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# THE $\eta$ CARINAE LIKE FeII-RICH SPECTRUM OF FBS0022-021

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RESUMEN

Informamos sobre los resultados de observaciones espectroscópicas Echelle y B&C del objeto con líneas de emisión FBS 0022 - 21 obtenidas en el Observatorio de San Pedro Mártir, México. Analizamos los espectros de las líneas de emisión junto con datos del óptico e IR disponibles. El espectro rico en FeII del objeto se asemeja fuertemente al del sistema binario peculiar $\eta$ Car. Se discuten las condiciones físicas que dan lugar a tal espectro y la naturaleza de este peculiar objeto.

ABSTRACT

We report results of Echelle and B&Ch spectroscopic observations of the emission-line object FBS 0022-021 that were obtained at SPM Observatory, Mexico. We analyze the emission-line spectra along with available optical and IR data. The FeII-rich spectrum of the object closely resembles that of the peculiar binary system $\eta$ car. The discussion of the physical conditions leading to such spectrum and the nature of this peculiar object are presented.

*Key Words:* **BINARIES: CLOSE — WHITE DWARFS**



## 1. INTRODUCTION

The FBS 0022-021 was selected as an emission-line object in the First Buyrocan Survey. The coordinates of the object are $\alpha_{2000} = 00:24:52.55$ and $\delta_{2000} = -01:53:35.3$. The object located out of Galactic plane $l = 107.66$, $b = -63.97$ with $A_B = 0.129$. Late MacAlpine et al., (1977) and Berger & Fringant (1980) refound this object and noted that the object have star-like profile and a blue star continuum spectrum with strong emission blushifted Balmer and FeII lines. They suggested Nova-like nature of the object. Kopylov et al., 1987 classified FBS0022-021 as a cataclysmic variable star using the spectral data obtained at the 6m BTA. The object catalogised in the catalogue of CV stars of Downes et al., 2001. The object was selected by us to an investigation as a low studied cataclysmal variable star. Our new observations show that the object demonstrates unexpected nature. In this paper we presented of the spectroscopic and photometric data and the analyze of the nature of this peculiar emission line object.

## 2. OBSERVATION AND RESULTS

Spectroscopic observations were performed using Echell (4025 — 9050 ÅÅ, $\sim$ 0.2Å/pixel), Boller & Chivens (3700 — 9200 ÅÅ, $\sim$ 3Å/pixel) at the Cassegrain focus of 2.1m telescope in SPM Observatory, Mexico. Broad band UBVRIH$_\alpha$ photometry were obtained during 11 Sept. 2002 and 23 Oct. 2003 nights using 0.84m telescope. The data were reduced using standard IRAF tasks.

The magnitudes of FBS 0022-021 are $U = 1443(5)$, $B = 15.10(5)$, $V = 15.02(5)$, $R = 14.27(3)$, $I = 14.39(5)$. We not found any changes of those magnitudes between two epochs of our observations. The infrared data $J = 13.471(27)$, $H = 12.290(31)$, $K = 11.096(27)$ were taking from 2MASS IR photometry of CVs by Hoard et al., 2002. The results of our spectroscopy and photometry are presented at Fig.1. The object shows emission-line spectrum similar to the spectrum of LBV binary system of $\eta$ Car. The continuum of the spectrum have blue (B5V-like) shape in the visual band with $T_{ef} \sim 10^4$ $K$. There are strong emission Balmer lines, FeII and forbidden [FeII] and [OI] only. The all lines are blue shifted with velocity $v \cong -50$ $km/s$. The Balmer and FeII lines demonstrate strong symmetric double-peak structure. The forbidden lines show single-peak only. We also found an evidence of a faint $H_\alpha$ extended structure in our spectral data that with the infrared excess corresponds to a hot circumstellar dust in the source. The sum of those features corresponds to presence of the B[e]-phenomenon in this object (Zickgraf, 1998). The B[e]- phenomenon objects do not form of a homogeneous group and can be expressed in terms of physical conditions for the circumstellar material around the star (Lamers et al., 1998). Several B[e] objects have been show components of binary systems. From the absent

