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The Catalogue of Rotational Velocities of Stars in Clusters

R. Głębocki[1], P. Gnaciński[1]

Abstract.

Compilation of all spectroscopic determinations of projected equatorial rotation velocities of individual stars, members of 7 associations, 27 open clusters and 7 globular clusters, is made. About 3200 $V \cdot \sin i$ values are found for 2473 stars. Up to the date we have found 65 papers dealing with $V \cdot \sin i$ measurements. Unfortunately, only half of the data contain information about individual errors. For each entry in the catalogue information about method of determination and source reference are presented.

Catalogue is a base for future analysis of evolution of rotation with age for stars of different initial mass.

1. Introduction

Much theoretical and observational work about the role that rotation plays in stellar evolution has been done. Angular momentum is one of the fundamental parameters in the process of star formation as well as in early life of a star. A considerable amount of research has been done on the stellar axial rotational velocities.

Because of the $\sin i$ factor in spectroscopic determinations of rotational velocity only statistical analysis of $V \cdot \sin i$ values allows for evaluation of V_{rot} assuming random distribution of inclination of rotational axes. It is customary to group stars by absolute magnitude or spectral type and derive a mean value for the actual rotational velocities for each group from the relation $\langle V_{rot} \rangle = 4/\pi \langle V \cdot \sin i \rangle$. The greater number of stars in a group the more accurate $\langle V_{rot} \rangle$ values are obtained.

Compilation of as many as possible of published $V \cdot \sin i$ data allow for statistical analysis leading to determination of true rotational velocity for a given group of stars. Therefore catalogues of $V \cdot \sin i$ values were published almost in each decade in last 40 years. The last catalogue for field stars has been completed by Głębocki and Stawikowski (2000). It allows not only for star grouping but also for analysis of errors. Unfortunately, different methods used for $V \cdot \sin i$ determination can introduce systematic errors.

So far, no compilation has been made for $V \cdot \sin i$ measurements for stars in clusters. Our study shows that a lot of data is dispersed in literature. Clusters present unique possibility of determination of age of stars. Catalogue presented

[1]Institute of Theoretical Physics and Astrophysics, University of Gdańsk, Poland

here could therefore be useful for analysis of relation between evolutionary age and rotation for stars of different initial mass.

2. Description of the Catalogue

During our extensive literature search we have found that many different, sometimes unfamiliar names are used by the authors analyzing particular clusters. With no commonly accepted designations stars in clusters (see e.g. SIMBAD nomenclature information for clusters) we divide our catalogue into tables each containing data for a given cluster. Below in Table 1 we compile information about data in our catalogue. Columns in Table 1 are self explanatory. Typical table in the catalogue contains: names of the star (in most cases two names, to avoid identification errors); value of $V \cdot \sin i$ in km/s ; error in km/s or uncertainty mark; method of determination of $V \cdot \sin i$; reference and sometimes remarks. For Orion association membership in subgroups Ia, Ib, Ic, ... is also given. Table 2 presents as an example part of the catalogue table for Pleiades. As mentioned above method of determination of $V \cdot \sin i$ value can introduce systematic errors. For future analysis we present information in the abbreviated form of the method with the following code:

- LW - line width estimation using eye or spectrogram (e.g. Slettebak et al. 1975,1997)
- FWHM - full width of half-maximum measurement of several lines converted to $V \cdot \sin i$ using standard stars (e.g. Fekel 1997)
- Conv - comparison of line profile of the program star to the set of rotationally broadened line profiles (e.g. Randich et al. 1994)
- C-C - cross-correlation technique used for radial velocity determination (e.g. Randich et al. 1994)
- FTLP - the Fourier transform of the observed line profile (e.g. Gray 1982, 1992)

For details of this description see Głębocki and Stawikowski (2000). In some cases we use acronym REF suggesting that the version of this particular method is described in the referenced paper.

Electronic version of the catalogue will be available from September 2001. For information please contact pg@iftia.univ.gda.pl.

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Table 1. General information about catalogue data

Cluster name	Type	No of data	No of stars	No of references
alfa Per	open	402	347	8
Blanco 1	open	33	33	1
Car OB2	association	55	55	1
Cha I	association	22	19	1
Collinder 228	open	37	37	1
Coma	open	55	47	4
Hyades	open	282	182	12
IC 2391	open	52	52	3
IC 2602	open	62	62	1
IC 4665	open	70	70	2
IC 4756	open	26	26	1
Lac I	association	26	26	1
Lup 3	association	9	8	1
M 3=NGC 5272	globular	27	26	2
M 4=NGC 6121	globular	9	9	1
M 5=NGC 5904	globular	9	7	1
M 7=NGC 6475	open	67	54	2
M 13=NGC 6205	globular	50	40	4
M 15=NGC 7078	globular	18	18	1
M 34=NGC 1039	open	49	49	1
M 35=NGC 2168	open	36	36	1
M 39=NGC 7092	open	33	18	2
M 92=NGC 6341	globular	10	5	1
NGC 288	globular	23	23	2
NGC 330	open	14	14	2
NGC 663	open	18	18	1
NGC 869 and 884	open	24	24	1
NGC 2264	open	87	86	2
NGC 2281	open	12	12	1
NGC 2355	open	8	8	1
NGC 2477	open	14	14	1
NGC 2516	open	64	34	4
NGC 2547	open	24	24	1
NGC 2632=Preasepe	open	76	64	4
NGC 3766	open	15	15	1
NGC 6193	open	18	18	1
NGC 6633	open	56	56	1
Orion	association	335	238	6
Per OB2	association	10	10	1
Pleiades	open	721	385	12
Sco OB2	association	204	204	1

Table 2. PLEIADES

Name	HD/BD or other names	$V \cdot \sin i$ km/s	Error/Limit km/s	Method	Ref. No
HII 1124	SSHJ K104	7.5	3	C-C	52
HII 1132	HD 23514	40	>	C-C	45
HII 1132	HD 23514	40		FWHM	11
HII 1132	HD 23514	40	3	C-C	52
HII 1136	SSHJ G208	71	5	C-C	29
HII 1136	SSHJ G208	80	:	C-C	52
HII 1139	HD 23513	31.4	1.9	C-C	45
HII 1139	HD 23513	30		FWHM	11
HII 1139	HD 23513	33	3	C-C	52
HII 1182	SSHJ F308	16.4	1.1	C-C	45
HII 1182	SSHJ F308	16	3	C-C	52
HII 1200	BD+22 553	13.7	0.9	C-C	45
HII 1200	BD+22 553	20	<=	FWHM	11
HII 1200	BD+22 553	20	<	C-C	52
HII 1207	SSHJ F310	5.1	1.3	C-C	45