THE USE OF PRAESEPE FOR THE DEFINITION OF THE LOWER PART OF THE ZERO-AGE MAIN SEQUENCE

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In an attempt to determine the Hyades distance (Golay, 1973), it was assumed that stars of the same "photometric $0^m.01$ box" (see Golay, 1977a) have the same visual absolute magnitude. The large amount of photometric data in the UBV $B_1B_2V_1G$ photometric system allows a discussion on this hypothesis (Golay, 1977b). We have 60 "photometric $0^m.01$ boxes", each containing a central star of known trigonometric parallax and at least one Praesepe star. We select the 16 boxes (Table I) containing single stars or binaries with an estimated mass ratio, a relative probable error < 30% for the parallaxes and a standard deviation for colors $<0^m.007$. The UBV $B_1B_2V_1G$ colors, the indices (B-V), (B_2-V_1) and the magnitude m_V are taken from the Second Catalogue (Rufener, 1976) and the internal catalogue of the Geneva Observatory. The color index (B-V) is taken from Johnson (1952, 1957), Johnson and Knuckles (1955), the trigonometric parallax from Jenkins (1952, 1963) and Gliese (1969) and the spectral type for Hyades stars from Morgan and Hiltner (1965). The listings of all $0^m.01$ photometric star boxes in the UBV $B_1B_2V_1G$ system are given by Golay (1977c). The parallax obtained for Praesepe is $\pi(0''.001) = 6.175 \pm$ p.e. 0.1, i.e. a distance modulus (m-M) = $6^m.05$ and a distance of 162 parsecs. Golay (1977c) published the differences of the distance moduli for pairs of clusters having stars in the same box. The distances of these clusters is given in Table III, assuming a distance of 162 pc for Praesepe. The accuracy of this method is independent of both the distance magnitude and the chemical composition of the stars of a cluster since the stars have to be in the same box as a star with a known trigonometric parallax. The main sequence of Praesepe and a sample of Hyades stars, in the same photometric box with a Praesepe star is given in Table II. The depth effect in

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Praesepe being very small, the main sequence is very thin and the main sequence fitting procedure is better starting from Praesepe than from the Hyades.

TABLE I

SELECTION OF STARS WITH TRIGONOMETRIC PARALLAX IN THE SAME SEVEN COLOR PHOTOMETRIC "STAR BOX" AS PRAESEPE'S STARS

HD	π 0".001	Sp	Praesepe Star
10476	133 ± 6	K1V	KW246
12230	26 ± 7	F0	KW124
17051	71 ± 7	G3IV	KW418
25680	69 ± 5	G5V	KW399
25893	45(± 7)	K2	KW297
30501	46 ± 7	K0V	KW533
34101	62 ± 12	G6	KW334
42250	41 ± 11	G5	KW 9*
43834	115 ± 8	G5V	KW543
48682	68 ± 6	G0V	KW258
61994	45 ± 9	G5	KW 30
65371	35 ± 11	K0	KW 9*
86661	32 ± 12	G8IV-V	KW368
101501	110 ± 8	G8V	KW539
151044	35 ± 6	F8V	KW341
160269	67 ± 4	G1V	KW325

KW = Klein-Wassink number (1927). * = Same star in two boxes.

TABLE II

ABSOLUTE MAGNITUDE FOR THE REGION OF THE FITS BETWEEN PRAESEPE AND HYADES IN THE COLOR-LUMINOSITY DIAGRAM

Praesepe KW	Sp	(B-V)	(B2-V1)	m_V	(B-V)	M_V (162 pc) (m-M) = 6^m.05
KW124	F2V	-^{m}.567	+^{m}.112	8^m.987	+^{m}.321	2^m.94
KW439	F5V	-.485	+.183	9.415		3.375
KW478	F4V	-.423	+.218	9.673	+.43	3.62
KW421	F9	-.327	+.287	10.160	+.516	4.11
KW341	F8	-.300	+.289	10.269	+.520	4.22
KW418	G4	-.268	+.324	10.481	+.565	4.43
KW288	G0	-.239	+.350	10.695	+.583	4.65
KW392	G5	-.229	+.349	10.702	+.595	4.65
KW466	G2	-.167	+.382	10.979	+.649	4.92
KW432	G	-.139	+.391	11.057	+.646	5.00
KW326	G	-.084	+.423	11.353	+.716	5.30
KW 32	G	+.011	+.479	11.634	+.775	5.58
KW263	K	+.061	+.517	11.972	+.814	5.92

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Hyades VB	Sp	(B-V)	(B2-V1)	m_V	(B-V)	M_V (162 pc) $(m-M) = 6^m.05$
VB 44	F5	$-^m.396$	$+^m.228$	$7^m.159$	$+^m.450$	$3^m.73$
VB 65	F8V	-.298	+.300	7.416	+.535	4.23 R1
VB113	F5	-.276	+.311	7.246	+.549	4.20
VB 52*	G1V	-.225	+.343	7.804	+.597	4.62 R2
VB 50	G1V	-.217	+.346	7.612	+.601	4.62
VB 52*	G1V	-.225	+.343	7.804	+.597	4.74 R2
VB 18	G0	-.171	+.381	8.033	+.638	4.93
VB 15	G3V	-.147	+.387	8.072	+.658	5.00
VB 69	G8V	-.046	+.446	8.593	+.746	5.39

VB = van Bueren number (1952). R1, M_V for main component
*R2, same star in two boxes

TABLE III

DISTANCES OF GALACTIC CLUSTERS (FIRST APPROACH)

Cluster	Modulus	Distance (parsec)
Praesepe	$6^m.05$	162
Coma	4.50	79
Pleiades	5.93	153
NGC 6475	a) 7.27	284
NGC 6475	b) 7.21	277
NGC 752	a) 8.16	428
NGC 752	b) 7.90	380
NGC 7092	7.38	299

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DISCUSSION

GLIESE: How many stars with reliable trigonometric parallaxes are available for calibrating the absolute magnitudes of stars in the same box?

GOLAY: I very often have one star, and sometimes two.

GLIESE: What seems to be the dispersion in M_V among the stars in one box?

GOLAY: The dispersion in M_V is $0^m.1$.

CAYREL de STROBEL: How can you put stars of the Hyades cluster and stars of the Praesepe cluster in the same box? They probably do not have exactly the same chemical composition, and not the same age. I understand that the stars in a $0^m.01$ Geneva photometric box must have the same age.

GOLAY: With respect to age, it will be true that the stars in a box have nearly the same age only for young clusters. I don't, myself, put Hyades and Praesepe stars in the same photometric box. The photometric data show that we can have a photometric box containing both Hyades and Praesepe stars. The stars in a box have the same energy distribution, and the spectroscopist has to confirm that these stars have the same chemical composition. With the published values of [Fe/H] we can confirm that stars in the same box have the same [Fe/H] (within the errors of determination of [Fe/H]).