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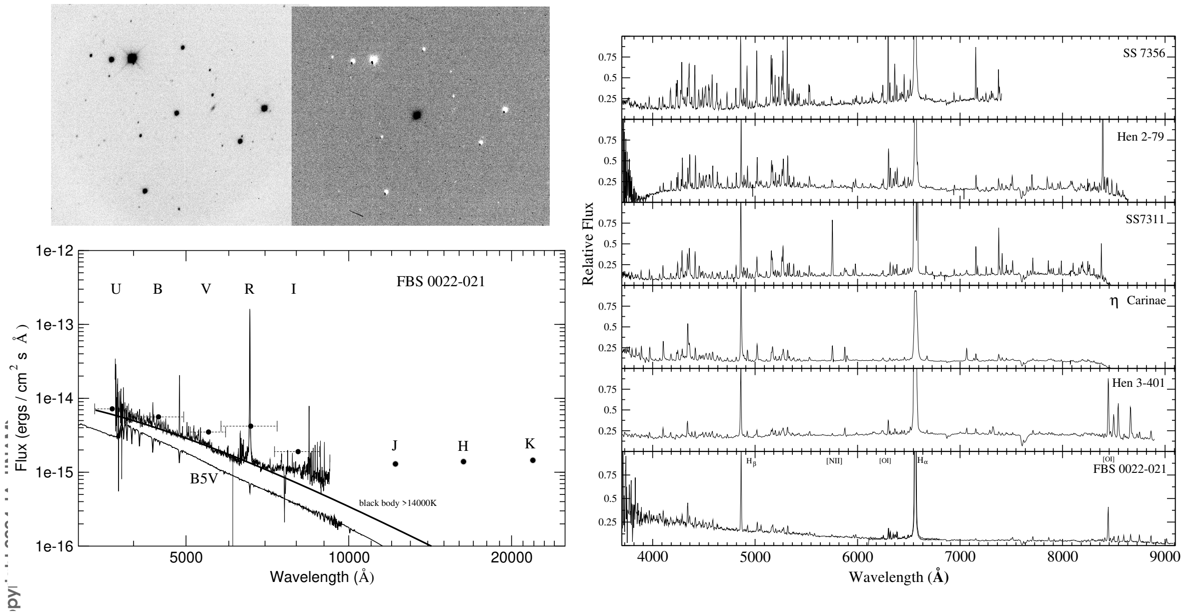


Fig. 1. **Left-Up:** The $R$ and $H\alpha - R$ band images of the FSB0022-021 field. **Left-Down:** The low resolution spectrum and results of photometry are presented. **Right:** The comparison of the spectrum of FSB0022-021 with the spectra of B[e] phenomenon objects of $\eta$ Car, SS7356, Hen 2-79, SS7311 and Hen 3-401.

of the distance estimation to FBS0022-021 the object could be in principle categorized in any of the following groups: supergiants sgB[e], pre-main sequence HAeB[e] stars, compact planetary nebulae cPNB[e], symbiotic stars SymB[e], $\eta$ Car like object or wide class of "unclassified B[e]-type unclB[e] stars. Zorec, (1998) shows that stars with the B[e]-phenomenon have a galactic distribution resembling that extreme Population I objects but the galactic latitude of FBS0022-021 is of $-64^o$. If the object belong to the Population I objects so the distance to it will be less than half of the Galactic disk ($\sim 300pc$). In this case FBS0022-021 can be classified as an isolated low luminosity HAeBe star. But it shows not any spectral features of HAeB[e] stars or sgB[e] and SymBp[e] stars. From luminosity reasons FBS 0022-021 have not same origin with $\eta$ Car $L/L_\odot > 10^6$ because the distance to the object must be more than 20kpc in this case. If the object is disposed out of the Galactic disk so it can be included in the class of cPNB[e] or unclB[e] stars with large probability. The spectrum of FBS0022-021 is closely resembles of the unclB[e] star HD 45677 spectrum (V=8.05 mag, $d \sim 300pc$, $L/L_\odot \sim 3$, isolated pre-main sequence HAeBe or post-AGB star, see de Winter et al., 1997). The distance to the FBS 0022-021 will be about 7.5kpc and both objects are more probably a hot post-AGB type star evolved to a planetary nebula in the case of the same nature and the luminosity of FBS 0022-021 and the HD45677 star. The Fig.1(right) presents the comparison of the FBS0022-021 spectrum with spectra of $\eta$ Car object and some proto-planetary nebulars takin from Pereira et al., 2003 and Garcia-Lario et al., 1999 An additional UV/visual/IR band spectral and photometric observation are needed for determination of the nature this peculiar blue emission-line object with extremal value of the galactic latitude for objects with B[e] phenomenon.

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