

30. COMMISSION DES VITESSES RADIALES STELLAIRES

PRÉSIDENT: Professeur Ch. Fehrenbach, Directeur de l'Observatoire de Marseille, 2 Place Le Verrier, Marseille-IV, France.

MEMBRES: Abt, Blaauw, Edmondson, D. S. Evans, Gollnow, Gratton, Heard, Herbig, Pearce, Petrie, Sahade, Taffara, Thackeray, O. C. Wilson.

La Commission a deux Sous-Commissions: 30a, 30b.

Suivant une vieille coutume de cette Commission, nous publions d'abord les rapports des divers observatoires engagés dans des mesures de vitesses radiales.

REPORTS FROM OBSERVATORIES

Royal Observatory, Cape

The radial-velocity programmes undertaken by Cape staff using the Radcliffe reflector have gradually grown in scope over the last ten years, so that it is difficult to summarise them briefly. Broadly speaking there has been a concentration on the later type stars near the Sun. These have been selected for measured trigonometrical parallax or high proper motion and it may now be claimed that almost all stars down to $m_{pg} \approx 10$ south of -26° declination with known trigonometrical parallaxes $> 0''.03$, or high proper motion, have had their velocities determined. It will probably still be some years before publication of the results is complete, since it is considered desirable to provide not only the velocities, but the photometric, spectroscopic, and proper-motion data as well.

A considerable number of high-velocity stars has been discovered which, although valuable in itself, produces a statistically distorted impression of the spatial sample of stars. Efforts have therefore been made, from a study of the spectral types and colours of all the stars in the Cape Photographic Catalogues, to identify possible nearby dwarfs with low proper motions. This has proved partly successful, or indeed, as successful as might be expected considering that there are probably not many to be found, and the work will be continued.

In addition some 400 relatively bright stars with unknown velocities have been put on the programme. The form of publication aimed at is the provision of data on these stars which are as complete as possible.

A first list of 339 programme stars and southern standard and reference stars was published in 1957 and has previously been reported. A second list of 161 stars was published in 1959 (1). This included revised values of the reference velocities. A report on the standardisation aspects of the work has been made to Sub-Commission 30a. A further list of about 170 stars under the authorship of Evans, Menzies, Stoy, and Wayman is in preparation and should be in publication in the *Royal Observatory Bulletins* before the 1961 meeting.

P. A. Wayman returned to Herstmonceux in 1960 having completed the observations of the velocities of 120 selected A-type stars in the south galactic cap and of 315 southern F0-M stars of HD magnitudes between 8.5 and 8.6. This work will be published shortly. Wayman has made a study of the true probable errors and weighting system of the Cape results and of the standard wave-lengths for use in A-star velocity measurement and his results will be included in the foregoing publications.

Evans has collected the available data on 24 single-lined stars showing variable radial velocity. These will be published shortly and will include elements for some of the stars. Evans has completed a paper on the double-lined spectroscopic binary HD 133822. Some other papers by Evans may also be noted. (2) (3) (4) (5) (6).

T. D. Kinman has completed a paper entitled 'Observations of Southern RR Lyrae Stars', to be published shortly, which gives velocity and photometric data for 22 southern RR Lyrae stars.

David Dunlap Observatory, Toronto

Alpha Persei Cluster. Velocity determinations have been continued on 55 faint stars regarded by Heckmann as members of the α Persei Cluster. A suspected double maximum in the velocity distribution curve has been rejected in the light of more complete data, but it appears that a few of Heckmann's stars must be regarded as non-members of the cluster. The mean velocity agrees with the velocity of α Persei itself within 1 km/sec. No certain spectrographic binaries have been turned up. The investigation continues.

