liquids the molecules do form into rows. But when external compulsion is applied, as by the application of external pressure, the molecules are no longer able to take their natural arrangement, but are forced into less natural positions, the coherent rows are broken up, the transfer of energy is interfered with, and the thermal conductivity is therefore less than to be expected according to the simple picture. This agrees with the observed fact that the increase of conductivity under pressure is less than that given by the simple formula.

Further refinement of the picture would obviously demand a detailed knowledge of molecular structure and of the fields of force surrounding the molecules.

[1] Bridgman, P. W., *Proc. Amer. Acad., Boston,* **49,** 1913 (1–114).

[2] Weber, H. F., *Sitzber. Ber. Akad., Berlin,* 1885[2] (809–815).

PHOTOVISUAL MAGNITUDES OF ONE HUNDRED BRIGHT STARS

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The combined results of my extra-focal observations for the photographic magnitudes of the brighter stars are given in *Harvard Annals,* **76,** No. 6. According to this system, the photographic magnitudes were made to correspond to Professor Pickering's photometric magnitudes for stars of Class A0.

The color indices, derived by subtracting the photometric from the photographic magnitudes, are in good agreement with the results of Parkhurst[1] and Schwarzschild.[2] Parkhurst used a Zeiss doublet lens of ultraviolet glass; Schwarzschild used a Zeiss Tessar lens; while I employed three different instruments, namely, the 11-inch Draper, the 13-inch Boyden, and the 8-inch Draper telescopes. Parkhurst placed his plates 0.6 cm. inside of focus; Schwarzschild placed his plates from 0.05 to 0.10 cm. inside of focus. All of my plates have been 1.25 cm. or more outside of focus. The accordance of the several results is probably due to the fact that extra-focal images partake but little of the idiosyncrasies of the individual telescope. Herein they have great advantage over focal images. Moreover, all the instruments were refractors. I have shown elsewhere that color indices found with the 24-inch Harvard Reflector[3] are less than those obtained with the 8-inch Draper telescope. This is due to the selective reflectivity of a silvered surface.

The present investigation concerns the *photovisual* magnitudes of bright stars and is being published in detail in *Harvard Annals*, **85**, No. 3. A preliminary discussion of the results for 24 stars has been given in *Harvard Annals*, **81**, No. 4. One hundred stars have now been observed with the 8-inch Draper telescope. Cramer Isochromatic Instantaneous plates have been used with a yellow filter, which cuts off all of the blue light. New apparatus was provided for setting the plate at different distances from the focal plane; but it was found that for a lens of large angular aperture that various inaccuracies, particularly for positions nearest to focus, may introduce slight errors, unless special precautions are taken. Even the curvature of the photographic plates may affect the results. A study was made by placing over the objective a grid of parallel wires arranged at intervals of 2.0 cm., and photographing out-of-focus images of a star at *different distances from the focus*. From measures of such images it is possible to determine the focal plane and the focal length of the objective.

To provide against errors due to the inaccuracies of the settings, I have, in observing, used a special cap over the objective, which has two wires parallel to each other and 16.0 cm. apart. The distance between the images of the wires, as shown on the out-of-focus disk, has been measured for nearly all the observations of this investigation. The other dimensions of each disk also have been measured and correction made for diffraction. From all these measures the light-value for each image is found. In other respects, the methods of observation, measurement, and reduction are the same as I have used heretofore.

Photovisual magnitudes of one hundred of the brightest stars, observable at Cambridge, have been determined from observations made on not fewer than five nights for each star. These magnitudes agree with the photometric magnitudes for stars of Class A0. The average deviation of the results for each star from the mean of the five or more observations is about ± 0.07 magnitudes. The photovisual magnitude of Polaris is found to be 1.99, corresponding to the photographic magnitude of 2.69, and the photometric magnitude of 2.12.

The stars are distributed, according to class of spectrum, as follows: B, 23; A, 32; F, 8; G, 9; K, 21; and M, 7. The following table gives the differences, photovisual magnitude minus photometric magnitude.

CLASS	NUMBER	DIFFERENCE	CLASS	NUMBER	DIFFERENCE
B0	6	−0.05	F0	2	+0.03
B1	3	+0.06	F5	4	−0.09
B2	3	−0.08	F8	2	−0.14
B3	2	+0.02	G0	8	−0.15
B5	2	−0.01	G5	1	−0.21
B8	7	−0.07	K0	14	−0.16
A0	16	0.00	K2	4	−0.18
A2	5	−0.06	K5	3	−0.16
A3	3	−0.05	M	7	−0.19
A5	8	−0.04			

The above values may be used to transform photometric to photovisual magnitudes. Perhaps, a better plan is to use general corrections according to spectral class, as follows: B, −0.02; A0, 0.00; A2, A3, and A5, −0.05; F, −0.10; G, −0.15; K, −0.16; and M, −0.20. Comparing photovisual magnitudes, computed thus, with the observed photovisual magnitudes of our list of stars, we find an average deviation of ±0.07 magnitudes.

The coefficient of photovisual atmospheric absorption is determined at 0.25, in contrast with the value of 0.47 for the absorption coefficient of the photographic rays.

The color indices for the several classes of spectrum are as follows: B0, −0.23; B1, −0.17; B2, −0.26; B3, −0.20; B5, −0.10; B8, −0.08; A0, −0.02; A2, +0.13; A3, +0.18; A5, +0.21; F0, +0.25; F5, +0.59; F8, +0.80; G0, +0.88; G5, +1.16; K0, +1.28; K2, +1.61; K5, +1.73; and M, +1.87. These values are independent of any visual observations. In general, the photovisual color index is greater than the visual or the photometric color index.

Observations have been begun also at Arequipa for the photovisual magnitudes of a selected list of southern stars. This work, when complete, may introduce some slight changes.

Correction has been made for the variation of Polaris, which was used almost exclusively as the comparison star in the present investigation. The residual curves exhibit errors for the plate or the night, which seem to indicate the presence of some recurring factor. Whatever may be the cause, the corrections actually used for the plate or night are the best to be derived from the data, since they include not only the peculiarities of Polaris, but any change in the conditions occurring between the times of photographing Polaris and the other stars on the same plate.

The color index of Nova Aquilae No. 3 was found in 1918 from photovisual and photographic magnitudes determined by the out-of-focus method.[4] The photovisual magnitude of Altair, the comparison star, was not then well determined. According to the latest value, which is 0.72, the photovisual magnitudes found for the nova should be corrected by 0.16 magnitudes, and the color index is changed from −0.35 to −0.19. This change brings it into accord with the color index found by comparing the photographic with the visual observations made at that time.

[1] *Astrophys. J., Chicago, Ill.*, **36**, 1912 (169–227), p. 218.

[2] *Göttingen Aktinometrie, Teil B*, 1912 (1–81), p. 27.

[3] *Harvard Annals, Cambridge, Mass.*, **76**, No. 10, 1915 (175–189).

[4] *Ibid.*, **81**, 1919, p. 213.