A Spectropolarimetric Atlas of 61 Bright Northern Be Stars

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Abstract. We are developing an atlas of spectropolarimetric observations of 61 bright northern Be stars obtained from 1989-94 using the halfwave polarimeter (HPOL) at the 0.9m telescope of the University of Wisconsin Pine Bluff Observatory (PBO). The data cover the wavelength range from about 3400-7600Å, with a spectral resolution of about 25Å. This atlas will contain all data (297 observations total) obtained as part of a survey program with HPOL during the time when the detector in use was a dual Reticon array; the survey observations with HPOL continue, using a new CCD detector which extends the spectral coverage out to 1.05μm and improves the spectral resolution to about 12Å. The CCD observations will be presented later in a second volume of the atlas.

Only a brief summary of the findings of the survey from the first 5 years of the project is presented here. A full analysis of the data will be included in a paper to be published elsewhere. The general wavelength dependence of polarization for classical Be stars can be considered on the basis of these observations, and results on polarimetric variability are available. In particular, we find that 56% (20 of 36) of the Be stars observed 3 or more times from 1989-94 show significantly variable polarization at the level of 0.1% changes (inclusion of preliminary results from the continuing CCD survey indicates that the percentage is even higher). The timescales for these changes range from as short as night-to-night to as long as several months. Several of the stars showed evidence for polarimetric "outbursts" during the time period covered by the observations.

1. Introduction

Spectropolarimetric monitoring of a number of different types of stars has been ongoing for the past 10 years using the Halfwave Polarimeter (HPOL) mounted on the dedicated 0.9m telescope of the University of Wisconsin Pine Bluff Observatory (PBO). The HPOL instrument is described in more detail by Wolff, Nordsieck, & Nook (1996). One of the science programs included in the HPOL observational effort has been monitoring of the spectropolarimetric characteris-

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tics and variability of Be stars. Originally begun as a ground-based support program for the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE), the HPOL monitoring program has developed into a large database of excellent quality spectropolarimetric data on a large number of Be stars.

From 1989-1994, HPOL used a dual Reticon array detector, which provided spectral coverage from about 3400-7600Å, with a spectral resolution for both spectroscopy and polarimetric measurements of about 25Å. In 1995, the Reticon was replaced by a new CCD detector, which extended the wavelength coverage to 3400-10500Å and improved the spectral resolution to about 12Å. The changeover from one detector to the other thus marked a logical breakpoint for analysis of the data set. During the 1989-94 period, 297 observations of 61 different Be stars were obtained as part of the monitoring program.

2. Preliminary Results

A full analysis of the data will be included in a paper to be published elsewhere. Here we simply report some general results regarding the polarimetric variability observed in the sample. Since not all stars were observed the same number of times, we only considered variability for those stars observed 3 or more times during the 1989-94 survey period. Those stars with fewer than 3 observations during this period have subsequently been re-observed with the HPOL CCD system, but we do not include those observations in the database discussed here.

We find that 56% (20 of 36) of the Be stars observed 3 or more times from 1989-94 show significantly variable polarization at the level of 0.1% changes (note that the inclusion of preliminary results from the continuing CCD survey indicates that the total percentage will be even higher). The timescales for these changes range from as short as night-to-night to as long as several months. Several of the stars showed evidence for polarimetric "outbursts" during the time period covered by the observations. Most notable of these was the Be star π Aqr, which showed several large polarimetric outbursts during this period (Bjorkman 1994; see also Bjorkman et al., elsewhere in these proceedings). The behavior of the wavelength-dependence of the observed polarization is also strongly variable with the overall level of polarization.

The level of polarimetric variability, together with the observed time scales and the variable wavelength-dependence of the polarization, places constraints on any models for producing such variability. In particular, it must be recognized that many proposed variability mechanisms for Be stars, while originally intended only to explain spectroscopic variations, will also have significant predicted polarimetric consequences (see for example McDavid et al., these proceedings), and these can be tested with a large-scale survey such as this one.

3. Atlas Plans

We plan to publish the atlas of Be stars both in print version (as a journal paper) and electronically via a web site, and the complete data set will be made available to the community. A preliminary version of the web site, equivalent to that demonstrated at this meeting, has been posted at

`http://www.sal.wisc.edu/HPOL/atlases/bes`

for comment. Eventually all of the data on the web site will be made available as FITS-format files that can be downloaded by users via `ftp`.

Data representations offered on the web-based version of the atlas will include (for each star) the following: summaries of all the observations, including date, time, and JD of each, plus observation details such as exposure length; plots of polarization vs. time, position angle vs. time, and Stokes Q vs. U for all observations of a particular star; and a "quick-look" plot showing an overview of all the observational data for a particular star.

For each individual observation of a given star, the following will be available: both graphical (plots) and tabular representations of each observation, including polarization measurements and flux; UBVRI filter polarimetry equivalent data for each observation, for use in comparison with data from the literature; Hα equivalent width measurements from the spectral data; a detailed combined plot of flux, polarization, and position angle vs. wavelength.

References

Bjorkman, K.S. 1994, Ap&SS 221, 335.
Wolff, M., Nordsieck, K.H., and Nook, M.A. 1996, AJ 111, 856