Star Formation Activity in the NGC 6820/6823 Complex

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Abstract

The NGC 6820/6823 is a complex region with a wealth of star formation activity. The young star cluster NGC 6823 is associated with massive stars, HII regions, illuminated and dark nebulous pillars. We present CCD broadband and emission-line imaging study of the region. Observations were taken by the Maidanak 1.5 m and 0.6 m, as well as by the 60/90 Schmidt telescope as part of the Beijing-Arizona-Taipei-Connecticut (BATC) project.Together with the 2MASS near-infrared photometry, these data ---ranging from one degree field of view to sub-arcsecond imaging--- allow us to identify young star candidates and shock-excited gas in the region. Some spectra of these young star candidates are presented that confirm the nature of their youth.

Parameters of NGC6820 /NGC6823

RA   19h 43m 06s (J2000)

Dec   +23 18' (J2000)

Age   5 Myr

Size   12'×12' (NGC6823)

   30'×40' (NGC6820)

Distance   3.5 ±0.5kpc

Parameters of BATC picture

Field of view   1 degree × 1 degree

CCD   2048 pix × 2048 pix

The filters we used

t band ➔ H   band

i band ➔ wavelength weight =6660Å

o band ➔ wavelength weight =9100Å
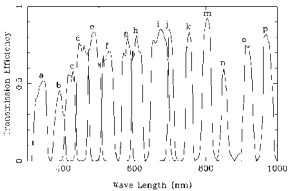
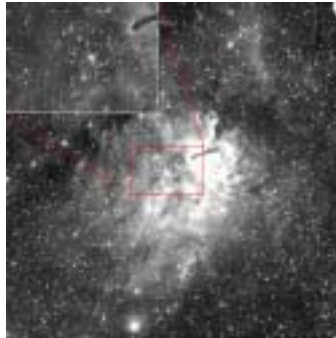Figure 3 is the transmission curves of the 15 BATC filters

Fig. 1.

Bigger one

Combined t band picture of NGC6820 and NGC6823 detected by BATC telescope.

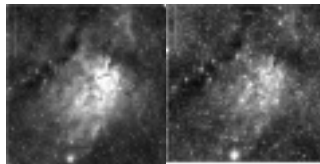Smaller one

The open cluster NGC6823 located in HII region.

Fig. 2. BATC i band.(left) and o band (right) picture of NGC6823 and NGC6820.

Fig. 3. The transmission curves of the 15 BATC filters.

Parameters of Maidanak 0.6m telescope picture

Field of view   11' × 11'   CCD   AP-8 (1024 pix × 1024 pix)
0.648"/pix

Data analysis and the result of Maidanak data

We scan a 1 degree radius circle area and NGC6823 is located at the center by Johnson R and I filter, and pay attention to the pictures near the center. We get 30 stars with both R and I photometric data. Figure 5 is the color-magnitude diagram of these 30 stars. Figure 6 is the color-magnitude diagram of R band and R band minus I band by A. Pigulski et al. Solid lines are ZAMS line and the instability strip borders for main sequence, and dashed lines are pre-main sequence. Compare figure 5 and figure 6, the star spread in the range of 7 magnitude. Except the mistake of standard star transform, the color-magnitude diagram is correct.

Fig. 5. Color-magnitude diagram of R band and R band minus I band.

Fig. 6. Color-magnitude diagram of R band and R band minus I band by A. Pigulski et al.

Conclusion and future work

NGC6820 is an HII region with star birthing. The eight stars with H emission are probably pre-main sequence stars, and we will do more observation to make sure.

It is a pity that there are many bright stars are saturated in BATC data. We can't get the information of bright (massive) stars. The next observation of NGC6823 is better to exposure low and high exposure time.

The Maidanak data is not deep enough, but it is clear that there is a main sequence is figure 5. The most stars are NGC6823 member stars, but most of them are main sequence stars. We did not find many pre-main sequence stars in NGC6823.

Maidanak data has small field of view. We have its H data, and are going to find is there any special star, for example, with jet or outflow in NGC6820.

Data analysis and the result of BATC data

The picture of BATC is undersample and without standard star data, we can only calibrate the most stars' instrument magnitude by PSF fitting. We find 12790 stars in i band picture and 17903 stars in o band picture, and find there are 11308 stars have both i band and o band photometry data. Figure 4 is the color-magnitude diagram of o band and o band minus i band. We only get the stars fainter than 13 o band instrument magnitude, we can't get the information of bright (massive) stars in this area because they are saturated. Otherwise, open cluster NGC6823 is located at the center of the picture. There are too many foreground and background stars in figure 4. So we saw a wide main-sequence. With H data, we use i band data to be its continue data base. And find that there are eight stars have H emission. Table is the list of these eight stars.
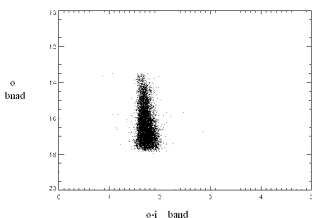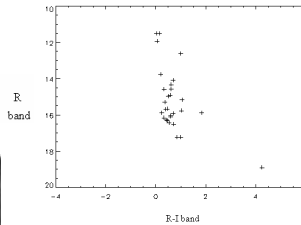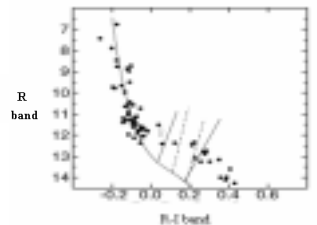
Fig. 4. Color-magnitude diagram of o band and o band minus i band.

Tab. 1. Eight stars have H emission

RA	Dec	H flux to I band flux ratio
19:41:15.1	23:42:51.5	1.1821
19:39:45.9	23:42:30.6	1.1958
19:43:31.1	23:42:22.6	1.1774
19:44:11.5	23:39:50.2	1.2342
19:44:14.4	23:41:20.5	1.1557
19:44:44.8	23:16:23.7	1.1248
19:44:45.1	23:12:20.4	1.1031
19:45:04.2	23:24:38.8	1.3915