Kapteyn Zones. Velocity measurements in the zones surrounding certain Kapteyn areas have been renewed in the interests of achieving greater accuracy than that from the survey reported in the *Transactions* for 1958. The results of this survey have not, therefore, been published, but a tabulation of velocities now regarded as satisfactory may be had from the Observatory. The stars involved are those without previously reported velocities as follows: 95 stars of spectral class A 0 and later between photographic magnitudes 7.5 and 8.0 in $6^\circ \times 6^\circ$ zones centred on the Kapteyn areas from $+15^\circ$ northward and between 0^h and 6^h ; 104 stars of spectral class A 0 and later, brighter than photographic magnitude 7.6 in the $8^\circ \times 8^\circ$ zones centred on the Kapteyn areas from $+15^\circ$ northward between 9^h and 18^h . Among these stars about 15 have been established as having variable velocity.

Kapteyn Area Fundamental Stars. Observations and measurements are well advanced on a programme for determining the radial velocities of 55 stars included in Hins' *General Catalogue of Positions and Proper Motions* which are in Kapteyn areas 13-15, 29-35 and 53-60 (galactic polar cap) and which are brighter than photographic magnitude 10.1 and not previously observed for radial velocity.

OB Stars. This programme consists of 102 OB stars of magnitude 10.6 and brighter selected as follows:

- (a) from the *Tonantzintla Bull.* no. 5;
- (b) the stars between -20° and the equator in *Tonantzintla Bull.* no. 9, pp. 41-5;
- (c) the stars in the aggregates north of the equator listed by Morgan, Whitford, and Code in *Ap. J.* **118**, 318, 1953.

The faintness of these stars, the unfavourable positions of the stars in group (b) and the poor quality of the lines in many of the spectra have made for slow progress in this investigation, but several stars of particular interest (high velocity or large velocity range) have been turned up. The programme is about half finished.

Dominion Astrophysical Observatory, Victoria

1. The extensive programme of the determination of radial velocities of faint B stars has been completed. A catalogue of the radial velocities is largely ready for the printer and it is expected to be distributed in 1961. The catalogue contains radial velocities of some 550 stars, mostly north of declination $+20^\circ$ and between apparent magnitudes 7.5 and 8.6. The spectral types are generally between O 9 and B 5. The velocities are derived usually from 3 or 4 single-

prism spectrograms with linear dispersion of 51 \AA/mm . at $H\gamma$. The work has been done by R. M. Petrie and J. A. Pearce.

2. The programme of radial velocities of stars near the north galactic pole is essentially completed. The list embraces some 120 stars of spectral types A 0 to F 5, brighter than ninth magnitude and located within 10° of the pole. It is expected that the radial-velocity measures shall have been completed by the end of 1961. The work is being shared by G. J. Odgers and R. M. Petrie.

3. The study of radial velocities of stars in the zone 1° to $2^\circ.5$ from the centre of Praesepe is completed. Fifty stars have been observed; of these 32 are field stars, 4 have variable velocity, 2 are possibly cluster stars, and 12 are definitely members of the cluster. The mean velocity of the 12 new members is $+32.9 \text{ km/sec}$, in exact agreement with the cluster radial velocity as found by R. J. Trumpler from stars located within 1° of the centre. This work has been done by J. K. McDonald, and is being prepared for publication.

4. Observations for radial velocities of OB stars in galactic clusters are being made by A. B. Underhill. The spectrograms are obtained with a single-prism instrument giving a linear dispersion, at $H\gamma$, of 90 \AA/mm . The clusters being studied in this way are; NGC 2264, IC 1805, IC 4996, NGC 6910 and NGC 7380. Some 60 stars have been observed to date to limits between 10th and 12th magnitude.

5. Radial-velocity observations of stellar associations are being continued by R. M. Petrie, G. J. Odgers, and E. H. Richardson. Some 350 single-prism spectrograms have been obtained of 60 stars in I Perseus, h and χ Persei, and I Lacertae.

6. G. J. Odgers is making radial-velocity observations of twelve β Cephei stars. These stars are being observed intensively with a single-prism spectrograph in order to study changes in the radial-velocity curves and changes in periods.

