RR LYRAE VARIABLE STARS

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Some twenty years have passed since the decision was taken by the General Assembly of IAU in 1958 to resume a regular control of light variation stability in RR Lyrae stars. With this end in view the revision of elements is carried out at the Odessa Astronomical Observatory yearly, whereas ephemerides of RR Lyrae stars are published at the Krakov Observatory. Now 164 stars brighter than $11^{m}.6$ at maximum light visible in the northern hemisphere have entered the list.

Considerable photometric observational material analyzed has shown that some RR Lyrae stars have stable periods of light variation (e.g. TV Lib, UY Cyg, SU Dra), while other ones have periods which vary regularly or proportionally to time (e.g. SV Eri, AV Peg, RV CrB) (Tsesevich, 1966; Firmanyuk, 1976; Romanov et al., 1978). In case of DR And at comparatively small amplitude of O-C variation, about 0.15, a synchronous variation in mean light at maximum nearly by $0^{m}.3$ has been found (Romanov, 1978). Unfortunately, necessary observational material is frequently unavailable to obtain the unambiguous classification of period stability character. The property of RR Lyrae stars light variation stability is connected with the weakening of KCaII absorption line (Tsesevich, 1966, 1971).

Periods of O-C variation range from 6000^{d} to 60000^{d} except three RRc stars. It is surprising that periods of O-C variations in variable stars of different types turn out to lie within the same range (Figure 1) (Firmanyuk, 1979).

The studies of normal and anomalous Blazhko effect have shown that besides variations in light curve, radial velocity and colour index,

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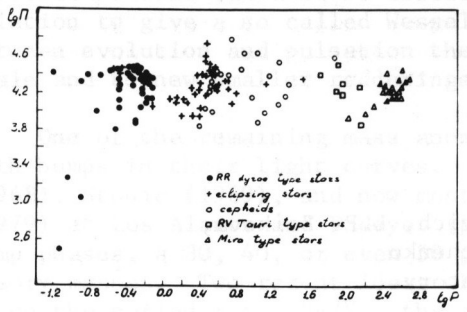

Figure 1. The dependence of a period of residual variation O-C on a period of light variation in variables of different types.

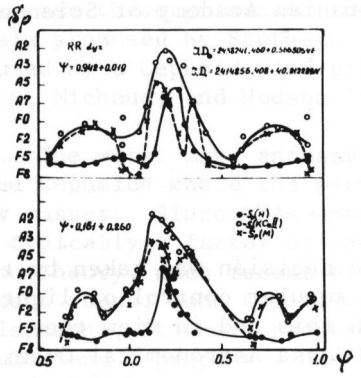

Figure 2. Spectral type variations in RR Lyrae.

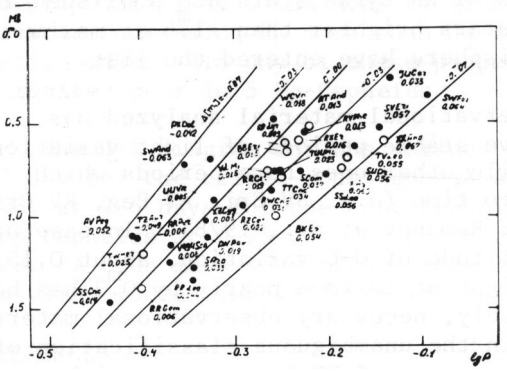

Figure 3. The location of RR Lyrae variables in the period-luminosity diagram depending on the metallicity parameter $\Delta\,(m_1)$.

there also occurs a variation in light gradient (Zaikova et al., 1974) as well as in spectral characteristics (Fenina et al., 1975; Romanov et al., 1976; Fenina, 1975). In Figure 2 is shown a spectral type variation determined from absorption lines of hydrogen, KCaII and other metals in RR Lyrae for two phases of Blazhko effect. In SW and at normal intensity of KCaII line a strengthening of metal line absorption is noticed (Fenina et al., 1975; Epstein, 1969). In RZ Lyr and XZ Cyg at large intensity weakening in KCaII line the same phenomenon in metal lines is not observed (Romanov et al., 1976; Fenina, 1975). As a whole, the intensity variation in KCaII and metal lines with the

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primary period and Blazhko effect in RR Lyrae stars turns out to be complicated. This may lead to ambiguous relations between $(m_1)_0$ and ΔS (Epstein, 1969) and even between $(k-b)_2$ and ΔS (Jones, 1973). The weakening of KCaII line in RR Lyrae stars is far from always followed by that in KCaII (Fenina, 1977). It is of interest to note that for RR Lyrae stars (save RRc and RRs) there arises a net of period-luminosity relations with the account of metal content (Figure 3) (Zaikova et al., 1979).

The presence of two perturbing radius variations at radial pulsations with definite phase and amplitude relations brings about anomalous Blazhko effect in RZ Lyrae (Romanov, 1973). It enables us to construct a general pattern of Blazhko effect manifestation supposing that there exists one or more perturbing radial variations (Romanov, 1975). The anomalous Blazhko effect in RZ Lyr may lead to the exceeding of radial velocity amplitude nearly two times than the expected one from the mean relation "radial velocity amplitude - light curve amplitude" (Romanov, 1977).

The primary period variation in RR Lyrae stars is a rule followed by the Blazhko effect period variation. However, in some cases this relationship is disrupted (RR Lyr, AR Ser and others) (Tsesevich, 1966, 1975). The variation of RR Lyr magnetic field takes place practically synchronously with stellar pulsation on the basis of 1978 observations with the aid of the 6m telescope.

For further investigations of RR Lyrae stars regular photometric and spectral observations are required. Of particular importance are observations in the uvby and k systems. It is desirable to extend the ephemeris service over southern RR Lyrae stars too. A significant advance in RR Lyrae stars study could be the realization of international cooperative spectral (involving the determination of magnetic field intensity) and photometric observations of RR Lyrae itself on all the light curve in different phases of Blazhko effect.

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