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Inflation of luminous metal-rich WR stars – a clue to mass loss?

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Abstract. We investigate the influence of metallicity and wind mass loss on the radii of luminous Wolf-Rayet stars.

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We investigate the influence of metallicity and wind mass loss on the radii of luminous Wolf-Rayet stars. We have calculated chemically homogeneous models of Wolf-Rayet stars of 10 to 200 $M_\odot$ without mass loss for two metallicities ($Z = 0.02$ and $Z = 0.001$), using OPAL opacities. We also constructed theoretical helium main sequences of 15 to 30 $M_\odot$ with stellar wind mass loss rates between 10^{-4} and $10^{-5}\,M_\odot\,yr^{-1}$.

Our models confirm the radius extension of luminous, metal-rich Wolf-Rayet stars reported previously by Ishii *et al.* (1999), i.e., the inflation of the hydrostatic stellar radius. We also show that for small values of the stellar wind mass loss rate, an extended envelope structure is still present. However, for mass loss rates above a critical value Wolf-Rayet radii decrease and the stellar structure becomes compact. We discuss possible evolutionary and observational consequences of an inflated envelope for a mass-losing Wolf-Rayet star.

Reference

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