WHEN THE STARDUST SETTLES:

temperature and grain size variation surrounding WR140

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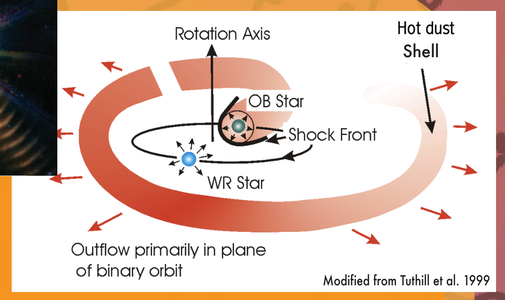
REFERENCES HERE!

DUST FORMATION in WCd BINARIES



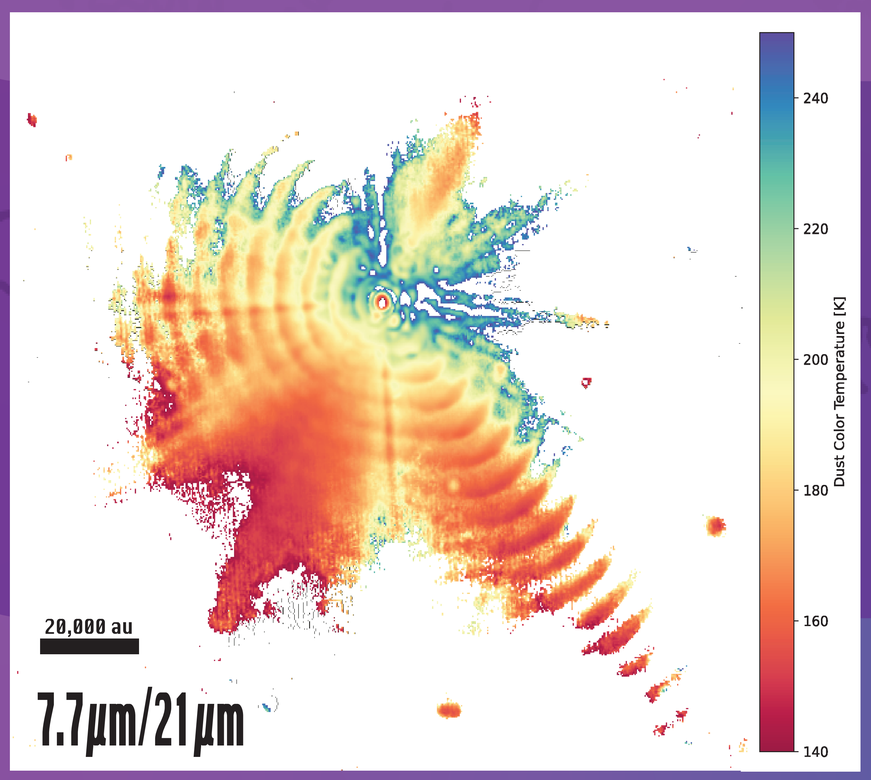
Carbon-rich WR binaries can be prominant dust producers in the galaxy. Dust is created in WC binaries where the hot, dense, hydrogen-poor stellar wind of the WC star collides with the weaker hydrogen-rich wind of the OB companion, creating a shock cone in which the conditions are ideal for the condensation of the carbon-rich stellar material into dust particles. A quintessential example of a periodic, episodic WC dust-producing binary is the system WR 140.

COLOR TEMPERATURE MAPS

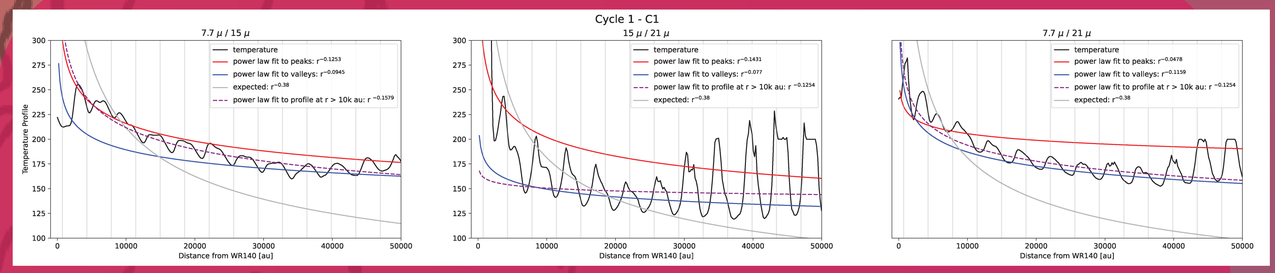
Using two observations of a dusty source at wavelengths λ_1 and λ_2, the dust color temperature, Tc, can be calculated from the ratio of the emission at λ_1 and λ_2:

