2. THE SOLAR MOTION FOR DIFFERENT TYPES OF STARS

Frank K. Edmondson

A. INTRODUCTION

It has been known for many years that the solar motion is a function of spectral type and absolute magnitude, and is widely different for objects with large velocity dispersion such as globular clusters, certain types of variable stars, etc. Table I is adapted from Vyssotsky (*P.A.S.P.* **69,** 109, 1957) and Edmondson (*A.J.* **61,** 176, 1956 or *Handbuch der Physik* **53,** 16, 1959). X_0 is positive toward the galactic center, Y_0 in the direction of galactic rotation, and Z_0 toward the galactic pole.

Table I

	X_0	Y_0	Z_0	Dispersion
B	+ 11·3:	+ 16·8:	+ 5·4:	± 8
A	10·3	10·7	6·0	11
F	10·3	12·2	5·8	15
G	10·4	13·4	5·9	19
G 5	10·3	14·7	5·9	21
K	10·3	16·1	5·9	22
M	10·5	20·8	5·8	25
dM	6·9:	17·1:	7·8:	28
Irregular variables	19·7:	27·4:	16·4:	30
Long-period variables	10·0:	52·3:	9·4:	45
Cluster-type variables	10·6: :	126·7: :	27·0: :	86:
Globular clusters	27·8: :	180·0: :	32·1: :	119:
BASIC SOLAR MOTION	+ 10·2	+ 10·1	+ 5·9	
Ca^+ (Blaauw)	11·6	14·4	7·6	
Cepheids (Weaver)	12·5	14·6	(6·8)	
STANDARD SOLAR MOTION	+ 10·5	+ 15·4	+ 7·3	
O 5–B 7 (Blaauw)	10·6	17·3	(6·6)	
Distant Cepheids (Raimond)	8·4	18·9	(7·3)	

11th magnitude K giants (Edmondson, unpublished) give a solar motion in agreement with the value in Table I.

K dwarfs within 20 parsecs of the Sun (Pillans, 1952) have solar motion elements:

$$L = 21°{\cdot}7,\ B = +\ 25°{\cdot}0,\ V_0 = 20{\cdot}3 \text{ km/sec.}$$

K dwarfs at a distance of 100 ± 15 parsecs (Edmondson, unpublished) give a lower solar velocity:

$$V_0 = 12{\cdot}7,\ K \text{ assumed } = 0,$$

$$\text{or } V_0 = 14{\cdot}9,\ K = +\ 4{\cdot}0$$

The co-ordinates of the apex are not well determined, and the disagreement with Pillans' velocity may not be significant.

The velocity dispersions along the three axes obtained by Pillans are ± 30·0, ± 18·6, ± 11·9, and by Edmondson are ± 29·8, ± 20·9, ± 17·6.

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(*a*) *The Standard Solar Motion.* The solar motion elements

$$A = 18^{h} = 270°, \; D = +30°, \; V_0 = 20 \text{ km/sec}$$

have been widely used to perform the reduction to the 'local standard of rest'.

(*b*) *The Basic Solar Motion.* Vyssotsky and Janssen (*A.J.* **56,** 58, 1951) have given arguments suggesting that the elements

$$A = 265°{\cdot}0 \pm 1°{\cdot}2, \; D = +20°{\cdot}7 \pm 1°{\cdot}4, \; V_0 = 15{\cdot}5 \pm 0{\cdot}4 \text{ km/sec}$$

are the correct reduction to the 'local standard of rest'.

B. DISCUSSION

It should be noted that only the changes in the Y-component in Table I are systematic. These are related to the two major factors of (*a*) velocity dispersion and (*b*) distance.

The velocity-dispersion effect may be explained in principle by reference to the well-known Haas-Bottlinger diagram. A large velocity dispersion means large deviations from circular motion with a resulting average rotational velocity that is smaller than the circular velocity. Stromberg (*Ap.J.* **61,** 363, 1925) found a quadratic relation between the Y-component and the dispersion along the same axis:

$$y' = -0{\cdot}0192\, \sigma^2(y') - 10{\cdot}0 \text{ km/sec}$$

This effect will explain the K-star solar motion, but not the B-star solar motion.

The B-star solar motion can be explained by another effect, a second-order galactic rotation term in the Y-component which varies as the square of the distance from the Sun (Edmondson, *Handbuch der Physik* **53,** 14, 1959). This statement is only qualitative, owing to the distance-scale uncertainties.

The conclusion of Vyssotsky and Janssen regarding the reduction to the 'local standard of rest' seems to be justified.

3. THE CONSTANTS OF DIFFERENTIAL GALACTIC ROTATION

J. H. Oort

These constants were originally defined as follows

$$A = \frac{1}{2}\left(\frac{\Theta_c}{R_0} - \frac{\partial \Theta_c}{\partial R}\right), \quad B = -\frac{1}{2}\left(\frac{\Theta_c}{R_0} + \frac{\partial \Theta_c}{\partial R}\right),$$

or, alternatively by

$$A = -\tfrac{1}{2} R_0 \frac{\partial \omega_c}{\partial R}, \quad A - B = \omega_c$$

R_0, Θ_c, ω_c referring to the region near the Sun.

For $|R - R_0| << R_0$, we have

$$V = -2A(R - R_0)\sin l^{\text{II}}$$

For $r << R_0$ we get

$$V = r\,A \sin 2l^{\text{II}}$$

$$4{\cdot}74\,\mu_l = B + A\cos 2l^{\text{II}}$$

In these expressions, which are for objects in the galactic plane, r is the distance from the

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