The Accuracy of Four-Color CCD Photometry of A-Type Stars
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A program of four-color CCD photometry of A-type stars in the galactic halo and in globular clusters has been underway since 1986 at Kitt Peak and Cerro Tololo Inter-American Observatories. Many of the stars in this program are stars which had been observed earlier with single-channel photometers on telescopes ranging from the 2.3 m at Steward Observatory to 0.5 m telescopes at KPNO and CTIO. For stars of y = 15 mag the single-channel photometry showed internal probable errors of ±0.05 in the c1 index. This showed the highest error because it includes measures made through the u filter. The combination of the narrow four-color u filter and the low intensity of this region of the spectrum of an A-type star results in a loss in over a magnitude relative to the y, b or v filters. In the (b-y) index the probable errors averaged about 0.03 mag for the same stars. Errors of this size make it impossible to do astrophysics with the photometric results. CCD photometry reduced these errors substantially. Internal probable errors for the c1 index were near ±0.01 and for the (b-y) index were near ±0.007 mag. With this it is possible to see structure on the horizontal branch. The A-stars can be classified by evolutionary age into two groups. One group is composed of stars evolving to the blue in the HR diagram (y versus b-y) and the second group consists of the more evolved stars on a redward track, back to the asymptotic giant branch. The c1 index has been a problem with RCA CCD chips since they are quite insensitive in the uv but the newer Ti chips are much improved in this respect.

Modelling of Magnetic Field Geometries and Chemical Abundance Distributions of Ap Si Stars
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It is well known that about 10% of main sequence A and B stars possess strong, roughly dipolar magnetic fields, of order $10^4 \times 3 \times 10^4$ G, that are usually oblique to the stellar rotation axes. Many of these stars exhibit anomalous abundances and spectrum variations of individual elements such as He, Si, Ca, Ti, and Cr. The variations are believed to occur because these elements may be non-uniformly distributed over the stellar surface. Variations in both the observed magnetic field strength and spectral line profiles then result as the star turns about its rotation axis.

In order to provide data that may be used to test theories of how the patchy distribution of certain elements may be produced, we have been trying to map the magnetic field geometry and distributions of a few elements over the surfaces of several silicon-rich Ap stars. This is done by comparing theoretical spectral lines, obtained from a model having a limited number of parameters describing the magnetic field geometry and abundance distribution, with observed line profiles observed at several phases in a star's rotation period. Preliminary maps of the distributions of Si, Ti, Cr, and Fe are now available for HD 24155, HD 32633, and HD 122532. These maps appear to reveal large-scale abundance variations of the order of one-half to ten dex over the stellar surfaces, comparable to the abundance variations found already for 53 Cam and HD 215441.

On the Uranium Abundance in the Am-star 73 Dra
G.M. Wahlgren (CSC/GSFC), D.S. Leckrone (GSFC), and S.J. Adelman (Citadel)

The uranium abundance in 73 Dra has been determined by Severnyi and Lyubimkova (1986, in Upper Main Sequence Stars with Anomalous Abundances) as part of a study of very heavy elements in chemically peculiar stars. From ASTRON satellite observations of the U II 2556A absorption feature, at a spectral resolution of 0.44A, and synthetic spectral techniques, they derived an uranium abundance of more than a thousand times solar.

Using IUE high-resolution spectra, having a spectral resolution of 0.17A, we have re-addressed the abundance of uranium in 73 Dra. Synthetic spectrum calculations, using ATLAS model atmospheres generated with similar atmospheric parameters as those used by Severnyi and Lyubimkova and an extensive list of atomic data (Kurucz), did not verify their claim of an uranium abundance enhancement. The identification of U II 2556.19A is made difficult by noise in the IUE spectrum, the close proximity of blended iron-peak element lines, and a noticeable variation in the spectrum during the rotation period (20.27 days). An effective temperature and gravity have been determined from recently obtained IUE low-resolution spectra and optical spectrophotometry and H-gamma profiles. A new model atmosphere has been generated and the abundance of uranium examined.

The Magnetic Field Geometry of Ap Stars: Inferred from their Doppler Images
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The Doppler imaging technique has been used to derive the surface distribution of silicon and chromium in a sample of 10 rapidly rotating Ap stars using high resolution, high signal-to-noise data taken at Lick Observatory. The silicon distributions are characterized by one or two depleted spots and enhanced regions in close proximity to the depleted spots. The enhanced regions sometime take the form of incomplete rings surrounding one of the depleted spots. In those stars having magnetic field variations, the depleted spots are always coincident in longitude to the magnetic poles of the dipole field. This is consistent with diffusion theory which predicts that silicon should be depleted in regions where the magnetic field lines are vertical with respect to the stellar surface. If these spots mark the magnetic poles of these stars then a direct measurement of the obliquity angle between the magnetic axis and the rotation axis of the star is obtained. The histogram of the obliquity angles appears bimodal with values clustering around 90° and 50°.

If diffusion theory is correct and enhanced regions of silicon accumulate where the surface magnetic field lines are horizontal then the close proximity of the enhanced silicon regions to the depleted spots suggests the presence of a non-axisymmetric magnetic field possibly resulting from a decelerated dipole. The relative location and size of the depleted and enhanced regions can be used to derive the decelerating parameters of the dipole. These values are typically about 0.2 stellar radii. The magnitude of the decelerating parameter also seems to correlate with the rotation period of the star indicating that redistribution of surface magnetic flux may be an important process in rapidly rotating Ap stars. Finally many of the derived chromium distributions exhibit depleted bands as well as depleted spots. This may be the result of horizontal diffusion of chromium in more evolved stars.

Session 70: Planetary Nebulae and Supernova Remnants Display Session, Grand Ballroom

70.01 Properties of the Hottest Central Stars of Planetary Nebulae
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We have begun a program to identify and determine the properties of the most massive central stars and their past and present ejecta (AGB-wind, nebula, radioactively driven wind). Ultimately, we wish to compare these properties with those of the great majority of central stars ending up with the canonical 0.6 M☉. Here, we report on our determination of the properties of the high-mass central stars.