model the effects of stronger convection at about this and cooler temperatures on the pulsational driving. If the very high growth rates calculated here indeed occur in real stars, it may be that the rapidly growing pulsations result in episodic ejections of mass of the tenuous outer layers of massive supergiants just below the H-D Line.

59.06
Use of Temperature-Sensitive Line Ratios for Stellar Seismology

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The line depths of virtually all stellar spectral lines are sensitive to small changes in stellar temperature $T_{\text{eff}}$ induced by pulsations, with varying degrees (and signs) depending on the mean $T_{\text{eff}}$ and the line ionization and excitation state. For large-amplitude pulsators, such as Cepheids, temperatures obtained from individual line pairs are sufficiently accurate and invariant to reddening to play an important role in distance measurements. For small-amplitude pulsators, this technique is inadequate. However, by combining the information from a very large number of spectral lines recorded with high spectral resolution, such as can be provided by a cross-dispersed echelle spectrograph, it should be possible to measure temperature changes to a precision considerably greater than can be obtained by comparing single pairs of lines. We explore this possibility by using a grid of synthetic stellar spectra to provide the run of temperature sensitivity as a function of wavelength throughout the spectrum, and make specific application to spectra obtained with the Advanced Fiber Optic Echelle (AFOE) spectrograph.

59.07
The Impact of Pulsations and Waves on Hot-Star Wind Variability

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Hot luminous stars (O, B, W-R) are observed to have strong and variable stellar winds, and many classes of these stars are also inferred to pulsate radially or nonradially. It has been suspected for some time that these oscillations can induce periodic modulations in the surrounding stellar wind and produce observational signatures in, e.g., ultraviolet P Cygni line profiles. However, the fact that most low-order and low-degree oscillation modes are evanescent in the photo sphere (i.e., damping exponentially instead of propagating sinusoidally) presents a problem to the survival of significant wave amplitude in the wind. We find, though, that the presence of an accelerating wind can provide the necessary impetus for evanescent modes to effectively "tunnel" their way out of the interior. First, in the subsonic, or near-static wind, the reference frame of the temporal oscillations is itself beginning to propagate, and this implies that a small degree of group velocity is imparted to the evanescent waves. Second, in the supersonic wind, the density no longer falls off exponentially, but much more slowly, so the effective scale height grows much larger. Frequencies previously evanescent here no longer "see" as much of an underlying density gradient, and are free to propagate nearly acoustically.

We model the propagation of oscillations into a hot-star wind via a numerical radiation-hydrodynamics code, and we find that evanescent is indeed not a hindrance to producing wind variability correlated with stellar pulsations. Preliminary models of strong (nonlinear) radial wind oscillations of the $\beta$ Cephei variable BW Vulpeculae show good agreement between observed and modeled base "radial velocity curves" and wind-contaminated UV profile variability. We are currently applying this general modeling technique to other systems, especially those which rotate rapidly and exhibit nonradial oscillations (e.g., $\zeta$ Puppis and HD 64760), extensively observed by the IUE MEGA project.

59.08
The Time-Dependence of the Frequency Components in the Light Curve of RV And

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The brightness variations of the semiregular variable RV And have been monitored for about 12 years at Grinnell College’s Grant O. Gale Observatory as part of a project designed to investigate the mode of pulsation for this class of stars. In the early 1980’s the Fourier spectrum of the light curve had only one strong frequency component, but following an apparent mode change in 1986 the Fourier spectrum became more complex, suggesting simultaneous pulsation in two or more modes. Since that time both the strengths and the frequencies of these components have been variable, although there has been a trend back toward a simpler Fourier spectrum. The behavior of the frequency components suggests that the oscillations of these stars may involve complex interactions among several modes of pulsation.

59.09
Beat Cepheid Period Ratios from OPAL Opacities

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We present the results of linear non-adiabatic pulsation models for intermediate-mass stars with metallicities typical of Milky Way, LMC, and SMC objects. A total of 1560 models of Milky Way Cepheids and 1470 models of LMC and SMC Cepheids have been analyzed for mode excitation and pulsation period. We compare our results with the observed period ratios seen in 12 Milky Way Beat Cepheids and the 45 LMC Beat Cepheids discovered by the MACHO project. The probable range of period ratios for SMC Beat Cepheids is also discussed.

59.10
Commensurability between Intermediate NRF modes of $\xi$ Oph from Multi-site Observations


From simultaneous multi-site high-resolution spectroscopic and photometric observations of $\xi$ Ophiuchi in 1993, we find that the line-profile variations of Hel $\lambda$ 6678 are well reproduced by two large and some small amplitude sinusoids. The periods of the two principal sinusoids, 2018 hr and 3330 hr are commensurate with a superperiod of 10.05 hr. Although our data in the period is limited, our photometric observations confirmed again very small amplitude of the light variations, close to their detection limit. No counterpart of the 2.018 hr and 3.377 hr periods can be reliably detected.

59.11
The MACHO Project LMC Variable Star Inventory: New R Coronae Borealis Stars


We report the discovery of several new R Coronae Borealis (RCB) star candidates in the Large Magellanic Cloud (LMC) using the MACHO project photometry database. The identification of these stars has been confirmed spectroscopically. One is a cool RCB star ($T_{\text{eff}}$ ~ 5000 K) characterized by very strong Swan bands of $C_2$ and violet bands of CN, and weak or absent Balmer lines, G-band and $^{12}C^{12}C$ bands. The second star is an example of a hot RCB star of which only 3 were previously known to exist in the Galaxy and none in the LMC. Its spectrum is characterized by several C II lines in emission. Both stars have shown deep declines of $\Delta V$=$4$ mag in brightness.