a transit, the total number of tables is fourteen. These tables, accurate to three significant figures, may be used for partial, total or annular eclipses, for the simultaneous solution of primary and secondary minima and, whenever an eclipsing binary is precisely observed in two colors, for the determination of differential limb-darkening. As an example of the use of these tables, 56 differential coefficients in the least-squares solution of a light-curve of U Sagittae were computed and checked in under four hours. It is interesting to note that the tables could have been computed in 1912 by differencing the original Russell α-tables,[4] long before the problem of a star completely darkened at the limb had been analytically solved.

1. Kopal, *Eclipsing Variables*, 1946.
2. *Bull. Inst. Astr. Leningrad* No. 45, 1939; *Bull. Inst. Astr. Acad. Sci. U.S.S.R.* No. 50, 1940.
3. *Proc. Amer. Phil. Soc.* **88**, 145, 1944.
4. *Ap. J.* **35**, 333, 1912; **36**, 243 and 390, 1912.

Flower Observatory,
University of Pennsylvania,
Upper Darby, Pa.

Kron, Gerald E. and Katherine C. Gordon. An infrared light-curve for the Wolf-Rayet eclipsing variable HD 193576.

Observations of HD 193576 in the region of 7200 A were made in 1943 and 1946 with a photoelectric photometer. Either the eclipsing binary or the comparison star, HD 193514, is intrinsically variable from night to night with an extreme range of 0.1 mag. A night-to-night analysis of observations made at 4500 A[1] also shows a variation with an extreme range of 0.06 mag. No check has as yet been made on the constancy of the comparison star, but the determination of intrinsic variation in another bright-line eclipsing variable, AR Lacertae, points to intrinsic variation in the binary. Observations of two eclipsing binaries without bright lines, α CrB and YZ Cass, which do not show intrinsic variability also lend support to the assumption of variation in HD 193576 rather than its comparison star.

Observations of primary minimum, both in the infrared and the blue, in 1946 show it to be occurring $0^{d}.02$ later than in 1940 and 1942, whereas the 1943 observations indicate the midpoint was occurring $0^{d}.01$ earlier. A mean light-curve in the infrared has been obtained after complete corrections for phase shift and night-to-night light variations in primary minimum. The depth of primary minimum is 0.26 mag. and that of secondary minimum, 0.19 mag. These values refer to depth from the respective shoulders; the shoulders of secondary minimum seem to be about 0.02 mag. brighter than those of primary minimum.

A comparison of the infrared and the blue curves for primary minimum, after the former is corrected to the same depth as the latter, reveals no significant difference in form or width.

1. *Ap. J.* **97**, 311, 1943.

Lick Observatory,
Mt. Hamilton, Calif.

Kuiper, G. P., W. Wilson and R. J. Cashman. An infrared stellar spectrometer.

A lead-sulfide photoconductive cell as developed by R. J. Cashman is used as the receiver in a stellar spectrometer designed by G. P. Kuiper. For the interval 0.8–3 μ, the cell is nearly 1000 times more sensitive than the thermocouple or the bolometer. The pre-amplifier and amplifier were designed and built by W. Wilson.

The instrument is used on the 82-inch telescope for recording stellar and planetary spectra for the range 0.75–2.6 μ. The heavy water-vapor band X, centered on 2.8 μ, prevents the extension to the limit of the cell, near 3 μ. The spectra produced by the camera are about one inch long and are scanned over the stationary receiver which is 0.25 mm wide and 1.5 mm high. The resolution obtained is about 80, but may be increased to 200 by adding an analyzing slit. The spectra are recorded graphically on a drum $4\frac{1}{2}$ inches wide; they are 10 inches long. The limiting magnitudes (for which the signal equals the noise) are:

Type	m_{vis}	Type	m_{vis}	Type	m_{vis}
B	1	gK0	4	gM5	7
A	2	gK5–M0	5	gM8e	12±
G0	3	gM3	6	N	7±

Stars somewhat fainter may still be observed for color data; the faintest star successfully observed was 13.5 visually.

A small album is displayed showing typical results. Mercury's own heat spectrum is well shown. Venus's reflection spectrum shows a large distortion near 1.6 μ due to four CO_2 bands; also the 2 μ region is distorted, by ω_0, ω_1 and ω_2, also of CO_2. The Jupiter and Saturn spectra are cut up by extremely heavy bands and are unlike any other spectra. The bands are probably due to CH_4 and NH_3, but laboratory intensities are still lacking. The spectrum of green leaves (chlorophyl) shows a remarkable depression near 1.6 μ, which will be helpful in the interpretation of the green spots on Mars.