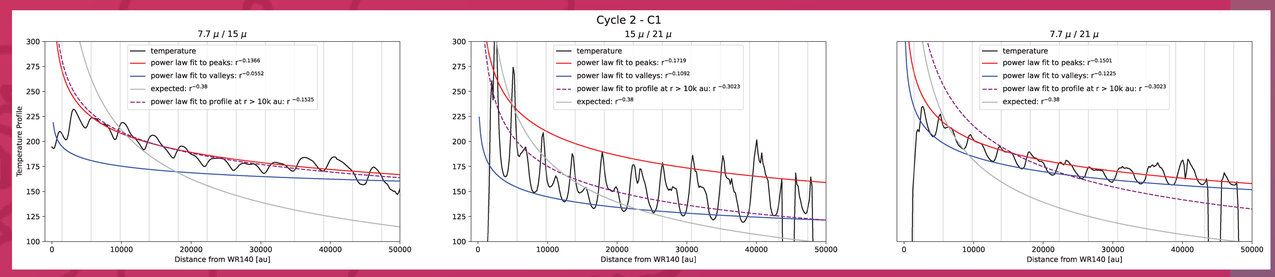
$$\frac{I_{\lambda_1}}{I_{\lambda_2}} = \left(\frac{\lambda_1}{\lambda_2}\right)^{-\beta} \frac{B_{\lambda_1}(T_c)}{B_{\lambda_2}(T_c)}$$

Color temperature maps of a dusty region that exhibit peaks or gradients indicate additional sources of heating and dust grain-size variation.



COLOR TEMPERATURE vs DISTANCE



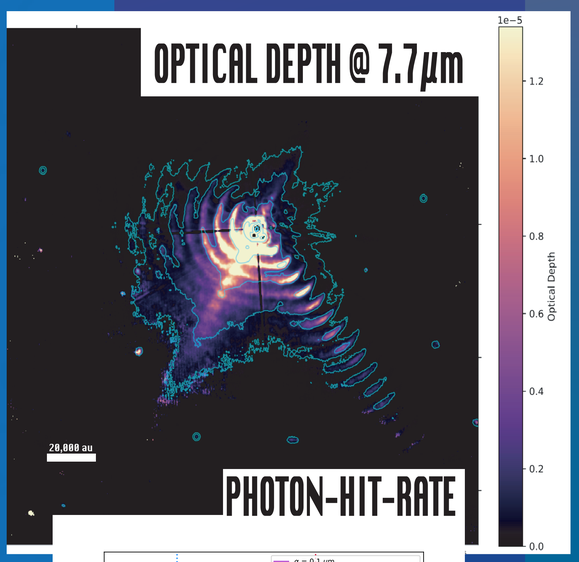


Measuring the temperature of the dust as a function of distance from the stars reveals how the dust grains are being heated. If all the dust surrounding WR140 were in thermal equilibrium, the temperature fall-off would follow an $r^{-0.38}$ relationship. Since all the dust surrounding WR140 is opticall thin, the shape of the temperature profiles above must be astrophysical.

MAJOR TAKE-AWAYS

The shape and fall-off of the color-temperature profiles imply that:

1. The dust surrounding WR140 is cooling much slower than expected, indicating that the grains are not in thermal equilibrium. There must be stochastic heating of the grains at radii >10,000 AU.
2. Only dust grains smaller than 0.001μm in diameter are receiving less than 1 photon per second and therefore can be heated stochastically at these radii .



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