7. A number of visual, and spectroscopic, binaries is under continuous observation in order to provide original, or repeat, radial-velocity curves. Two-prism spectrographs giving linear dispersions, at $H\gamma$, of 11.0 \AA/mm and 15 \AA/mm , are used for the most part although some single-prism observations are being made. Nine visual binaries and twenty spectroscopic, and eclipsing, binaries are included in the programmes being carried on by R. M. Petrie, A. B. Underhill, and A. H. Batten.

Observatoires de Marseille et de Haute Provence

Les mesures de vitesses radiales ont été une partie importante du programme des travaux de ces deux observatoires.

1. Les mesures de vitesses radiales au prisme objectif à champ normal de Fehrenbach ont été continuées avec le Prisme de 15 cm de diamètre (P.P.O.) qui permet d'atteindre la 10^{ème} magnitude. (M. Fehrenbach, Mme Dufлот, M. Boulon, Mme Barbier).

Le programme de mesures comporte trois domaines différents:

(a) Mesure des étoiles d'une vingtaine de champs de petite latitude galactique. Le programme d'observation est achevé et le dépouillement presque terminé. La publication complète sera faite lorsque quelques étoiles de référence auront été mesurées avec le spectrographe à fente. Les résultats de 1200 étoiles ont été publiés (7). Les résultats de 1500 nouvelles étoiles mesurées entre 3 et 7 fois seront publiés incessamment. Les études de l'association d'étoiles OB dans le Cygne et de champs dans Persée sont presque achevées.

(b) Mesure d'un certain nombre de champs situés près du pôle galactique.

(c) Un grand nombre de Selected Areas de Kapteyn ont été observées. La liste en est donnée dans le rapport de la Commission 32 de ce volume.

Les types spectraux dans le système MK de Morgan et Keenan ont été déterminés pour la plupart de ces étoiles. Des mesures photométriques dans le système U, B, V de nombreuses étoiles ont été effectuées par ailleurs, (MM. Bouigue, Boulon). Enfin les mesures d'absorption totale des raies $H\gamma$ et $H\delta$ permettent la détermination des magnitudes absolues des étoiles O, B et A. (Mlle Martin).

Un nouveau prisme objectif de 40 cm de diamètre (G.P.O.) a été mis en service en 1957 (8), (9), mais la qualité de l'un des prismes était très mauvaise de sorte qu'il a fallu remplacer le prisme en 1959. L'instrument, maintenant excellent, permet d'atteindre la 12^{ème} grandeur et la précision des résultats est bonne; les difficultés rencontrées avec le premier prisme ont disparues. Les premiers résultats doivent être publiés au début de 1961 (Mme Duflot).

Les programmes suivants sont en observation: Champs galactiques et SA 19, champs au pôle galactique. Etudes d'étoiles lointaines dans Persée. Structure fine (étoiles G et K voisines du soleil).

Enfin un second prisme objectif de 40 cm est en voie d'achèvement et sera installé en Afrique du Sud en mars 1961. Le problème principal que cet instrument doit permettre de résoudre est la recherche des étoiles appartenant aux Nuages de Magellan. Mais il servira aussi à l'étude de champs galactiques. Ceci permettra de compléter les études faites dans l'hémisphère boréal.

2. Les mesures de vitesses radiales au spectrographe à fente ont été continuées et des listes obtenues avec le télescope de 120 cm ont été publiées par M. Boulon (10). Un nouveau spectrographe (11) installé au foyer coudé du télescope de 193 cm permet des mesures de vitesses radiales dans d'excellentes conditions. Près de 500 clichés pris sont à la mesure. (MM Fehrenbach, Boulon, Baranne, Prévot).

Les programmes comportent l'étude d'étoiles standard, en vue de préciser les tables de longueurs d'ondes. Le programme de nos recherches comprend essentiellement la mesure des vitesses radiales des raies interstellaires d'étoiles lointaines, d'étoiles à grandes vitesses et de quelques doubles spectroscopiques.

