CONVECTIVELY GENERATED TURBULENT PRESSURE: A POSSIBLE CAUSE FOR η CAR - TYPE SHELL EJECTIONS

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A selfconsistent hydrodynamic calculation of a very massive star ($M_{ZAMS} = 200 M_\odot$) including turbulent pressure and energy has been performed. In the contraction phase after core hydrogen exhaustion, the star moves towards cool surface temperatures in the HR diagram (cf. Fig. 1). Consequently, (at $T_{eff} \simeq 8\,000 K$) an envelope convection zone developes, and its inner boundery moves inwards with time. First, the envelope remains in hydrostatic equilibrium, with radiation pressure correspondingly decreasing as turbulent pressure increases (gas pressure is small). However, due to the fact, that the gradient of the turbulent pressure is directed inwards at the bottom of the convective zone, this part of the star rapidly contracts. Due to the released contraction energy, the luminosity locally exceeds the Eddington-luminosity. It cannot be transported outwards by convection in the upper part of the convection zone, where convective energy transport is inefficient ($\nabla_c \simeq \nabla_r$). Thus, the local super-Eddington luminosity leads to the ejection of the overlying layers.

In our example we found about $\sim 0.2\, M_\odot$ to be ejected with velocities of about 230 km/s. The stellar surface temperature increases to $T_{eff} \simeq 30\,000 K$. Many of our model properties resemble observed properties of η Car or other Luminous Blue Variables. During the further evolution of the remaining star, the process of shell ejection will probably be repeated with a period of some 100 yr.

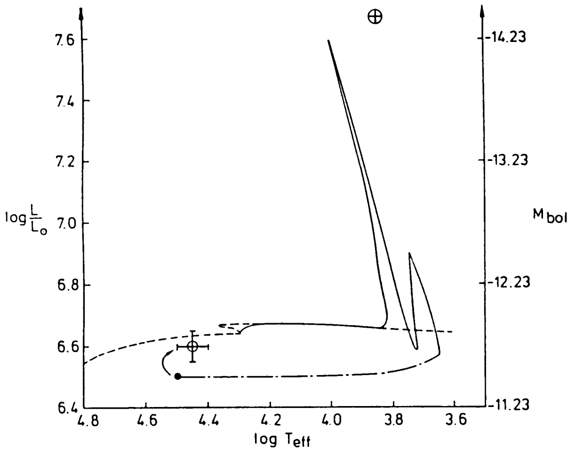

Figure 1: Evolutionary tracks of our 200 $M_\odot$ sequences in the HRD. The solid and dashed lines correspond to computations with and without turbulence, respectively. The encircled crosses show the positions of η Car today and during the great eruption (Davidson, 1986, in: *Instabilities in Luminous Early Type Stars*, H. Lamers, C. de Loore, eds., p. 127; Davidson, 1989, IAU-Colloq. **113**, p. 101). The filled circle corresponds to the last model of our sequence. The arrow indicates the probable further evolution.

K. A. van der Hucht and B. Hidayat (eds.),
Wolf-Rayet Stars and Interrelations with Other Massive Stars in Galaxies, 549.

https://doi.org/10.1017/S0074180900045745 Published online by Cambridge University Press