

NEW HERBIG-HARO OBJECTS AND $H\alpha$ EMISSION STARS IN THE STAR FORMING REGIONS GM 1-64/GM 2-4 AND GM 2-41. E.H. Nikogossian, T.Yu. Magakian, T.A. Movsessian, *Byurakan Astrophysical Observatory, 378433, Aragotsom reg., Armenia, (elena@bao.sci.am)*.

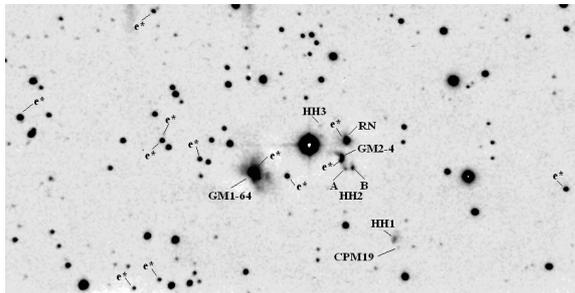


Figure 1: GM 1-61 and GM 2-4 area. HH objects and emission-line stars are marked.

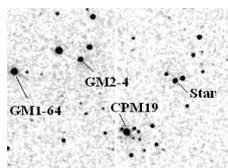


Figure 2: GM 1-61 and GM 2-4 area in K map of 2MASS.

Introduction: For two regions: the central part of the molecular cloud KOY98 183.7-03.6 including reflection nebulae GM 1-64 (RNO53) and GM 2-4 [1] and the field of cometary nebula GM 2-41 (RNO122) [1] we present the results of an ongoing optical survey of the nebulous objects in dark clouds, conducted at the Byurakan Observatory [2].

Observations were carried out in the prime focus of the 2.6m telescope of Byurakan observatory in 1999 with the Byu-FOSC2 camera and Thomson 1060×514 CCD detector (field of view 11'×5.5') and in 2004 with the SCORPIO camera and Loral 2063×2058 CCD detector (field of view 14'×14'). For the search of HH objects the optical images were taken through [SII] ($\lambda_c = 6730\text{\AA}$, $\Delta\lambda = 75\text{\AA}$) and $H\alpha$ ($\lambda_c = 6670\text{\AA}$, $\Delta\lambda = 85\text{\AA}$) interference filters and, for the continuum, an I-band filter ($\lambda_c = 8500\text{\AA}$, $\Delta\lambda = 1200\text{\AA}$) was used. The search of $H\alpha$ emission stars was carried out by slitless method, using combination of the grism with spectral range 5500-7500 \AA and dispersion 2.1 $\text{\AA}/\text{pix}$ and the $H\alpha$ interference filter.

GM 1-64 & GM 2-4 area. A large number of radio and IR observations were performed in this area [3-6], but hitherto it was practically not investigated in the optical range. We have found three new HH objects (see Fig. 1). HH2 (numbering is provisional), which consists of two components A and B, and a very weak HH3 are located on the equal distances around

GM2-4, what allows to suppose that the central star of this nebula is the source of these objects.

One more HH object with comet-like shape is located in 1.6' from GM2-4 toward SW (HH1, see Fig. 1). There are two prominent condensations in the head of object. The HH1 source is not obvious. In this connection it should be mentioned that HH1 is located very near to YSO CPM19, which is associated with the supposed source of the molecular outflow IRAS 05373+2349 and H_2O maser [3-7]. We found that the brightness of this star undergoes very high variations. Its colours are typical for the accreting protostars ([5,6] and 2MASS data). Actually, on K map from 2MASS (see Fig. 2) we see a compact group of stars, situated in the immediate vicinity of CPM19, which is only barely visible in optical range and J and H maps. It is quite probable that one of the members of this dense group of forming stars can be the source of HH1. It should be noted that the recent NIR observations revealed several H_2 flows all around this compact IR cluster [8]. Yet another very red star with typical for Class 1 objects colours also is shown on Fig. 2 (marked as 'star'). Besides that, 12 new stars with $H\alpha$ emission were found in the investigated area.

