THE RESULTS OF SPECTRAL OBSERVATIONS OF COLLIMATED OUTFLOWS

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ABSTRACT. The results of spectral investigations of collimated outflows from young stellar objects, including HL/XZ Tau, L723, Bernes 48, RNO 43N, CoKu Tau/1, obtained on 6-m telescope BTA with two-dimensional photon counting system in 1986-1988 are presented.

1. INTRODUCTION

The discovery of collimated optical outflows from young stars [1] and their subsequent investigations (see review [2]) can be considered as a major step in understanding of early evolution of low and intermediate mass stars. The studies of this phenomenon are in continuation.

In this paper the main results of observations of collimated outflows on 6-m telescope BTA of the SAO USSR in 1986-1988 are presented. All spectra were obtained with UAGS spectrograph in prime focus and two - dimensional TV photon counting system "KVANT". For 15 objects (mostly for the first time) the radial velocity fields were obtained and different parameters estimated. Among observed objects are RNO 43N, 1548C27,HL/XZ Tau and HH30 region, L723, Bernes 48, CoKu Tau/1, GGD 34, HH105 and others.

2. RESULTS AND DISCUSSION

2.1. HL/XZ Tau

Even first images of optical outflows in this region [2] revealed rather complicated picture. Subsequent spectral observations confirmed this impression. We obtained the spectra of north-western and southern jets. On the maps of their radial velocity field the regions with splitted spectral lines, i. e. with two radial velocity components were

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found. This was interpreted as projection of two flows on the line of sight [3]. Recent data [4] confirmed this suggestion.

2.2. L723

The presence of optical flow in this cloud was suspected in [5]. Our spectrum of nebulous object in cloud shows, that it is really the collimated outflow from non-observable in optics source, which can be IRAS PSC 19155+1906. Large angular distance between them indicates, that outflow, practically without expansion, goes through whole dark cloud and only after leaving it becomes visible [6].

2.3. Bernes 48

The presence of collimated outflow in this star with cometary nebula was suspected in [7]. On our new spectrum this outflow is visible directly. Furthermore, the new Herbig-Haro object, consisted of several condensations with different radial velocities, was found nearby (Fig.1). The unusual feature is that HH object lies not on the axis of directed outflow and

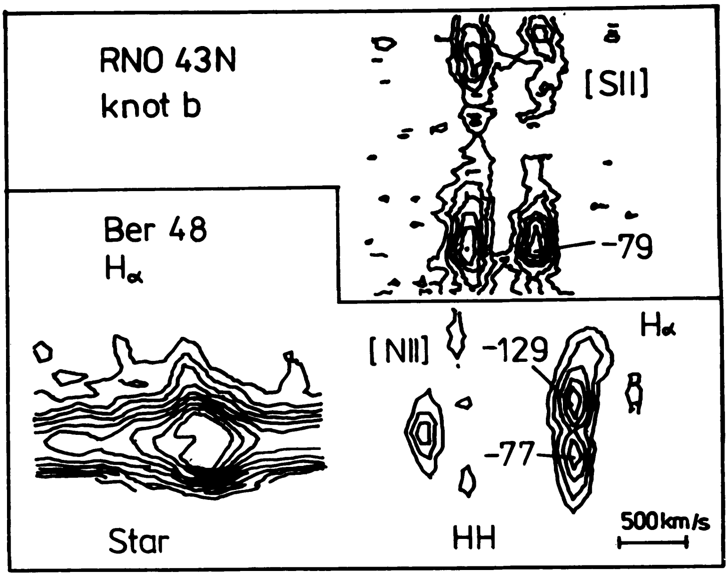

Figure 1. The contours of emission lines in RNO 43N and Bernes 48 (star and HH-object) spectra

cometary nebula, as in most cases. But no other source capable to excite HH object except Bernes 48 star is known in this region.

2.4. RNO 43

In this complex of HH-objects [8] we succeeded to obtain spectra of several knots in the region known as RNO 43N. The detailed study of this field is in progress. But it is worth to mention the interesting "triangular" shape of Hα - line contours of "d" knot. It is in complete agreement with theoretical models for bow-shock [9]. The direction of shock and the object's proper motions are opposite.

2.5. CoKu Tau/1

This rather faint star in CZ/DD Tau field [10] also appeared to be a source of collimated outflow. Most interesting circumstance is the very low luminosity of central star ($L < 0.001 L_{\odot}$) . Probably with some other objects it belongs to a separate subgroup [11].

3. CONCLUSION

From the results of observations of collimated outflows and Herbig-Haro objects it may be noted, first of all, that phenomenon of anisotropic outflow from young stars possesses the large diversity of observational effects and physical characteristics. It is nessesary to mention the great capabilities of 6-m telescope for such studies. We are planning to continue this observational program on BTA with modern equipment.

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SZECSENYI-NAGY: We were shown a lot of detailed spectral intensity maps. Are you able to calibrate these in intensity for real quantitative studies?

MAGAKIAN: Now it is not possible, but we can do it in our future observations with the new multi-lens spectrograph.

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