

## POLARIMETRIC INVESTIGATION OF BL LAC.

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**ABSTRACT.** The extensive homogeneous set of polarimetric observations of BL Lac (1969–1991) has been obtained at Astronomical Observatory of St.-Petersburg University. We discuss the general polarization behavior of the object. The existence of the preferable direction of polarization (in the range between 20 and 30 degrees) as well as the dependencies between polarization parameters and between the polarization and brightness is found. In the individual sources responsible for variability the degree of polarization is as high as 50%. The synchrotron nature of these sources is undoubted.

**Key words:** BL Lac

The problem of the activity of the extragalactic objects is one of the main problems of current astrophysics. Many extragalactic objects demonstrate the activity of different levels, but blazars are the most active. They show the high variable polarization and the strong rapid photometric variability in the optical region. BL Lac is one of the most studied object of that type, but the details of its behavior on long time scales are not quite clear.

In this paper we discuss the results of the polarimetric observations of BL Lac obtained at Astronomical Observatory of St.-Petersburg University in 1969–1991 (Hagen-Thorn et al. 1984, Hagen-Thorn et al. in press). These observations were carried out with the 48-cm reflector. Because of the small aperture the duration of one polarimetric observation was 1.0–1.5 hours. The comparison of our results with those obtained with the large telescopes shows a good agreement (Hagen-Thorn et al. 1984).

The behavior of the polarization parameters is different for different time ranges. Some-

times the parameters of polarization are constant during the month (for example, October 1983, September 1989, August 1989), but sometimes they are variable within a day. A strong variability of polarization on the time scales of an hour was observed only once (6/7 October 1978).

According Angel & Stockman (1980) there are two groups of blazars: the first one with the preferable direction of polarization and the second one without this. But we feel that the conclusion about absence of the preferable direction for some lacertids may arise from the lack of observational data. For example, in the case of BL Lac those authors pointed out that there is "no tendency for preferable angle" but our extensive observations show undoubtedly that the preferable direction exists (Hagen-Thorn et al. 1985, Hagen-Thorn et al. in press).

It has been found that only a weak correlation exists between the degree of polarization and brightness, but the polarization angle shows the dependence on the brightness: for the low brightnesses only directions near to preferable one exist (Hagen-Thorn et al., 1986). This fact is in agreement with the idea of the existence of constantly acting polarized source in blazars; its polarization angle defines the preferable direction (Hagen-Thorn, 1980).

Clearing up of the origin of variable sources is of great importance. In (Hagen-Thorn, 1981) the method was proposed of extracting of the sources of polarized radiation. The application of this method to BL Lac shows that the polarization degree in some sources is as high as 50%. The only possible explanation of so high polarization. The colorimetric data also give arguments for synchrotron origin of variable

sources.

Since the radiation of polarized sources is synchrotron in nature, the existence of preferable direction of polarization (determined by magnetic field direction) is the indication of stable magnetic fields in blazars.

#### References

- Angel J.R.P., Stockman H.S.: 1980, *Ann. Rev. As. Ap.*, **18**, 321.  
Hagen-Thorn V.A.: 1980, *Ap. Sp. Sci.*, **73**, 263.

- Hagen-Thorn V.A.: 1981, *Transactions Astron. Obs. Leningrad State Univ.*, **36**, 20.  
Hagen-Thorn V.A., Marchenko S.G., Yakovleva V.A.: 1984, *Astron. Zhurn.*, **61**, 625.  
Hagen-Thorn V.A., Marchenko S.G., Yakovleva V.A.: 1985, *Astrofizika*, **22**, 5.  
Hagen-Thorn V.A., Marchenko S.G., Yakovleva V.A.: 1986, *Astrofizika*, **25**, 485.  
Hagen-Thorn V.A., Marchenko S.G., Yurchenko A.V., Yakovleva V.A. *Astron. Zhurn.* (in press).

## THE EFFECTIVE TEMPERATURE DETERMINATION OF O-B STARS BY H AND He RADIO RECOMBINATION LINES OBSERVATIONS

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**ABSTRACT.** It is proposed to evaluate, on the basis of H and He radio recombination line observations, the number ratio of stellar photons, capable to ionize helium, to those capable to ionize hydrogen. Then, comparing this ratio with a prediction of model stellar atmospheres, the effective temperature and other stellar parameters are determined. Thus to the information about a total number of Ly- $\gamma$  quanta it adds the information about a spectrum slope in Ly- $\gamma$  wavelength range, which is not directly observable, but information about it is special importance for O-B stars. The choice of an object and angular radio telescope resolution needs to make so that ionizing photons (Ly- $\gamma$ ) should be absorbed completely in a region of investigation and beam should cover enough this region. Therefore it is proposed to use

compact HII regions and a central part (core) of such HII regions which have a "blister"-type structure. This way is applied to the galactic HII regions: Orion A (38500), DR-21 (36000), S106 (35300), Sgr B2(N3) (35100), W48 (38700), Orion B (36100), W3A (43000), there the obtained effective temperature of exciting stars are in parentheses. Results of it are discussed and compared with different model stellar atmospheres. For sources S106 and Sgr B2(N3) it has obtained the strong difference of total number of Ly- $\gamma$  photons between its determination by radio flux density and that by radio lines. Possibly this difference is needed to take into account in further study of these objects. Full paper was published in *Astronomicheskii Zhurnal* (1993, 70, 72).

**Key words:** HII regions, O-B stars.