sequence stars. In composite systems (typically G giant + A Dwarf) the rotational velocities of the early type components are on the average less than in the general field (Markowitz, (Perkins)).

WHITE DWARFS, NUCLEI OF PLANETARY NEBULAE

Greenstein continues his work on white dwarfs. DB star frequency increases with decreasing space velocities. $\lambda 4670$ stars seem confined to the high velocity group or binary systems. Work with Trimble on the Einstein effect has been published (*Ap. J.*, **149**, 283). Spectroscopy has been extended to the infrared. Other work is: spectral scans (Oke); Sirius B at 10 Å mm^{-1} (Kodaira, *P.A.S.J.*, **19**, 172); a new white dwarf (Hiltner *et al.*, *Astr. Letters*, **2**, 153). Emission nuclei of planetary nebulae are classified by Smith and Aller (*Ap. J.*, **157**, 1245).

STELLAR CHROMOSPHERES

Recent reviews are Praderie (IAU Colloquium No. 42; Feast, *Lunteren*). Work on Ca II emission in late type stars includes; variations in giants (sometimes flare-like). Liller (*Ap. J.*, **151**, 589 Deutsch, *P.A.S.P.*, **79**, 431; *Lunteren*); use of a spectrum scanner, chromospheric activity and age, variations in main sequence stars (e.g. 61 Cyg A period $\sim 6\frac{1}{2}$ months, 61 Cyg B period ~ 1 year) (Wilson, *Ap. J.*, **153**, 221, etc.); variations in o'Ori (MS type); (Boesgaard, *P.A.S.P.*, **81**, 283); use of Ca II emission to define lower main sequence of Hyades and Pleiades (Kraft, Greenstein, *Low Luminosity Stars*, 1969; also Haro, Chavira, *Ton. Bol.*, **31**); widths and intensities in 200 southern stars, emission in γVir N (F0 V) (Warner, *M.N.R.A.S.*, **144**, 333; *Observatory*, **88**, 217); Ca II in γBoo (Praderie); intensification of emission in binaries (Abt *et al.*, *Ap. J.*, **157**, 717); inverse correlation of emission and intrinsic polarization (Dyck, Johnson, *Ap. J.*, **156**, 389). Wilson finds H and K widths are similar in normal and very metal deficient giants. However Pagel, Tomkin (*Q.J.R.A.S.*, **10**, 194) find that K widths underestimate ($\sim 1^m$) the luminosities of metal deficient giants.

Vaughan, Zirin studied chromospheric He I 10830 Å absorption (and sometimes emission) in late type stars (*Ap. J.*, **152**, 123). The line originates in clouds or streams, not a homogeneous layer. Work continues and time variations are found. εGem (G8 Ia), θHer (K1 II) have strong chromospheric activity and strong CN absorption which may thus be a general indicator of such activity (Zirin). Chromospheric He I 5876 absorption is present in ζDor (F8), other work is in progress (Feast). Deutsch has studied chromospheric Balmer absorption and Hε emission which are strongly time dependent in some red giants (cf. also Deutsch *et al.*, *Ap. J.*, **156**, 107).

M. W. FEAST
President of the Commission

29a. WORKING GROUP ON ABSOLUTE SPECTROPHOTOMETRY

Two new and independent determinations of the absolute spectral energy distribution in αLyr have been completed during the last three years. The first of these by Hayes has been published in part (Wolff, Kuhi and Hayes, 1968). It was done at the Lick Observatory using the Crossley reflector and two ribbon-filament standard lamps. His published results are based on the old practical temperature scale which is based on a melting point for gold of 1336·16K. The new scale has been adjusted to agree as well as possible with the thermodynamic temperature scale and is based on 1337·59K for the melting point of gold. Hayes' results have been adjusted to this new scale and are shown in Table 1. The numbers listed are $-2{\cdot}5 \log f_\nu + \text{const.}$ when f_ν is the flux from αLyr in ergs s^{-1} cm^{-2} Hz^{-1}. The results are normalized to 0·000 at $\lambda 5556$.

The new calibration by Oke and Schild was carried out on Palomar Mountain. A four inch reflecting telescope was built and mounted with the prime focus scanner which was built for the 200-inch telescope. Three light sources were used (1) a ribbon-filament standard lamp calibrated with an accuracy of 2% by the National Bureau of Standards was used from $\lambda 3300$ to $\lambda 8000$. (2) Radiation from a sight tube immersed in pure copper in the process of melting or freezing was

