CONFERENCE OF 6 m TELESCOPE USERS
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Spectroscopy of stars at BTA: new possibilities and prospects

Yu. Yu. Balega

The 6 m telescope in the first half of 1998

Weather conditions

The observational time distribution for the first half of 1998 is given in Table 2.

The weather conditions may be considered unfavourable: as compared with the first half of 1997, the observational time was by 100 hours shorter.

Auxiliary equipment and methods

The BTA is a tool which is still most efficient in spectral investigations. Over 80 % of observational time is allocated for spectral observations. This is the reason for giving priority to the development of spectral techniques.

In early 1998, first spectra were taken with the large collimated beam diameter (240–260 mm) echelle spectrometer NES at the N-2 focus. The spectral resolution was 60000. An iodine cell and polarimetric attachments were tested.

Moderate resolution spectra (about 15000) were obtained for objects to 15^m with the prime focus echelle spectrometer (PFES) in test observations. The

Table 2: *Observational time at BTA in the first half of 1998 (hours)*

1998	BTA MS data	Observers' data	Difference	%
Jan	194.5	155.0	39.5	80
Feb	101.0	62.0	39.0	61
Mar	76.0	57.0	19.0	75
Apr	96.0	74.5	21.5	78
May	105.5	63.0	42.5	60
Jun	94.0	74.0	20.0	79
Total	667.0	485.5	181.5	73

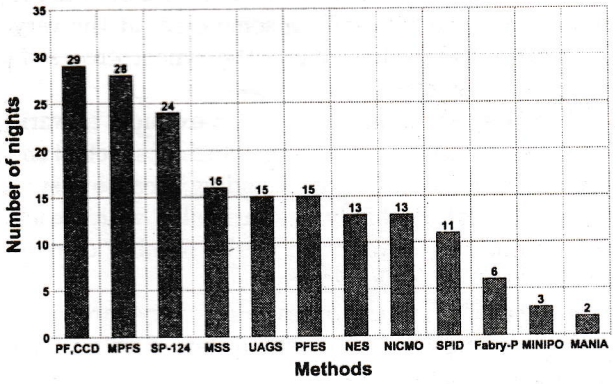

Figure 3: *Time distribution in the techniques used in the 1st half of 1998.*

spectrograph had been developed and built on the initiative of the Stellar Spectroscopy Laboratory and in 1999 it is to be placed into service at the BTA as the device of general use.

The multipupil field spectrograph (MPFS) rates second in the amount of time allocated. Its use in observations in the first half of 1998 demonstrated improvement in the quality of spectra and increased limiting magnitude.

New descriptions of the methods are given in the 6mTPC circular letter.

In the year 1998 the oil supply system modernization has been completed. All-season oil is now used in the system. The temperature conditions inside the dome have been improved.

Observational programmes

The 6mTPC considered 67 time requests 37 of which were granted. The low degree of fulfilment of a number of programmes is due solely to weather conditions.

The time distribution in accordance with the techniques used is presented in Fig. 3.

The increased proportion of direct images is caused by allocation of much time to the programme "Investigation of gamma bursters" (Sokolov, SAO).

The most successful programmes:

K. L. Maslennikov — "Kuiper belt objects"

G. Hasinger — "AGN candidates from the ROSAT list"

O. K. Sil'chenko — "Decoupled galactic nuclei"

S. A. Pustil'nik — "Young dwarf galaxies"

N. A. Tikhonov — "Galaxies in anti-Virgo direction"

Major BTA results

1. Two more dwarf companions have been revealed in the galaxy M 31 in addition to the 5 components discovered in the current century. Distances to these galaxies have been measured for the first time from the data obtained with the CCD camera.

2. From the data for the peculiar supergiants with large infrared excesses — candidates for protoplanetary nebulae — it has been concluded that there is a close correlation between the presence of emission in their spectra at the wavelength of 21 μm and the excess of heavy elements produced in their atmospheres by reactions of slow neutronization.

