MASS-LOSS FROM LATE-TYPE STARS: NEW OBSERVATIONAL EVIDENCE

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Rapid mass-loss is observed in many late-type stars, yet the mass-loss mechanisms operating are not well understood. A survey of molecular emission from circumstellar shells has been carried out using millimeterwave molecular lines and suggests that radiation pressure alone may be inadequate to explain the observed mass-loss, especially in the case of carbon-rich objects which may display rates in excess of 10^{-5} $M_\odot$/yr. Recent near-IR molecular line observations provide evidence for ejected material at several different velocities along the line-of-sight and may indicate the additional mass-loss mechanism at work. Resonantly scattered IR radiation spatially displaced from the central IR continuum source has now been observed for the first time and sheds new light on the IR absorption-line results, providing information about material within 10^{16} cm of the central star. These results are discussed along with recent high-resolution millimeterwave observations.

BEGELMAN: Your point concerning acceleration of the wind by radiation pressure is valid only if the optical depth across the acceleration zone is smaller than unity. If multiple scattering occurred in the acceleration zone, then the amount of momentum which could be extracted from the radiation field would be larger by a factor of about τ, up to a maximum of about c/v_{wind}.

WANNIER: That is correct, though such a high amplification seems unlikely owing to degradation to longer wavelengths upon multiple scattering.

WEHRSE: In our investigations of the CO 2.3 μm lines, we find that the main problem in the interpretation is the mode of line formation (true absorption or scattering) and not the temperature stratification.

WANNIER: In the extended envelopes of high mass-loss objects, the low rotational levels of CO are thermalized. The knowledge of T(r) is necessary in these cases.

BECK: What are the differences in velocity between the observed velocity components?

WANNIER: Typically, as small as 5 km s^{-1} (comparable to the infrared spectral resolution which is used) and up to the expansion velocity (several tens of km s^{-1}). On the other hand, I should point out our results for V Hya, which show significantly larger velocities - several times the expansion velocity.

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