3. M. Courtès a publié d'importantes mesures de vitesses radiales obtenues avec l'interféromètre de Pérot-Fabry (12). Le détail de ses résultats est publié dans le rapport de la Commission 34.

Yerkes and McDonald Observatories

The observing programmes of H. A. Abt have involved a large number of radial-velocity measures. One programme (now finished) consists of the determination of the fraction of metallic-line (A m) stars that are spectroscopic binaries. A random sample of 25 stars was selected and an average of 11 spectra of each were taken with the 82-inch coudé spectrograph at McDonald Observatory and the 60-inch Cassegrain spectrograph at Mount Wilson. It turned out that 22 stars have variable velocity and the other three can be accounted for as being undetectable binaries. First orbits were found for 11 stars; these are ζ UMa B (361.24 days), λ Vir (1.93017), ν Oph (13.456), ν^2 Dra (38.59583), 15 Vul (3606), θ Cep (840.6), μ Aqr (1782), HR 906 (11.665), ζ Eri (17.86588), 60 Tau (2.14328), and σ^1 Tau (251.205). The period for ω Tau is about 5300 days and the orbit for 51 Sgr (8.1158125) was found.

Another project involves the determination of the frequency of binaries among normal A4 V – F2 V stars. Again about nine spectra of each of 32 stars were obtained at McDonald

and Mount Wilson. So far the plates of only eight stars have been measured; these give a first orbit for HR 6237 (363.57 days).

Radial velocities have been obtained for the brighter members of the visual system (ADS 11745) containing β Lyrae as part of a photo-electric, astrometric, and spectroscopic study of this physical system by Jeffers, James Gibson, Sandage, and Abt. A first orbit was found for the spectroscopic binary β^2 Lyrae (ADS 11745 B), whose period is 4.3451 days.

Radial-velocity curves have been obtained for the binary-Cepheid FF Aquilae (13), the Cepheid SU Cas (14) and the population II variable BL Her (15).

Arnold M. Heiser of the Yerkes Observatory is doing a spectroscopic study of the eclipsing binary with gaseous streams, V367 Cygni. He has a new spectroscopic orbit which differs a great deal from the previous one due to a new interpretation of the line profiles.

The Burbidges and K. H. Prendergast are working on the rotational velocity distributions in various types of galaxies for the purpose of determining the mass/luminosity ratios. Recent results are published on NGC 5128 (16) NGC 2444-5 (17) NGC 7317-20 (18) NGC 1068 (19) the Hercules Cluster (20) NGC 2146 (21) NGC 5055 (22) NGC 3556 (23) and NGC 1097 and 1365 (24).

Mount Stromlo Observatory

W. Buscombe, H. Gollnow, P. Morris and A. Przybylski continue the observations of fundamental southern stars (FK3 and N30) and of the Scorpio-Centaurus Association, both programmes nearing completion.

W. Buscombe and P. Morris continue their studies of binaries; the orbits of the single-lined B-type binaries HD 114911, 170465 and 184035 will be published shortly; 10 other binary systems are under observation (HD 4293, 7312, 88955, 112244, 134687, 180885, 189198, 214085, 217792, 222095). They have also under observation for luminosity classification and radial velocities about 30 suspected sub-dwarfs, 50 B and A stars in Selected Area 193 (Carina) and 30 members of the galactic cluster IC 2391 (Vela). Further, they have observed some B stars in the Small Magellanic Cloud.

H. Gollnow and A. Przybylski have practically completed the observations of 35 probable members of the Theta Carinae Cluster (IC2602); J. Whiteoak, who also measured photo-electrically the U, B, V colours, is carrying out the spectral classification.

A. Przybylski has finished the observations for 25 high-velocity stars; about 130 suspected high-velocity stars are still under observation. A new spectral classification of all these stars is being carried out.

The publications since the last IAU meeting are given (25) to (29).

