A PRELIMINARY REPORT ON SIMULTANEOUS ULTRAVIOLET AND OPTICAL OBSERVATIONS OF LAMBDA ERIDANI

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Radial velocity observations of λ Eridani between 1971 and 1980 and uvbyHα photometry in 1977 show that the star is both a light and velocity variable with a period of 0.701538 d. *Copernicus* observations in 1977 are compatible with this result. Both the radial velocity and photometric amplitude are variable, and these variations may be correlated with the hydrogen emission line strength. The character and phasing of the light and velocity curves suggest that λ Eridani is a pulsating variable.

I obtained five 12 Å mm^{-1} spectrograms of λ Eridani in 1974 after Irvine (1974, 1975) discovered Hα emission in its spectra and suggested that it might be a binary star. No emission was apparent in the Hβ line at that time, and the radial velocity seemed to be constant. I obtained a large number of new spectrograms in 1976 following the report by Percy (1976) that it was varying by $\Delta b \simeq 0^m.06$ (Percy and Lane 1977). There was a broad, double-peaked emission present in Hβ at this time, and the radial velocity measured from the He I lines was varying by about 60 km s^{-1} with a period of either 0.4 or 0.7 d. The velocities of the Hβ emission peaks and central absorption were not variable, but the V/R ratio was correlated with the He I velocities in a way that suggested that the V/R variations were caused by shifts or profile changes of the underlying absorption line.

In order to check the reality of the periodicity, resolve the period ambiguity from the 1976 observations, and determine the nature of the variability I obtained simultaneous ultraviolet and optical spectroscopic and photometric observations of the star during December, 1977. I obtained uvbyHα observations with the University of Toronto's 0.6 m telescope at Las Campanas, Chile from December 5-15, 1977. A total of 233 differential magnitude measurements were obtained in each of the 6 filters on 9 different nights. During a 2.5 day period in the middle of this run I obtained repeated scans of the Fe III lines in the λλ1114-1135 Å region and the Si IV lines in the λλ1390-1404 region of the spectrum with the U2 photometer on the *Copernicus*

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satellite. At the same time the U1 photometer was left fixed in a continuum region near 1200Å. These observations were supplemented with 12 Å mm^{-1} spectrograms taken during the period November, 1977 to January, 1978 with the 1.88 m telescope at the David Dunlap Observatory. I have extended the time coverage of this data by obtaining spectrograms frequently in each succeeding season and by borrowing and re-measuring KPNO coudé spectrograms obtained by Abt (Abt and Levy 1978) between 1971 and 1976. This paper is a preliminary report based on partial reduction and analysis of this material.

There was no emission visible in Hβ during 1977, but Hα was almost completely filled in. Hβ showed a double-peaked emission again during the 1978-79 observing season, which was still faintly visible during part of the 1979-80 season, but there was no obvious Hβ emission during the past season. Power spectrum analysis of the He I radial velocities measured from the spectrograms taken during the period 1971-80 indicates that the velocity varies with the period 0.701538 d. There are no other statistically significant periodic variations in these data, but the amplitude of the variation does change from less than 30 km s^{-1} to as much as 56 km s^{-1} on time scales of a year or less. There are indications that these amplitude changes are correlated with the strength of the hydrogen emission and changes in the amplitude of the photometric variations. Examination of the "emission free" Hβ profiles obtained in 1977 suggests that the absorption line profile varies in a manner similar to that seen in non-radially pulsating stars (Smith and McCall 1978), but this must be confirmed by the He I line profiles.

Power spectra of the 1977 uvby observations show the same period as the radial velocities. There is also significant but much smaller power at one-half this period. The amplitude of the periodic variation is about $0\overset{m}{.}02$. In addition to these variations there was a (roughly) linear decrease in brightness of $0\overset{m}{.}0015$ d^{-1} during the observing interval. All of the variations have comparable amplitude in each color, but there is a hint that the amplitude is inversely proportional to wavelength. The Copernicus data have not been fully analyzed, but the power spectra of the U1 and V3 data are consistent with all of the conclusions drawn from the uvby data.

So far I have only examined the u light curve in detail. If phase $0\overset{p}{.}0$ is defined as the time of maximum radial velocity, then the primary (1Θ) light curve variation has minimum near $0\overset{p}{.}25$ and maximum near $0\overset{p}{.}75$, and the secondary (2Θ) variations have minima near $0\overset{p}{.}35$ and $0\overset{p}{.}85$. The secondary variations are only significant at about the 3σ level. The shape of the light curve and its phasing with the radial velocity curve exclude ellipsoidal and eclipsing variable explanations for the variations. The variations are consistent with pulsation provided that the temperature is nearly constant during the cycle. If the pulsational interpretation is borne out by the complete analysis of the observations and the correlation between hydrogen emission strength and amplitude of the variations suggested above is confirmed, we must consider the possibility that the ejection of emission envelopes in at least some Be stars may be related to pulsation of the source star.

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DISCUSSION

Jerzykiewicz: The period of $^{d}\!.7$ is much too long for a radial fundamental pulsation mode. If it corresponds to an oscillation, the mode involved would have to be a g-mode. Such modes are strongly damped in these stars. Could the $^{d}\!.7$ period be due to a spot on the surface of the star carried around by rotation?

Bolton: I think it is too early in the data analysis to be drawing conclusions. I suspect that you cannot explain both the light and velocity amplitudes by a spot. Detailed examination of the HeI line profiles will probably permit this to be sorted out.

Snow: When you analyzed the power spectrum of the *Copernicus* satellite data, did you find periodic behaviour with the orbital period of the satellite?

Bolton: No, I was surprised that I found nothing because the orbital period of the satellite changed the position of the stationary U1/V1 tube. Apparently I chose the continuum position well. The orbital period of the satellite did show up in the window function because of periodic occultation of the star and the South Atlantic Anomaly.

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