Disk Loss and Disk Renewal Phases in Classical Be Stars I: Analysis of Long-Term Spectropolarimetric Data

John P. Wisniewski(1), Zachary H. Draper(1), Karen S. Bjorkman(2), Marilyn R. Meade(3), Jon E. Bjorkman(2), and Adam F. Kowalski(1)

(1) University of Washington; (2) University of Toledo; (3) University of Wisconsin

Classical Be stars are known to occasionally transition from having a gaseous circumstellar disk ("Be phase") to a state in which all observational evidence for the presence of these disks disappears ("normal B-star phase"). We present one of the most comprehensive spectropolarimetric views to date of such a transition for two Be stars, pi Aquarii and 60 Cygni. 60 Cyg's disk loss episode was characterized by a generally monotonic decrease in emission strength over a time-scale of 1000 days from the maximum V-band polarization to the minimum H-alpha equivalent width, consistent with the viscous time-scale of the disk, assuming alpha is 0.14. pi Aqr's disk loss was episodic in nature and occurred over a time-scale of 2440 days. An observed time lag between the behavior of the polarization and H-alpha in both stars indicates the disk clearing proceeded in an "inside-out" manner. We determine the position angle of the intrinsic polarization to be 166.7 +/- 0.1 degrees for pi Aqr and 107.7 +/- 0.4 degrees for 60 Cyg, and model the wavelength dependence of the observed polarization during the quiescent diskless phase of each star to determine the interstellar polarization along the line of sight. Minor outbursts observed during the quiescent phase of each star shared similar lifetimes as those previously reported for mu Cen, suggesting that the outbursts represent the injection and subsequent viscous dissipation of individual blobs of material into the inner circumstellar environments of these stars. We also observe deviations from the mean intrinsic polarization position angle during polarization outbursts in each star, indicating deviations from axisymmetry. We propose that these deviations might be indicative of the injection (and subsequent circularization) of new blobs into the inner disk, either in the plane of the bulk of the disk material or in a slightly inclined (non-coplanar) orbit.

Reference: ApJ (in press)
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/0912.1504

Comments:

Email: jwisnie@u.washington.edu