Emission Line Variations in γ^2 Velorum

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In this paper, we present results of an intensive search for periodic variations in the strength of the HeII emission line of γ^2 Vel relative to the nearby continuum. The data were obtained in 1986 and 1988 using an automated optical system located at the Amundsen-Scott South Pole Station. Ten of the data sets have a time resolution between 2 and 3 minutes and consist of 2.3 - 20.4 hours of continuous photometry (Taylor, *AJ*, in press). Three of the data sets have a time resolution of about 1 minute and span between 1.2 and 6.5 hours.

Power spectrum analyses of the lower resolution data suggest a period of about 1.26 hours. According to recent theoretical models (Cox and Cahn 1988, *Ap.J.* 326, 804), a hydrogen-deficient Wolf-Rayet star with an initial mass of $85M_{\odot}$ exhibits a first-overtone radial mode of oscillation with a period of 1.23 hours. Additional models by Maeder (private communication) indicate radial oscillations with periods on the order of an hour.

Since the HeII emission line is optically thick, we do not detect the actual pulsation of the star, but, rather, the effects of stellar pulsations on the overlying atmosphere. We believe that radial instabilities in γ^2 Vel give rise to intermittent mass ejection which in turn changes the ionization state of the wind. According to theoretical work by MacFarlane and Cassinelli (1989, *Ap.J.* 347, 1090), as mass propagates outward, it is accelerated to supersonic rates and as it overtakes slower moving gas, both forward and reverse shocks are formed. At the boundary of the two shocks is a sharp density enhancement which modifies the ionization structure of that part of the wind and which in turn, leads to changes in the emission lines.

Preliminary analysis of the higher resolution data, suggests more rapid fluctuations, on the order of 3 - 8 minutes. Although we do not yet understand this result, it may confirm work previously reported by Jeffers, et al. (1973, *Nature Phys. Sci.* 243, 109) of 200 ± 50 seconds.

It is clear that before we can understand the physical processes which are taking place in γ^2 Vel, high resolution continuous photometry spanning several days, at least, are essential.

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