Table 1

λ	$1/\lambda$	Hayes	Oke Schild	Oke 64
3200	3·125	+1·285		
3250	3·077	+1·246		
3300	3·030	+1·134	+1·082	+1·135
3350	2·985	+1·155		
3400	2·941	+1·127	+1·057	+1·110
3450	2·898	+1·113		+1·095
3500	2·857	+1·095	+1·035	+1·075
3571	2·801	+1·065		+1·050
3600	2·778		+1·014	
3636	2·750	+1·050		+1·030
3680	2·717		+0·998	
3704	2·700	+0·995		+1·005
4036	2·478	−0·303	−0·308	−0·225
4167	2·400	−0·273	−0·288	−0·205
4255	2·350	−0·269	−0·275	−0·190
4460	2·242	−0·221	−0·231	−0·165
4566	2·190	−0·198	−0·210	−0·150
4780	2·092	−0·166	−0·166	−0·115
5000	2·000	−0·099	−0·121	−0·085
5263	1·900	−0·039	−0·064	−0·045
5556	1·800	0·000	0·000	0·000
5840	1·712	+0·081	+0·061	+0·040
6050	1·653	+0·126	+0·102	+0·070
6370	1·570		+0·16	+0·115
6439	1·554	+0·175		
6800	1·471	+0·227	+0·24	+0·175
7100	1·408	+0·289	+0·28	+0·215
7550	1·325	+0·278	+0·35	+0·280
8080	1·238		+0·43	+0·35
8400	1·190		+0·46	+0·38
8804	1·136		+0·44	+0·39
9700	1·031		+0·48	+0·40
9950	1·005		+0·50	+0·44
10250	0·976		+0·53	+0·48
10400	0·962		+0·54	+0·50
10800	0·900		+0·61	+0·56

used from $\gamma 6300$ to $\gamma 10800$. The temperature of melting copper on the new scale is 1357·9 K and is very accurately known since it is near the melting point of gold. (3) Radiation from a sight tube immersed in melting or freezing platinum was used from $\lambda 3500$ to $\lambda 10800$. The melting point of platinum is 2044 K but is not well known. This source was used as a secondary standard. The final results are also shown in Table 1. For comparison the calibration adopted by Oke in 1964 (Oke, 1964) is also shown.

Several comments can be made. (1) From $\lambda 4000$ to $\lambda 7100$ the calibrations of Hayes and Oke-Schild are in excellent agreement. They differ substantially from results by Willstrop (1965) and Bahner (1963) which are very similar to the numbers in the column Oke 64. (2) The Balmer jump found by Hayes is approximately 0·06 mag greater than that obtained by Oke and Schild.

Oke and Schild have determined the absolute flux from αLyr at $\lambda 5556$ from the copper source

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and from the standard lamp. The two agree and give a flux of $3{\cdot}50 \times 10^{-20}$ ergs s^{-1} cm^{-2} Hz^{-1} or 3.40×10^{-9} ergs s^{-1} cm^{-2} $Å^{-1}$.

This figure is substantially lower than was adopted by Code (1960) or found by Willstrop (1965).

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J. B. OKE
Chairman of the Working Group

29b. WORKING GROUP ON LINE INTENSITY STANDARDS

Systematic equivalent width comparisons as initiated by K. O. Wright during the Seventh General Assembly of the IAU in 1948 and continued by G. Cayrel de Strobel since the Twelfth General Assembly in 1964 are meeting less and less response from the astronomical community. Griffin has stressed systematic errors in spectrographic results. For instance he claims in his paper (*M.N.R.A.S.*, **143**, 319) that owing to the light thrown in the wings of the instrumental profiles, the observed equivalent widths of absorption lines in late type stellar spectra are 5 to 10 % less than the true values. Furthermore Griffin pointed out the weakness of purely spectrographic comparisons which are all affected by the same type of errors. What is really needed is to know the true equivalent width of a few lines as they can be obtained from an accurate double pass photoelectric scanner. Pagel suggested that this can be done by comparing spectra of integrated sunlight from sky or minor planets with scans obtained by solar spectrometers. Griffin prefers that a bright star be used for this purpose. A complete change in the activity of this working group could very well be decided if the primary object is to have true standards of equivalent widths and if these cannot be obtained from conventional high dispersion spectrography.

G. CAYREL DE STROBEL
Chairman of the Working Group

29c. GROUPE DE TRAVAIL SUR LES ÈTOILES Be

Spectrophotométrie, variations, vitesses radiales

A. Peton (*Meudon*) à partir de spectres à petite dispersion, a évalué une période de 33 ans pour les variations de l'émission de HD4180, une classe B5 IV et des oscillations assez importantes de l'enveloppe absorbante sur 3–4 ans (non publ.).

F. R. Hickok (*Dunlap*) a étudié les structures fines et les vitesses radiales de ϕPer à grande dispersion de telle sorte que les courbes de vitesse sont plus détaillées, mais, la période ne change pas. Probablement binaire. Des difficultés sont soulignées (non publ.).

Des variations spectrales et de vitesse radiale ont été observées par M. Hack et P. Stenner (*Trieste*, dans l'enveloppe de ζTau (publ.) ainsi que par Van der Wel (*Utrecht*) pour la période 1964–66 (non publ.). A. M. Delplace (*Meudon*) a mis en évidence une relation très étroite entre les profils Balmer H et la période de 7 ans. L'enveloppe, en moyenne, est en récession (publ.).

J. P. Swings (*Liège*), N. L. Burnichon, D. Chalonge et L. Divan (*I.A. Paris*) ont déterminé le spectre continu et la classe spectrale de l'étoile HD45677 (B2 IVe) ainsi que l'identification des