)

SPECTROSCOPIC AND PHOTOMETRIC OBSERVATIONS OF THE SUPERNOVAE SN2020JEE

N. Z. Ismailov [a*], *Kh. M. Mikhailov* [a], *O. V. Khalilov* [a],

I. A. Alekberov [a], *S. A. Alishov* [a]

[a] *N.Tusi Shamakhy Astrophysical Observatory of Azerbaijan National Academy of Sciences, Shamakhy, Azerbaijan*

Information on the SN2020jee supernova is first listed in the web page Gaia Alert Index list (http://gsaweb.ast.cam.ac.uk/alerts/alert/Gaia20cgo/). These data are as follows: date of observation 2020-05-13 UT 08:17:40 (JD 2458982.85), with coordinates RA (2000) = 11: 42: 14.70 DEC (2000) = 20: 05: 51.07. The object is located approximately in the center one of the very weakly radiating galaxy MCG + 03-30-048 in a large cluster of galaxies in this region. We performed spectral and photometric observations of this object from May 21 to June 23, 2020. Table 1 summarizes our observations:

Keywords: Optical – Supernovae – Transient

1. INTRODUCTION

All our spectral and photometric observations were performed simultaneously on the 2 m ShAO telescope. Spectral observations were made at the Cassegrain focus of the 2 m telescope. As a light receiver complex spectrograph UAGS + objective Canon EF (f = 200 mm, f/2) + CCD Andor (ikonL-936-BEX2-DD 2048x2048, $px = 13.5 \mu$) was used. The spectral range is $3750 - 7650$Å. The width of the slit was $3.3''$. The spectral resolution is about 6Å/ px. The height of the slit was set to the maximum, which made it possible to obtain a background spectrum simultaneously with the spectrum of the object. Spectrophotometric standard stars were observed every night immediately after the object. The spectra were processed using the new version of the DECH software package. All spectra were isolated using an IRAF mask. The process included dark current

---

Table 1: Journal of observations SN2020jee.

BV photometry

Date	UT	JD	Bands	mag	$\pm\sigma$	B-V
21.05 .2020	18 : 14 : 24	2458991.26	V	15.45	0.01	0.719
21.05 .2020	18 : 43 : 12	2458991.28	B	16.169	0.02	
27.05 .2020	18 : 57 : 36	2458997.29	V	15.15	0.005	0.71
27.05 .2020	19 : 26 : 24	2458997.31	B	15.86	0.006	
16.06 .2020	19 : 12 : 00	2459017.30	V	16.259	0.010	1.039
23.06 .2020	18 : 43 : 12	2459024.28	V	16.342	0.02	
23.06 .2020	19 : 12 : 00	2459024.30	B	17.381	0.03	

Spectral observations

Date UT	JD		Spectral range, Å	Exposition, sec	S/N
21.05 .2020	18 : 24	2458991.26	3700 − 8000	3600	345
27.05 .2020	19 : 06	2458997.29	3700 − 8000	2000	220
16.06 .2020	19 : 32	2459017.31	3700 − 8000	3000	95
23.06 .2020	18 : 17	2459024.26	3700 − 8000	2000	115

subtraction, correction for flat fields; remove of cosmic rays, 2D linearization of wavelengths and subtraction of the spectrum of the sky. The spectra were calibrated by wavelength and absolute flux. When calibrating by wavelength, the redshift of the host galaxy and the heliocentric correction are taken into account. Information on the spectral material is given in the second part of Table 1.

Photometry of the object was carried out on a 30 cm guide-refractor of the 2 m telescope. A photometer with broadband filters BVRc is installed in the focus of the refractor tube ($F = 5050$ mm). The light receiver was a CCD FLI 2048x3072. The limiting magnitude in V band is 18 mag for 600 sec of accumulation.

An object identification map is shown in Fig. 1. Table 1 shows the the results of measurements obtained in the BV bands and in the last column, the errors of the measurements. Since the brightness of the standard was not known, its brightness value was obtained from special observations using binding to the star's brightness standard TYC1440-44-1, BV values of which are given in the SIMBAD archive ($B = 11.71, V = 11.02$).

