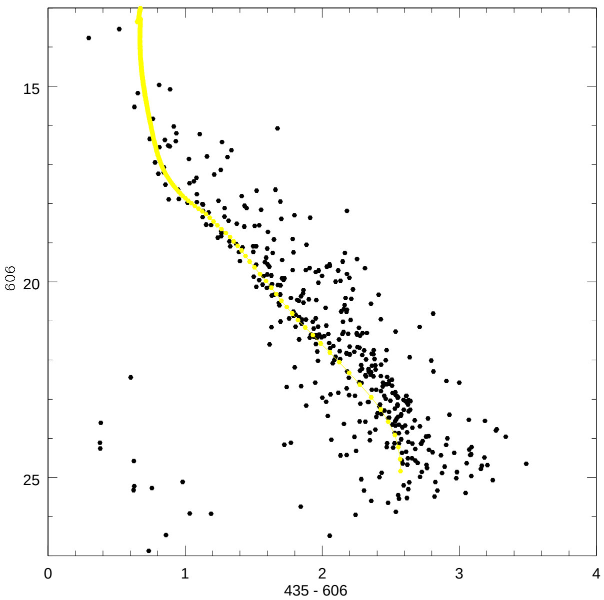

Fig. 1. CMD for F606W vs F435W-F606W for non-saturated stars. MS have been defined for an isochrone from Cassisi 2006 (yellow line). The data agree nicely.

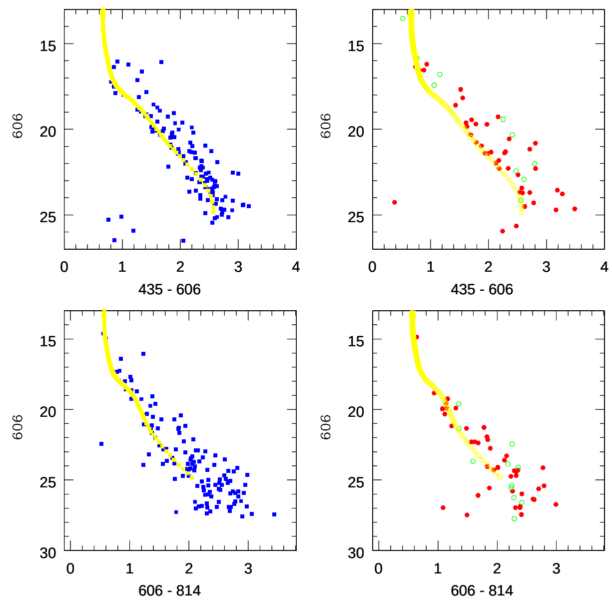

Fig. 2. CMD for 3 regions from V838 Mon. (i) R=75″=2.3pc; (ii) R=37.5″=1.14pc; (iii) R=15″=0.46pc.

ever, we have yet to determine where along the line of sight to V838 Mon this MS originates.

V838 Mon is in a spiral arm of the Milky Way and there are many stars in the same direction (field stars). Before we can analyse the V838 Mon cluster, we have to know which stars really belong to this cluster. For that reason we need to do many statistical tests.

We divided the HST images into 3 regions and computed the CMD for these. In Figure 2 we plot F606W vs F435W-F606W (top) and F606W vs F606W-F814W (bottom): (i) blue squares from $R = 75''$ from V838 Mon; (ii) red points from $R = 37.5''$; (iii) green open points from $R = 15''$. A cluster near V838 Mon (iii) may be expected to have CMD different from that of field stars, which will be distributed over the whole area. The results for the stars analyzed until now show than most of them are field stars. We need to do more statistical tests.

2.2. *Future work*

For our study, we are also analysing the spectra of some of the field stars, using data from the WIYN Observatory. We are doing the spectral classification from a visual comparison with standard stars. The B stars near V838 Mon are known to have Diffuse Interestellar Bands (DIB) and thus any other cluster members should as well. Therefore, it is these features that we will first be looking for in new cluster members.

We hope to finish the spectroscopic analysis for those stars for which have the magnitudes. Furthermore, we are doing other statistical analysis including: comparison to CMDs in same part of the Galaxy and proper motions. We will fit the data with a younger isochrone and a suitable metallicity for V838 Mon.

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