A COMPARISON OF STAR SPOT DISTRIBUTIONS FOR VARIOUS ACTIVE STARS BASED ON DOPPLER IMAGES.

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ABSTRACT We present Doppler images for three active stars. Spot distributions obtained with different imaging algorithms are compared.

Keywords: star spots, Doppler imaging

INTRODUCTION

Doppler imaging is becoming an important tool for the study of stellar activity as it allows to determine the distribution of stellar magnetic surface flux and spot migration patterns (‘butterfly diagram’). With Doppler imaging large polar spots have been found on three RS CVn–primaries (e.g. Vogt 1988, Strassmeier et al. 1991, Vogt & Hatzes 1991) and one FK Com–type star (Vogt 1988). Spot distributions on the FK Com–type giant YY Men=HD 32918 (Piskunov et al. 1990) and on the post–T Tau star AB Dor (Kürster & Schmitt 1990, Kürster 1990) seem to be dominated by an active latitude belt at low stellar latitudes.

Here we add another young star, the HD 155555 primary, to the list of imaged stars and show new images of YY Men and AB Dor. The CLEAN–like algorithm for the production of discrete 2–temperature images (Kürster & Schmitt 1990, Kürster 1991) and the maximum entropy method (MEM, Vogt et al., 1987) are compared. MEM reconstructions are displayed as thresholded 2–temperature images. All data were obtained with the ESO 1.4m–CAT/CES.

DOPPLER IMAGES

HD 155555=V824 Ara: Spectra from 8–18 Sep 1990 were used for the image (fig. 1) of the primary of this post–T Tau binary (cf. Pasquini et al. 1991 for evolutionary status, ephemeris, inclination). CLEAN and MEM images agree on the overall spot distribution if one considers that no smoothing is implemented in the CLEAN algorithm. CLEAN replaces the decentered polar cap seen in the MEM image by many small spots which can arise from several reasons. Limited space prohibits a discussion of these, but we note that the hypothesis of large star spots actually being groups of smaller spots agrees well with the data.
Fig. 1: HD 155555=V824 Ara. $i = 55^\circ$. Sep 90. 12 profiles of CaI$\lambda$6439. (a) CLEAN reconstruction. (b) MEM reconstruction.

Fig. 2: YY Men = HD 32918. $i = 35^\circ$. 6 profiles of CaI$\lambda$6718. b) MEM image. 5 profiles of CaI$\lambda$6439. c) MEM image. d) MEM image.
YY Men=HD 32918: Data from 15–20 Dec 1987 and 9–18 Sep 1990 were used for two images (fig. 2). Contrary to Piskunov et al. (1990) who used $i = 65^\circ$ we found best fits for $i = 35^\circ$. CLEAN and MEM images are very similar. In both years YY Men has a polar spot and an active latitude belt. In their Jan. 1987 image Piskunov et al. (1990) also found a low–latitude belt, but no polar feature. However, we suspect that the polar spot is a long–lived feature much as it seems to be for the other so far imaged FK Com– or RS CVn–type stars.

AB Dor=HD 36705: Only CLEAN images (fig. 3) based on data from Dec 1987, Feb 1989 (already published by Kürster & Schmitt 1990, Kürster 1991), and Sep 1990 are shown. In 1989 and 1990 most features are close to an active latitude of $\approx +25^\circ$. In the 1987 image high–latitude structure prevails. However, due to minor quality data we consider this image as preliminary.

Fig. 3: AB Dor = HD 36705. $i = 60^\circ$.

a) Dec 87: CLEAN reconstruction. 7 profiles of CaI\(\lambda6718\).

b) Feb 89: CLEAN reconstruction. 26 profiles of CaI\(\lambda6439\).

c) Sep 90: CLEAN reconstruction. 22 profiles of CaI\(\lambda6439\).

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