Phase-resolved spectroscopy of the polar AN Ursae Majoris in intermediate brightness state

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Abstract.

We report the results of simultaneous time-resolved spectral and photometric observations of AN UMa obtained with the TV scanner and photometer NEPh of the 6 m telescope in an intermediate state of brightness $16.^m0$ - $16.^m5$ in March, 1991 and $17.^m0$ - $17.^m5$ in January, 1992. The variation of profiles, equivalent widths, central intensities, half-widths and radial velocities of the hydrogen and HeII 4686 Å emission lines with the orbital period is followed from 106 spectra with an average temporal resolution of 5 minutes and spectral resolution ≈ 2 Å in the wavelength range $\approx$ 4000 - 5000 Å. The emission line profiles show a complex structure and strong variability with the phase of orbital period. Cases of appearance of new components have been recorded on a time scale of 5 minutes in the state close to the low state of system brightness. The lifetime of these components is 20-40 minutes. Significant variations of the equivalent width and central intensity of the HeII 4686 Å with the orbital period depending on the brightness of the system have been revealed. These parameters remained practically unchanged in the state, when the system was about 17^m, whereas in the intermediate state ($16.^m0$ - $16.^m5$) they vary dramatically with the phase of the orbital period and have two maxima at phases 0.7(0.4) and 1.2(0.9) (phases without brackets are computed from Bonnet-Bidaud et al., 1996, and in brackets for comparison are given the phases from Liebert et al., 1982) as well as for Balmer lines. The distribution curves of the halfwidths with the phase of the orbital period for HeII 4686 Å and Balmer lines have maxima at phase 0.8(0.5) and in the vicinity of phases 1.2(0.9)-1.3(1.0). At phases between 0.65(0.35) and 0.95(0.65) the helium line branches, i.e. it becomes two-component.

The radial velocity curves measured from the peaks and centers of gravity of the emission lines $H\beta$, $H\gamma$, HeI 4471Å and HeII 4686Å have been approximated by sinusoids fitted with the least square method. The observations made at SAO RAS have demonstrated that all spectral characteristics and their variations with orbital period are not the same in different years, i.e. they are time-variable depending on the state of brightness of the system. Two different levels of brightness may be interpreted under the assumption of variable rate of matter accretion by the magnetized white dwarf.