On the effective wavelengths of photovisual magnitudes

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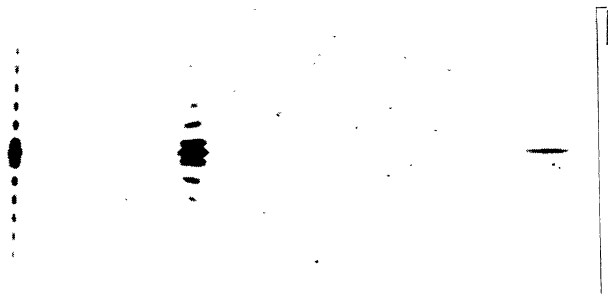
On the effective wavelengths of photovisual magnitudes, by *Ejnar Hertzsprung*.

The spectral sensitiveness of erythrosinesilver plates and the selective absorption of filters used in connection with them have been frequently investigated.

Nevertheless it seemed worth while to analyse spectroscopically in a direct way the resulting effect in actual stellar photography without intervention of other additional instrumental parts than diffraction gratings.

The procedure used for this purpose is as follows. A combination of two different gratings, placed at right angles to each other in front of the 33-cm Leiden refractor, produced an image of Vega, part of which is shown about 3 times enlarged in Figure 1. The

FIGURE 1.



focal length of the refractor is 524 cm. The exposure time of the plate, which was taken by P. TH. OOSTERHOFF, was 12 min. Both gratings consisted of wires of a diameter d nearly equal to the width of the free spaces, l, between them. The constant $l + d$ was in the one case ·4 mm and in the other 7·6 mm. The first grating served to give in the spectra of the third order a dispersion as required for sufficient separation of the different wavelengths on the plate, as shown by the three spectra lying near to each other on the extreme right part of Figure 1. The other, coarser, grating served to fix the scale of magnitudes by the aid of the known difference in magnitude (^{m}·97) between the central image and the diffraction images of the first order as produced by this second grating.

The three right hand spectra, as well as the three corresponding spectra (not shown on Figure 1) to the left of the central image, in Figure 1 were measured in the Schilt microphotometer in steps of one tenth of a millimeter.

The differences in magnitude thus obtained between the photographic effects on the plate at different wavelengths are given in Table 1, the zero point of the magnitudes being arbitrary. These magnitudes were slightly smoothed and converted into relative intensities, taking the maximum intensity in the image of the spectrum as unit. The values put in parentheses are extrapolated. These relative intensities are plotted in Figure 2.

Supposing for Vega an effective temperature of 12000°, I have, using the tables of the radiation of the black body edited by the Bureau of Standards, calculated the corresponding relative intensities for 6000° and 3000°.

TABLE 1.

distance from central image	wavelength	magnitude equivalent of intensity of image	relative intensity of image
		const. +	
mm	Å	*m*	
20·4	5184		(·05)
·5	5209	2·47	·183
·6	35	1·95	·294
·7	60	1·70	·368
·8	85	1·50	·424
·9	5311	1·43	·468
21·0	36	1·34	·516
·1	62	1·25	·565
·2	87	1·09	·628
·3	5412	1·02	·693
·4	38	·97	·765
·5	63	·81	·844
·6	89	·67	·915
·7	5514	·60	·982
·8	40	·65	1·000
·9	65	·66	·991
22·0	90	·65	·948
·1	5616	·74	·906
·2	41	·82	·851
·3	67	·89	·779
·4	92	·97	·669
·5	5717	1·24	·530
·6	43	1·72	·417
·7	68	1·87	·319
·8	94	2·03	·253
·9	5819	2·34	·198
23·0	44		(·12)
·1	70		(·08)
·2	95		(·05)
·3	5921		(·02)
·4	46		(·01)

FIGURE 2.