GM 2-41 area. To our best knowledge this region was not studied yet in optical range for star formation, though its manifestations are prominent. We have found 5 HH objects here. All of them are marked on Fig. 3 (the numbering again is provisional). HH1 has filamentary structure with three condensations. HH2 is a group of three HH knots. Very faint HH3 is located nearby to an emission-line star. HH4 is a group of three components, one of which has marked bow-shock structure. HH5 has cometary-like shape. This area is also very rich with emission stars. We have found 43 such objects. Some of them are marked on Fig. 3. The studies of this rich region will be continued.

In total 8 new HH objects and outflows as well as more than 50 new emission stars were discovered in these two regions.

This work was supported by INTAS grants 00-0287 and 03-51-4838 and by grant of CRDF/NFSAT AS 062-02/CRDF 12009.

References: [1] Magakian, T. Yu. (2003), *A&A*, 399, 141. [2] Magakian, T. Yu, Movsessian, T. A. & Nikogossian E. H. (2004), *Astrofizika*, 47, 161. [3] Harju, Y., Lehtinen, K., Booth, R. S. & Zinchenko, I. (1998), *A&AS*, 132, 211. [4] Casoli, F., Dupraz, G. et al. (1986), *A&A*, 169, 281. [5] Carballo R., Mampaso, A. & Eiroa, C. (1988), *MNRAS* 232, 497. [6] Campbell, B., Persson, S. E. & Matthews, K. (1989), *AJ*, 98, 643. [7] Magnier, E. A., Volp, A. W. et al, (1999), *A&A*, 352, 228. [8] Khanzadyan, T. et al., in preparation

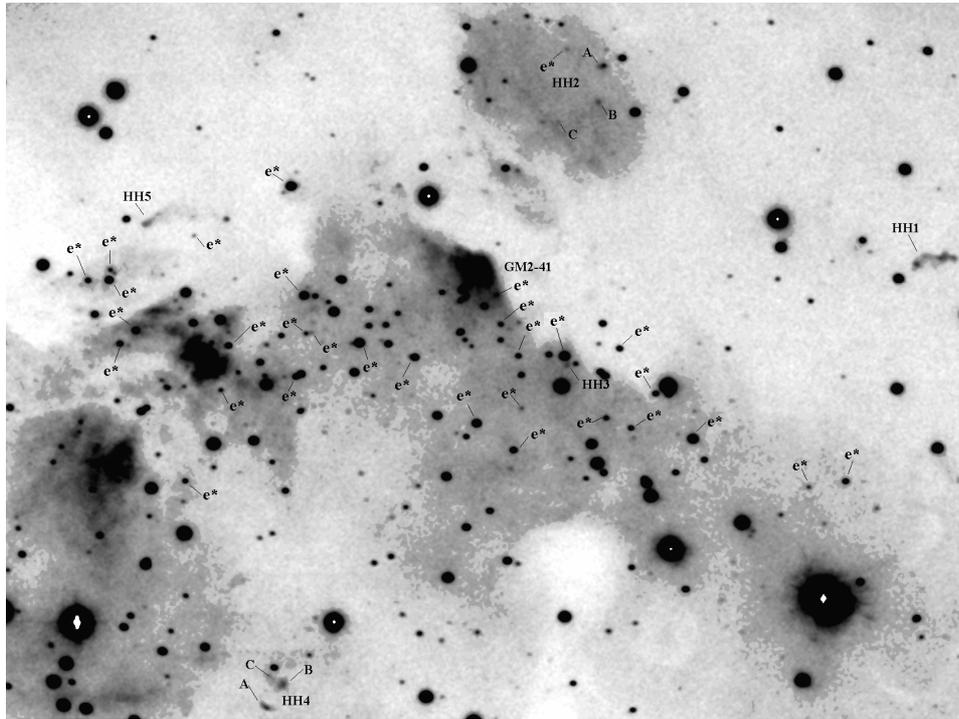


Figure 3: GM 2-41 area. HH objects and emission-line stars are marked.