Dusty and dust-free A stars

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Abstract. We present preliminary results of our search for circumstellar absorption features in the Ca K lines based on high S/N observations obtained with the ESO CAT/CES system.

Key words: Stars: atmospheres – Stars: chemically peculiar – Stars: circumstellar matter – Stars: rotation

1. Introduction

Main-sequence A stars have shallow surface convection zones, therefore their composition responds sensitively to any 'contamination' by processes of diffusion or accretion. For example, the metal deficiency of the λ Bootis stars indicates accretion of depleted gas after separation of gas and dust in the stellar environment. Yet not all A stars with circumstellar (CS) matter show chemical anomalies indicative of accretion. A prominent example is β Pictoris.

However, in most cases nothing is known about their composition and the presence of CS gas. Accurate surface abundances of A stars that are positive or negative IRAS detections and a sensitive search for CS lines permit to trace the signature of accretion differentially and with a high sensitivity.

2. Results

Table 1 provides some data of our programme stars. Spectral types and rotational velocities are adapted from Holweger & Rentzsch-Holm (1995) or, if not available, from the Bright Star Catalogue (Hoffleit & Jaschek 1982). A detailed spectrum synthesis will be carried out to improve the $v \sin i$ values and to determine the calcium abundances. The parallaxes and the visual magnitudes have been obtained from the HIPPARCOS catalogue. The version of the UVBYBETA code (Moon & Dworetsky 1985) modified by Napiwotzki et al. (1993) was used to determine $T_{\rm eff}$ and $\log g$ from Strömgren photometry (Hauck & Mermilliod 1990).

Stars marked as 'dusty' are IRAS sources whose infrared excesses are attributed to circumstellar dust (Cheng et al. 1991, 1992). The other stars are negative IRAS detections. The last column indicates preliminary detections of narrow absorption components in the Ca K lines.

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Figure 1 shows the projected rotational velocities of the program stars as a function of effective temperature. Filled squares indicate stars with circumstellar components in Ca K.

Table 1.

HR	V [mag]	Plx [mas]	Sp. Type	v sin i [km/s]	Teff [K]	log g [cm/s^2]	dusty?	CS lines?
1483	4.99	14.34	A2IV	43	8930	3.90	yes	no
1666	2.78	36.71	A3III	179	8105	3.58	no	no
2020	3.85	51.87	A5V	132	8200	4.24	yes	yes
2491	-1.44	379.21	A1V	13	10135	4.31	no	no
2550	3.24	32.96	A7IV	205	7525	3.48	no	yes
2763	3.58	34.59	A3V	154	8480	3.91	no	no
3485	1.93	40.90	A1V	160	9250	3.79	no	yes
3615	4.00	26.24	A2-A3IVm	45	8300	4.13	yes	no
3685	1.67	29.34	A2IV	133	9090	3.08	no	yes
3863	5.30	14.85	A3IV	39	7965	4.07	yes	no
4138	4.72	12.60	A2m	7	8965	3.59	?	no
4534	2.14	90.16	A3V	121	8625	4.21	yes	no
4796	5.78	14.91	A0V	130	10265	4.45	yes	yes
4828	4.88	27.10	A0V	166	9210	4.24	yes	no
4881	6.14	16.62	A0III	126	7440	3.96	?	yes
5028	2.75	55.64	A2V	85	9395	4.10	no	yes
5367	4.05	13.19	A0IV	132	10245	3.71	yes	yes
5531	2.75	42.25	A3IV	84	8240	3.95	no	no
6378	2.43	38.77	A2V	26	8850	3.90	no	no
6519	4.78	7.65	A0V	272	9930	3.09	yes	yes
6549	5.25	23.71	A5IV-V	41	8190	4.25	yes	no
6556	2.08	69.84	A5III	219	7960	3.62	no	yes

Obviously stars with detectable CS gas are found preferably among rapid rotators. This strengthens the findings of Holweger & Rentzsch-Holm (1995) and their supposition that $v \sin i$ is the prime factor responsible for the presence, or absence, of CS absorption in Ca K'. Hauck et al. (preprint 1997) provide additional evidence for this conclusion from an independent study of a different sample of λ Bootis stars.

The lack of stars with CS lines and small $v \sin i$ values is interpreted tentatively by Holweger & Rentzsch-Holm (1995): for stars with CS gas concentrated in a disk-like structure the column density of absorbing gas along the line of sight will be at its maximum if the disk is viewed edge-on. Therefore CS lines should be detected preferably in objects with $\sin i \approx 1$. Hence the chance to find a rapid rotator with CS lines in the lower part of the diagram is small.

Figure 2 is an HR diagram. The symbols are the same as in Figure 1. The absolute magnitudes have been calculated using the parallaxes found by HIPPARCOS. The solid line represents the ZAMS (Vandenberg 1985). Stars with CS gas are found both near and above the ZAMS.

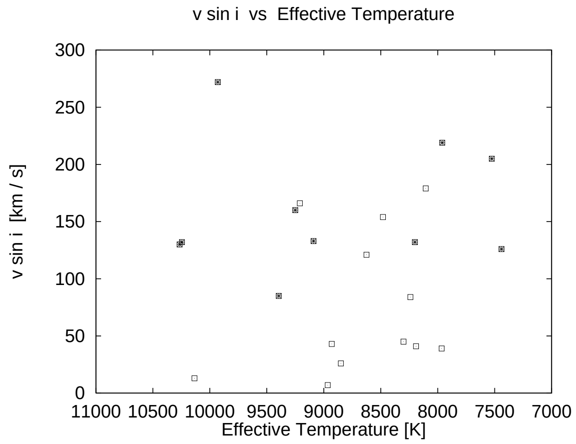

Figure 1.

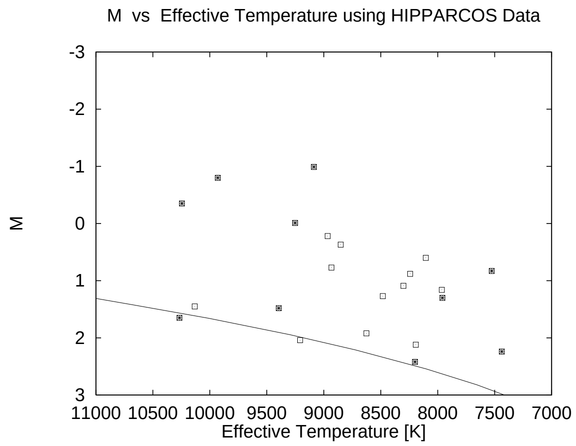

Figure 2.

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