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POLARIZATION ECLIPSE MODEL OF THE WOLF–RAYET BINARY V444 CYGNI WITH CONSTRAINS ON THE STELLAR RADII AND AN ESTIMATE OF THE WOLF–RAYET MASS–LOSS RATE

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ABSTRACT. We present an improved analytical model as well as a new set of multiwavelength observation of the polarization eclipse of the Wolf–Rayet binary V444 Cygni (WN5+O6). Comparing the model with the observations yields an estimate of the O and Wolf–Rayet star radii as well as of the Wolf–Rayet mass–loss rate. For the O star we find R = 8.5 $R_\odot$ and for the Wolf-Rayet star R<4 $R_\odot$. This values are in agreement with those derived by Cherepashchuk et al. from the detailed analysis of multiwavelength light curves.

For the Wolf-Rayet mass-loss rate we obtain $\dot{M} = 7.5{\cdot}10^{-6} M_\odot$/yr, which is compatible with the dynamical values obtained from the rate of orbital period increase and with the value of dM/dt determined from the orbital double-wave modulation in polarization, but is at least 3 times smaller than the values derived from free–free radio fluxes and modeling of infrared spectral lines. However, no allowance has been made in calculating the mass-loss rates for inhomogeneities, for which evidence is increasing in hot star winds. If the wind of the WR star V444 Cygni is found to be clumpy, the radio/IR mass-loss rates are likely to be overestimated because of their dependency on the square of density. In such case, these values would probably have to be significantly decreased, bringing them closer to the polarization estimates, for which clumpy winds are irrelevant, providing the electron scattering remains optically thin.

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