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The Behavior of the Rotational Velocity in Lithium-rich Evolved Stars

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Abstract. We analyse the behavior of the projected rotational velocity $v\sin i$ for a sample of 20 lithium-rich evolved stars. Most of these stars show normal rotational velocity with respect to the typical lithium-normal evolved stars of the same spectral type. Stars presenting enhanced rotation show also high activity level. No sign of binarity was found for these lithium-rich evolved stars.

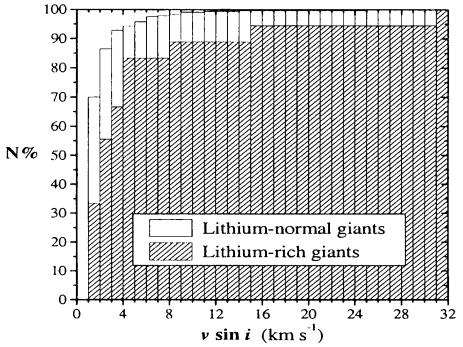
1. Introduction

One of the most puzzling events in observational stellar astrophysics in recent years has been the discovery of the lithium-rich giant stars. Essentially such stars present an abnormally strong lithium feature for their spectral types, some of them possessing surface lithium abundance approaching the cosmic value of the interstellar medium and young main-sequence stars. The excess lithium content seen in the lithium-rich giants may be fresh lithium synthesized in the so-called beryllium transport mechanism or a preserved intrinsic lithium (e.g. Fekel & Balachandran 1993). In the present work we study the behavior of the rotational velocity for the lithium-rich giant stars, by using precise CORAVEL measurements.

2. Working Sample and Discussions

We have selected only giants with a lithium abundance larger than $\log n(\mathrm{Li})=1.4$ because the standard models of convective dilution predict that lithium in red giants should not exceed that value. The entire sample of lithium-rich giants is presented in Table 1. The rotational velocity measurements were obtained from De Medeiros & Mayor (1999). For a more complete study of the behavior of the rotation in the lithium-rich giants, we have carried out a comparative study of the distribution of the rotational velocity values for such stars with the one for lithium-normal ($\log n(\mathrm{Li})< 1.4$) giant stars, as shows the Figure 1. To construct the distribution of rotational velocities for lithium-normal giants we have used a large sample of 333 G- and K-type giants with lithium abundances determined by Brown et al. (1989) for which we have now CORAVEL rotational velocity measurements. The main goal here was to control if these two data sets had been drawn from the same distribution function. For this analysis we have applied the Kolmogorov-Smirnov test. If we reject HD 9746, HD 31993 and HDE 233517 which are typically active stars, lithium-rich and lithium-normal giants show a

Figure 1. Cumulative distributions.



high probability to be drawn from the same parent population. The present analysis seems to indicate two important points: first, HD 9746, HD 31993 and HDE 233517 are abnormally high rotators in comparison with the other lithium-rich giants; and mainly, there is no significant difference between the rotational behavior of lithium-normal and non active lithium-rich giant stars. This study confirms the preliminary results obtained by De Medeiros et al. (1996).

Table 1. Lithium-rich giants.

Star	ST	$B-V$	$\log n$(Li)	$v \sin i$ (km s^{-1})	Remark
HD 787	K5III	1.21	1.80	2.0	1; 3
HD 9746	K1III	1.21	2.70	8.7	1; 7
HD 19745	K0III	1.02	4.75	1.0	3
HD 30834	K2,5III	1.41	1.80	2.7	7
HD 31993	K2III	1.28	1.83	31.1	2
HD 39853	K5III	1.53	2.80	3.1	8
HD 40827	K1III-IV	1.10	1.60	1.9	1
HD 57669	K0III	1.22	1.50	4.5	1
HD 95799	G8III	1.32	3.05	2.1	2
HD 108471	G8III	0.93	2.00	4.1	1; 7
HD 112127	K2,5III	1.26	2.70	1.7	1; 7; 8
HD 121710	K3III	1.43	1.50	1.5	7
HD 148293	K2III	1.12	2.00	1.2	1; 7
HD 172365	F9Ib	0.79	2.20	3.3	9
HD 174104	G0Ib	0.73	3.50	4.8	9
HD 176588	K2III	1.78	1.57	2.1	2
HD 183492	K0III	1.05	2.00	1.0	1; 7
HDE 233517	K2III	1.32	3.30	15.0	6

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