Yu.N. Gnedin

Ultraviolet polarimetry of celestial objects: discrepancies between theory and observations

A review of present-day data of polarimetric observations of celestial objects in the UV spectrum range ($\lambda\lambda$ 1000–3000 ÅÅ) is presented. The basic data have been obtained with the polarimeters installed in the Hubble Space Telescope and the space mission ASTRO–1. The space polarimetric observations in conjunction with ground-based can supply data in a wide, $\lambda\lambda$(1500–7600) Å, spectral range. A sudden rise in the degree of linear polarization in the UV range proved to be unexpected. So, in a number of cases the UV interstellar polarization curve lies well above the interstellar polarization curve derived by extrapolation from the optical range, which is described by the well-known formula of Serkowsky. For two stars excess polarization is observed around the famous interstellar spectral feature λ2175 Å. For a number of quasars is observed a strong spectral feature in the spectrum of polarized radiation, which corresponds to the Ly_α line. The strong feature may result from the resonance scattering of the line HeI λ584 Å. In this case the relation between the intensities of the polarized radiation resulting from the resonance scattering can be explained by the Hanle effect. Then we have the case when the field of the accretion disk around a supermassive black hole (quasar) can be directly measured for the first time.

Two other mechanisms that may be responsible for the abrupt increase in polarization in the UV region can be the mechanisms of resonance conversion of photons into massless axions (see Yu.N. Gnedin, 1997, Astrophys. Space Sci., **249**, 125) and the effect of Faraday rotation of the polarization plane with Thomson scattering by electrons (Yu.N. Gnedin, N.A. Silant'ev, 1997, Astrophys. Sp. Phys. Rev., **10**, 1).

V. A. Hagen-Thorn, S. G. Marchenko, V.A. Yakovleva, A.V.Hagen-Thorn

Variable sources in active galactic nuclei

The sources responsible for the variability of active galactic nuclei are located in the immediate vicinity of the central engine. Clarifying the nature of these sources might give the clue to the solution of the problem of nuclear activity in general. Because in photometric observations the total radiation of several components (host galaxy, accretion disk, etc.) is recorded, it is necessary to extract the radiation of a variable source from the total radiation. This can be done on the basis of variability studies. For clearing up the nature of variable sources, it is of prime importance to know their spectral energy distributions. These can be found by analysis of multicolour data on photometric variability (Choloniewski J., 1981, Acta Astron., **31**, 293; Hagen-Thorn V.A., 1997, Astronomy Letters, **23**, 23) . Analysis of data on polarimetric variability can provide information about polarization properties of the sources (Hagen-Thorn V.A., 1981, Trudy Astron. Obs. Leningrad Univ. **36**, 20). In both cases information about variable sources can be obtained **without** knowing their contribution to the total flux (for photometry) or to the observed absolute Stokes parameters (for polarimetry). For the analysis we have used both our data and data taken from literature. The main results obtained can be formulated as follows.

1. In many cases the photometric behaviour of AGN on different time scales and in different ranges can be explained by the existence of a single variable source which has a variable flux but changeless shape of spectral energy distribution. In particular, this refers to the behaviour in the flares. As a rule, the spectral shape in the optical–UV region is the same from the very beginning to the end of each event.

2. The spectrum can be well represented by one of a homogeneous synchrotron source with or without the high-frequency cut-off. In some cases at the very top of the outburst light curve the synchrotron self-absorption may exist.

3. The spectral shape constancy excludes all variability mechanisms resulting in change of spectral energy distributions (for instance, fading because of synchrotron losses). Probably, the variability within each event is due to the variation of the number of relativistic electrons in the source.

4. The polarization behaviour is very rarely defined by a single variable source; but if this is the case, the polarization degree of the source may be as high as 50 %. This can be considered as evidence of its synchrotron nature.

V.E. Panchuk

Spectroscopy of stars at BTA: new possibilities and prospects

Results of the work performed in the period between 1996 and 1998 to replace the first-generation BTA echelle spectrometers by updated devices — a prime focus echelle spectrometer (PFES, Panchuk et al., 1998, Bul.SAO, **44**, 127), echelle spectrograph with a large collimated beam diameter (NES, Panchuk et al., 1999, Prepr. SAO RAS, No. 135), an improved version of the fast echelle spectrograph LYNX (Panchuk et al., 1999, Prepr. SAO RAS , No. 139) are presented. Objects with V = 15^{m} have come to be within the grasp of echelle spectroscopy at the BTA in the long run. Examples of accomplishment of selected observational programmes are considered. New classes of tasks that can be provided for by the facilities mentioned are enumerated. Resources are evaluated for the development of BTA spectral devices designed to study point-like objects with high spectral resolution. Suggestions for the improvement of the Main Stellar Spectrograph are put forward.