can imagine, that the remains of the mountains are firmly united with the actively working zone, in the second case we need not make this supposition.

Only if we admit, that the active forces do not lie in the folded beds themselves, the use of compressive machines is allowed in the experimental tectonics, for there the folded beds are likewise passive during the folding.

Amsterdam, January 16, 1912. B. G. ESCHER.

Astronomy. — *"Star systems and the Milky Way"*. By Prof. J. C. KAPTEYN.

(Communicated in the meeting of January 27, 1912).

In the November-meeting of last year, I tried to show that there is an evident relation between the Milky Way and the star-streams. The relation consists in the fact, that the motion in the great star-streams *relatively to the centre of gravity of the whole system* is perfectly, or very nearly, parallel to the plane of the Milky Way. This is true separately for the stars of the B, A, and G types. Consequently it is true also for the relative motion of these several streams and it was this relative motion which was then particularly considered.

I have found since that this approximate parallelism with the plane of the Milky Way subsists for the motion of *all* the somewhat rich systems for which sufficient data are available.

Relatively to the centre of gravity of the whole system let:

h = yearly linear motion of the solar system;

β = galactic latitude of the Apex of this motion;

V = yearly linear motion of a determined stargroup,

B = galactic latitude of the true vertex (convergent);

and furthermore, *relatively to the solar system:*

v = yearly linear motion of this same group:

b = galactic latitude of the apparent vertex (convergent).

Then v is the resultant of V and $-h$.

Therefore, if we project on the normal to the Milky Way,

$$v \sin b = V \sin B - h \sin \beta \quad . \quad . \quad . \quad . \quad . \quad (1)$$

For the coordinates of the Apex let us adopt:

$$\alpha = 269°0 \quad \delta = +32°0, \text{ consequently } \beta = +23°0.$$

For h the best available value must be that which CAMPBELL has

produced from his rich — unfortunately to other astronomers still inaccessible — storehouse of radial velocities:

$$h = 19\,5 \text{ kil. p. sec.}$$

The equation (1) thus becomes:

$$v \sin b = -7.6 + V \sin B. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

For those groups for which our present data are more or less reliable we find the following values of v, resp. $v \sin b$. I add the values of $V \sin B$, furnished by (2), i. e. the component of the true velocity at right angles to the Milky Way.

Group	v	$v \sin b$	$V \sin B$
Hyades	45.6	— 3.4 kil.	+ 4.2
Ursa Major	18.4	— 11.1	— 3.5
Scorp-Centaur	18.8	— 6.7	+ 0.9
Perseus	18.0	— 4.1	+ 3.5
G I	32 6	— 8.4	— 0.8
A I	27.7	— 6.0[5]	+ 1.5[5]
He I	22.0	— 6.7[5]	+ 0.8[5]
G II	18.4	— 8.5	— 0.9
A II	24.5	— 10.2[5]	— 2.6[5]
		— 7.25	+ 0.35

The uncertainty

a in the position of the vertices,

b in the group velocities v;

c in the direction and amount of the sun's velocity;

d in the position of the Milky Way,

is still considerable. Presumably the values found for $V \sin B$ are *not* or *hardly* greater than their uncertainty. They are smallest for the best determined groups.

This result, if confirmed by further observation, must be of great importance for the investigation *in detail* of the cosmic motions. For it would enable us to find out all the elements of the stream-motion of any small local group of stars showing common proper motion. We might thus hope to find out any differences in the motion of parts of the stellar system situated in different quarters of the sky or at different distances.

As an example take the *Pleiades*.

I find *six* stars for which the radial velocity has been measured. In the mean of all we get:

α 1900	δ 1900	μ	p	ϱ corrected
$8^h\,40^m$	$+\,23°\,53'$	$0''.053$	$158°$	$+\,5.5$ kil p.s.

in which μ represents the total proper motion, p its angle of position, ϱ the corrected radial velocity. Direct observation gave $+\,9.8$ for this velocity, but the Pleiades are Helium stars and it has been found that these require a correction of $-\,4.3$ kil. p. sec. which not improbably may be due to pressure shift By the use of the just mentioned working hypothesis that the true motion is parallel to the Milky Way, I derive from these data

Direction of the motion (relatively to the sun) towards the point of the sphere $5^h\ 28^m\ -\,38°.7$; stream-velocity 15.0 kil. p. sec; parallax $0''.018$, consequently distance 181 light-years.

In addition to my communiation at the November meeting, I wish to draw attention to two more facts which seem hardly reconcilable with EDDINGTON's theory.

1st. The fact that according to EDDINGTON's and our own determinations, neither do the elements of stream II for the *A* stars coincide with those of the *G* stars, nor are they intermediate between these and the elements of the *B* stream.

2nd. The fact that, according to a provisional investigation, the average value of the radial velocities of the *A*, *F*, *G*, *K*-stars with insensible astronomical proper motion, corrected for the sun's motion through space and taken all positively, does not coincide with and is much in excess of that for the helium-stars. This result, if it is further confirmed, would at least prove that, even in the regions of space more remote than the bulk of our helium-stars, the motion of the stars is still dependent on their spectral class.

It seems desirable to wait for some additional materials which will very soon be available, before discussing these points further.

Finally, in order to prevent misconstruction, it may be well to remark that, where I concluded to *expansion* of matter, I meant expansion in a determined direction.

Such an expansion does not in the least exclude contraction in other directions. On the contrary. In my opinion there is good reason to assume that the kinetic energy of the system is increasing. If this is the case and if there is no action from without, we cannot but admit contraction of some sort.