Figure 2 shows the brightness variation with time for all photometric observations of the object, including those given in the literature. Despite the fact that
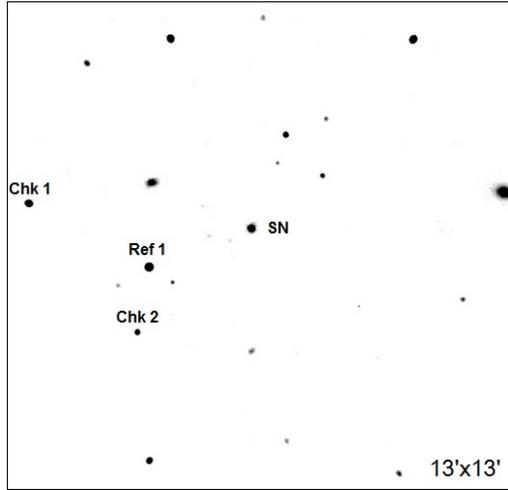
Fig. 1: The searching field of the SN2020jee. Reference star's magnitudes are V=13.042±0.02, B=14.031±0.01

the brightness value of the object is given in different system filters, from Fig. 2 we can get information of the brightness variation in time. The vertical bars mark the dates at which the spectra of the object were obtained.

In Fig. 2 it can be seen that the brightness of the object was in the brightest state (maximum) on 05.27.2020 (JD2458997). The total interval of brightness changes from the beginning of all observations of the object is about 2 mag. However, if we take into account that, in inactive state, the galaxy's brightness was 18.65 mag in the G band [1], then the total amplitude of the brightness changes in the G band should be at least 3 mag. Figure 3 shows the spectra of the object
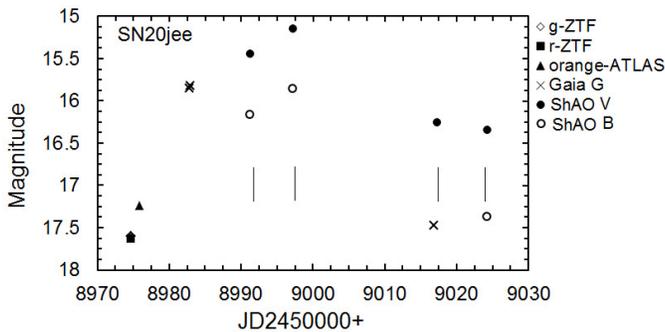

Fig. 2: SN20jee supernova light variations in time. Different characters in the figure indicate data from different authors. Vertical bars indicate the dates of spectral observations in the ShAO [2].

obtained at different dates. A group of authors [3] obtained the first spectrum. This spectrum was obtained to a maximum of brightness on 05.06.2020. Here, individual details and spectral bands are clearly visible.
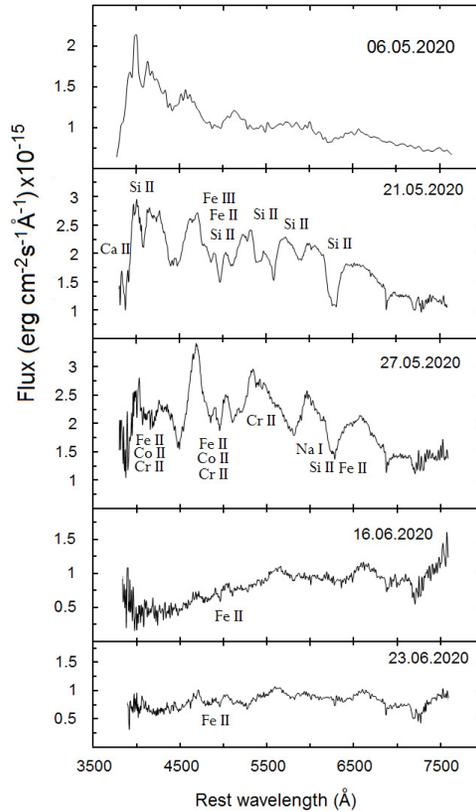

Fig. 3: Results of spectral observations of SN2020jee. First top panel –data from [3].

Other spectrums which are shown in Fig. 3 were obtained in the ShAQ. Judging by the photometric data, a spectrum was obtained at 05.21.2020 to the maximum brightness in bands B and V (Fig. 3). We can see here the bands of the Si II, Fe II, FeII, Ca II line groups which are clearly distinguished. We measured the shift of the Si II line, where two lines $\lambda 6347 + 6371$ Å are dominated. On May 21, 2020, the enhancement velocity of the photosphere shell was obtained at about -10116 ± 15 km/s. Based on the material, an article is being prepared for publication.

REFERENCES

1. 2018yCat.1345, 0G

2. oreng-ATLAS - J. Tonry, L. Denneau, A. Heinze et al. (ESO), Gaia G -S.T. Hodgkin, E. Breedt, A. Delgado et al., on behalf of the Gaia Alerts team, ZTF - J. Nordin, V. Brinnel, M. Giomi, J. van Santen et al., on behalf of ZTF

3. A. Dahiwale, C. Fremling (https://wis-tns.weizmann.ac.il/object/2020jee)