Unveiling the nature of the He II λ4686 periodic minima in η Carinae

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η Carinae is known to be a massive binary system, but some of the orbital parameters remain uncertain. The nature of the periodic minima seen in several spectral features are associated with periastron passages near stellar conjunction, but its nature has been interpreted either as a low excitation event or as an eclipse of the hotter secondary star by the dense inner wind of the primary. We conducted an intense spectroscopic monitoring of the He II λ4686 emission line across the 2014.6 event using ground- and space-based telescopes. Comparison with results from the past two events confirmed the stability of the equivalent width and radial velocity of this line, as well as the strict periodicity of its minima. In combination with different other measurements, the orbital period is 2022.7 (±0.3) d. We adopted a power law model in combination with the total opacity in the line of sight to the apex of the wind-wind collision region obtained from hydrodynamic simulations to reproduce the observed He II λ4686 equivalent width curve. We constrained the orbital inclination to 135°-153° and the longitude of periastron to 234°-252°. Periastron passage occurred on T_0(2014.6)=2456874.4 (±1.3) d. With these orbital elements, we successfully reproduced both the equivalent width curve observed from our direct view of the central source and the polar view. This suggests that the He II λ4686 minimum is ultimately caused by an increase in the opacity in the line of sight to the emitting region as the secondary star moves behind the primary star and plunges into denser regions of its wind.

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