Radcliffe Observatory—Pretoria

1. *Globular Clusters.* T. D. Kinman (30) has published radial velocities of 30 southern globular clusters (using mainly a dispersion of 86 Å/mm), of which 18 had previously unknown velocities. Kinman (31) has analysed the radial velocities of 70 globular clusters and derived a solar motion of 167 ± 30 km/sec. There is no conclusive evidence of differential motion in the cluster system. Kinman has also observed radial velocities of some southern RR Lyr variables with Radcliffe equipment.

In 47 Tuc M. W. Feast and A. D. Thackeray (32) have observed the radial velocities of 32 member stars, and find the mass of the cluster to be certainly less than $6.0 \times 10^5 \odot$ and probably

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less than $2.5 \times 10^5 \odot$. The radial velocities of two RR Lyr variables point to membership of 47 Tuc (33).

2. *Magellanic Clouds*. Radial velocities of 41 members of the Small Cloud and 72 members of the Large Cloud (almost entirely individual stars), based on slit spectra, have been published (Feast, Thackeray, Wesselink, *M.N.* in press). These are being analysed for rotation, velocity dispersion etc.

3. *Distant B Stars*. The Radcliffe Observatory programme on the radial velocities of distant southern B-type stars has been continued. Observations are nearly complete for a third list of radial velocities. Some stars have been observed in co-operation with the David Dunlap Observatory.

4. *Long-Period Variables*. Radial velocities of about 106 southern Me variables (based on about 250 spectra) are being measured by Feast, and it is expected that a list of velocities will be published soon. Some faint Me variables in the direction of the galactic centre are being observed.

5. *Coudé Spectra*. The Radcliffe Observatory coudé spectrograph is in operation and is being tested on standard radial velocity stars. It is being used for observations of structure in interstellar lines of southern B stars.

6. Radial velocity observations of 120 A-stars near the south galactic pole have been completed and reduced by P. A. Wayman. Fifteen standard stars have been specially observed. The material has been used to give information on solar motion, K -term, and dispersion in the v -components of motion for these stars. This dispersion appears to be independent of distance from the galactic plane.

7. Observations of 315 stars of types F to M at $m_{pg} 8.5$ have also been completed by Wayman. These stars lie south of -21° and supplement Moore and Paddock's observations of similar stars north of -21° . Measurement of the spectra has been finished but the reductions are, as yet, incomplete.

Royal Greenwich Observatory, Herstmonceux

B. Pagel gives a brief summary of radial-velocity work carried out at Herstmonceux with the one-prism Cassegrain slit spectrograph (dispersion 120 \AA/mm at $H\gamma$) attached to the 36-inch Yapp Reflector.

1. In a study of the ζ Per group, D. H. P. Jones has found that HD 24640 is a β Canis Majoris-type variable and has confirmed Jordan's orbit for α Per (34).

2. During the very fine summer of 1959 B. Pagel made an intensive study of the orbit of HD 134646, F2, $6^m.8$, SB, this star being selected with a view to testing for the presence of short-period variation. Such a variation does not occur with detectable amplitude, but the star is a single-lined binary with period $2^d.45$, range $K = 70 \text{ km/sec.}$ and a circular orbit within observational error. The type and orbit are close to the range where magnetic variables occur, but this star has a normal spectrum, F 4 III on the MK system (35).

3. The current programme of the Royal Greenwich Observatory is an attempt to improve available radial-velocity data for stars classified as A0 in the HD Catalogue down to $6^m.34$. This should be completed in about a year, after which it is expected that a new grating Cassegrain spectrograph will be installed.

4. In addition to work with Herstmonceux plates, measurements were carried out by B. R. Leaton and others of some plates, of stars within 20 pc from Gliese's catalogue obtained by

R. v. d. R. Woolley with the Xf spectrograph-camera combination on the Mount Wilson 60-inch (36).

Mount Wilson and Palomar Observatories

Plates for the velocity of known F, G and some K sub-dwarfs have been obtained for a general velocity programme on these objects by J. L. Greenstein.

