On the Nature of Radio Emission of Late-Type Giants

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Long-period variable stars (LPV's) are considered. Pulsations of the surface of such a star result in formation in the stellar atmosphere of a shock wave in each cycle of the star's variability, ionizing the circumstellar gas which, recombining, gives rise to emissions in optical lines hydrogen and metals. I show the recombining layer behind the shock front to be optically thick in the free-free continuum at the radio wavelengths as short as 1 cm. At the gas temperatures behind the front T = 20000 K, the radio flux density at 1 cm from the front surface at a distance of a few hundred parsecs will be several or several tens of mjy. So far, the only positive result of searches for LPVS' radio continuum is the detection of radio flux from R Aql, obtained at different epochs by several authors. In October 1978 R Aql showed radio emission of 5.3 mjy at 14.9 GHz (Bowers and Kundu, 1979), and in August 1985 - 0.54 mjy at the same frequency (Drake et al., 1987); these figures are consistent with our model. Besides that, R Aql experienced stronger radio flares at longer wavelengths, up to a few hundred mjy (Woodsworth and Hughes, 1973; Estalella et al., 1983); these cannot be explained by thermal radio emission and require a nonthermal mechanism (synchrotron or cyclotron maser).

No continuum radio emission was found in other LPVS, possibly due to unfavorable observaional epochs. It is desirable to monitor systematically the nearest LPVS (R Cas, W Hya, O Cet, R Leo), especially at the variability phases when optical emissions are present.

LPVS' continuum radio emission may influence the intensity of their circumstellar molecular maser emission (OH, H_2O, SiO), provided the maser is initially unsaturated and the molecules are amplifying the stellar radio continuum. In this case, correlation must exist between the fluxes in the radio continuum and maser line (Rudnitskij, 1987).

References

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