Cepheids in galactic clusters: membership confirmed for DL Cas in NGC 129 and EV Sct in NGC 6664 by R. P. Kraft (37).

Velocity programmes in progress by R. P. Kraft:

(a) Cepheids in galactic clusters: membership of CF Cas, CEa Cas and CEb Cas in NGC 7790 being tested.

(b) Forty-five stars in NGC 6633 are being observed for rotational velocity. Radial velocities will be incidentally obtained, and a test made for membership. Proper motions are known.

(c) Radial velocities of stars of type U Gem: observations completed on RU Peg and RX And.

(d) Radial velocities of AQ Pup and II Pup association.

As continuation of the work published in (38) about 25 additional faint OB stars in longitude $35^\circ > l > -15^\circ$ recently discovered will be observed for radial velocity by Guido and Luis Münch with the X-spectrograph.

Radial-velocity programmes have been completed since 1958 by George Wallerstein as follows:

(a) Stars in the galactic cluster M 25 (39).

(b) Sigma Orionis E (40).

Observatoire de La Plata

J. Sahade indique les mesures de vitesses radiales faites pour les étoiles suivantes:

Type β CMa: σ Sco—Ap. γ . sous presse.

Doubles spectroscopiques: Algol (41), α Vir (42), 29 UW CMa (43), Y Cyg (44), β Lyr (45), γ^1 Vel (46), V Pup (en préparation), ζ Hor (en préparation).

Etoiles diverses: ν Per (47), 27 CMa (sous presse), BS 4511 (en préparation).

A. Feinstein indique la variabilité de α Car (périodes de 40 min, 70 min, et 80 jours, amplitude 4 km/sec). ι Car a une vitesse radiale constante.

Lick Observatory

G. H. Herbig indique que les travaux suivants sont exécutés par lui-même ou sous sa direction:

(a) concluding observations on a few bright spectroscopic binaries of very long period, or of special interest;

(b) radial-velocity observations of several bright G and K-type stars in the cluster NGC 2264, as a check on membership;

(c) concluding observations of a number of irregular variables of the R CrB type.

Goethe Link Observatory, Indiana

F. K. Edmondson indique qu'il a complété la prise de spectres d'étoiles A et K faibles

(déclinaison -45°) à l'Observatoire McDonald. Les étoiles K sont terminées; les étoiles A sont mesurées en ce moment.

Observatoire d'Asiago

Des mesures sont en préparation.

Observatoire d'Abastumani

E. Kharadze a fait des mesures de vitesses radiales avec un prisme-objectif de 70 cm de diamètre. Il a atteint la 11-ème magnitude dans l'association Persei II.

Actuellement il a déjà mesuré les vitesses radiales de 240 étoiles dans quatre champs dont les coordonnées de centres (époque 1950) sont:

$3^h 35^m, +31^\circ 30'$; $3^h 54^m, +31^\circ 50'$; $3^h 54^m, +34^\circ 15'$; et $3^h 34^m, +34^\circ 15'$.

Son programme comporte aussi les vitesses radiales dans les champs dont les centres sont les suivants:

$20^h 05^m, +45^\circ 15'$ et $22^h 40^m, +45^\circ 00'$.

CONCLUSION

La détermination des Vitesses Radiales demande de grands instruments et un personnel important pour les mesures des clichés. Ces circonstances expliquent certainement pourquoi certains observatoires ont abandonné la mesure des vitesses radiales. Il y a quelques années la situation paraissait assez inquiétante. Il est réconfortant de constater que 10 observatoires au moins sont engagés dans des mesures de vitesses radiales et que quatre d'entre eux consacrent un temps important à ces recherches. La contribution des observatoires de l'hémisphère sud est importante. Les observatoires de Marseille et de Haute Provence consacrent beaucoup d'efforts à la détermination des vitesses radiales au Prisme Objectif. L'observatoire d'Abastumani est engagé dans des travaux analogues.

Grâce à de nombreux efforts, plusieurs tables de longueurs d'ondes valables ont été publiées. Ces listes peuvent être assez facilement adaptées aux besoins des autres observatoires. L'emploi d'étoiles standard a permis d'affranchir les mesures d'erreurs systématiques. Toutefois les vitesses radiales d'étoiles faibles $m_{pg} > 7$ déterminées anciennement, doivent être utilisées avec précaution.

Deux autres difficultés doivent être signalées:

1. La proportion des étoiles à vitesses radiales variables est importante; Petrie l'a évaluée dernièrement à près de 50% (48). Cette circonstance montre qu'il est indispensable de répéter les mesures de vitesses radiales.
2. Les étoiles choisies pour la mesure sont souvent des étoiles particulières, ceci rend difficile l'emploi statistique des résultats. Les programmes de mesures systématiques doivent être vivement encouragés. L'effet de selection explique certainement la petite abondance réelle des étoiles à grandes vitesses qui sont beaucoup moins nombreuses qu'on ne le pensait. D. S. Evans et le groupe de Marseille sont un peu déçus par leur faible récolte d'étoiles à grandes vitesses radiales.

De nombreux Astronomes complètent leurs mesures de vitesses radiales de données accessoires, spectres, couleur etc. . . . de très grandes valeurs. Ces efforts doivent être encouragés.

CH. FEHRENBACH
Président de la Commission

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30a. SOUS-COMMISSION DES VITESSES RADIALES FONDAMENTALES

PRÉSIDENT: Dr J. F. Heard, Director of the David Dunlap Observatory, Richmond Hill, Ontario, Canada.

MEMBRES: D. S. Evans, Gratton, Pearce.

STANDARD VELOCITY STARS

It will be recalled that at the last meeting of the Sub-Commission it was decided to drop the super-giant stars α Per and α Car from the last lists of standard velocity stars published by the Sub-Commission (1), and to view the other super-giants on the lists with suspicion.

During the past three years little or no other dissatisfaction with the adopted velocities has been expressed, although it is noted that the Cape astronomers use a list of eleven reference stars (2) (of which seven are from the IAU lists) which includes what Evans describes as improved values of the velocities. The differences amount to a few tenths of a km/sec.

USE OF STANDARD VELOCITY STARS

Differing practices in the use to which the standard velocities are put have been emphasized in the correspondence preceding this draft report. Evans, reporting for the Cape astronomers, has emphasized their practice of establishing corrections applicable to each measurer by ensuring that each measures all reference star spectra, at least one of which is taken on each night of radial velocity observation. By contrast, the practice at Mount Stromlo, as reported by Buscombe, is to reduce their programme velocity measures in an absolute manner without recourse to constant comparison with measures of standard velocity spectra. They do use regular measures of the standards, however, to check the performance of their instruments and to satisfy themselves that their system is consistent with the Lick system. A similar use of standard velocity stars has been the practice at David Dunlap and at Victoria.

Despite the confidence which most observers have in their radial velocity systems, Evans has expressed concern over our lack of progress in reducing the uncertainties of radial velocities at a time when increasing accuracy is being demanded by the theoreticians. Two points in particular worry him: (a) the links between northern and southern velocity measures, and (b) the links between velocities for B- and A-stars and solar-type stars. In respect to (a), he has suggested a programme of observation of a few stars jointly by northern and southern observatories. In respect to (b) he has no specific recommendation to make, but he would like to see both points discussed at the forthcoming IAU meeting.

The Mount Stromlo observers likewise have raised the point of linking the B- and A-stars with the solar-type stars; they would like to see both B- and A-stars included in IAU velocity lists (a proposal which is not new in the discussions of the Sub-Commission), and Buscombe has listed eleven B-stars for which the Mount Stromlo observers find especially small internal probable errors. Pearce and Petrie, speaking from experience with early-type stars, are doubtful of the wisdom of attempting to settle on standard velocities for such stars; they doubt that the