(a) The spectrum of the night sky in Alaska when no aurora is visible exhibits the negative band system of ionized nitrogen in addition to the features normally observed at latitudes 30° – 35° .

(b) Wide bands in the spectrum of the night sky observed in California seem to be coincident with groups of faint lines present in the spectra of high altitude aurora.

(c) Spectra of the tips of auroral rays show an enhancement of several sharp lines, probably atomic oxygen and nitrogen, and of wide symmetrical lines at wave lengths coincident with $H\beta$ and $H\gamma$.

(d) The spectra of diffuse aurora are intermediate between that of high altitude aurora and of the night sky, some having a rather strong continuous spectrum.

(e) The intensities of the enhanced lines of sodium in the spectrum of twilight or dawn are directly related to the intensity of the sodium lines in the spectrum of the night sky.

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Naval Ordnance Test Station,
Inyokern, Calif.

Epstein, I. Pulsation periods of noise-zone models.

The pulsation equation is solved numerically for an example of a noise-zone model,¹ using a value $\gamma = 5/3$.

Model	$Q_0 = (\text{Period in days}) \times (\bar{\rho}/\bar{\rho}_{\odot})^{1/2}$
Noise-zone model	0.0314
Russell-mixture model	0.0320
Oxygen model	0.0292
Standard model	0.0381

Comparing the results for the models² tabulated above, one finds that the noise-zone model and the Russell-mixture model have similar pulsation periods. Since the central densities of the two models differ by a factor 3×10^5 , one infers that the envelope, rather than the core, plays the dominant role in the pulsations.

To carry this analysis further, the variational method³ of solving for the period is considered. A weight function, giving the relative contribution to the period of different regions of the star, is computed. This shows a maximum at $7/10$ the stellar radius, and practically no contribution from the convective core, the noise zone, or the atmospheric regions ($r/R > .95$) of the star. Ionization of hydrogen and the ionizations of helium are found to be of no importance in influencing the period, except if they should pro-

duce a convection zone reaching deep into the star. In the region of highest weight, the opacity is found to follow Kramers' law closely, and the ratio of radiation pressure to total pressure is of order of magnitude $1/6$, yielding⁴ an effective polytropic index of 3.4 and an effective γ of $3/2$.

The pulsation integration for the noise-zone model had been carried out with $\gamma = 5/3$, corresponding to negligible radiation pressure. Since the effective γ , taking account of radiation pressure, is substantially smaller, a corrected value of Q_0 must be derived. For this purpose, G. Keller's integrations² are used for estimating the dependence of Q_0 on γ , and a value of approximately 0.042 is found for Q_0 . The observed value of Q_0 is about 0.09 , if one employs for Cepheids masses determined by the mass-luminosity relation.⁵ This shows a discrepancy of about a factor 2 in the period, which might be explained by reduction of Cepheid masses by about a factor 4 , or possibly by a reduction of the effective temperature scale as applied to Cepheids by 25 per cent.

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Princeton University Observatory,
Princeton, N. J.

Gaposchkin, Cecilia Payne. Phase relations for intrinsic variables.

The intricate and numerous phase relations for intrinsic variables, classical Cepheids and RV Tauri stars, were shown as existing between light variation, period, radius at maximum and at minimum, temperature at maximum and at minimum, shape of curves and their breaks along the period's length.

Harvard College Observatory,
Cambridge, Mass.

Gaposchkin, Sergei. New variables in NGC 6522.

From 350 stars down to apparent magnitude 20.5 of the globular cluster NGC 6522, five are variables of cluster type with the periods 0.222336 , 0.481903 , 0.563826 , 0.635019 and $0.6?$ day and the ranges 17.4 – 18.3 , 18.1 – 19.6 , 17.3 – 18.9 and 18.5 – $19.6?$ mag. respectively.

Harvard College Observatory,
Cambridge, Mass.

Gartlein, C. W. Alternating current amplifier for astronomical photometry.

The National Geographic Society-Cornell University Study of Aurora has used photomultipliers with A.C. amplification methods regularly since 1941. By 1944, results were so promising that it seemed desirable to build the best equipment possible. The new amplifying set-up was completed early in 1945 and modified some since then.

The incoming light is chopped at 330 cycles before entering the photomultiplier and the output current fed into a 330 cycle push pull amplifier (Goldberg circuit) having band width of 20 cycles and a maximum gain of one million. The output is rectified, filtered and put through a D.C. impedance matching amplifier into a Leeds and Northrup or Esterline-Angus recorder.

Response is linear within a few per cent and constant over periods up to eight hours, even though this is all operated from A.C.

It is believed this type of circuit offers advantages over other circuits for astronomical use except in those cases where linearity is the prime requisite or where the photomultiplier tubes will be refrigerated. It would appear that this method allows fainter stars to be measured without refrigeration of the cell. It also allows the use of cells so noisy or having leakage currents so high that they cannot be used on D.C. amplification. One of these amplifiers is now being used by Dr. E. F. Carpenter of the Steward Observatory.

*Cornell University,
Ithaca, N. Y.*

Green, Louis C. Wave functions with I.B.M. equipment.

Under an Office of Naval Research contract administered by Yale University an effort has been made to apply International Business Machine equipment to the computation of atomic wave functions. Through the courtesy of the I.B.M. Company this work has been carried on at the Watson Laboratory. Staff members of the Laboratory have been most cooperative and helpful, especially Miss Eleanor Krawitz.

A board for the integration of the radial part of the Schrodinger equation has been designed, built, and used on the relay calculators. This board enables the machine to compute a wave function for a given set of parameters in about ten minutes. This is approximately 150 times as fast as a solution of the same accuracy could be

obtained by hand. A deck of master cards must be prepared ahead. On these are punched the atomic field and certain instructions, primarily those for interval change. The master deck is introduced in the read feed of the relay calculators. The energy and angular momentum parameters are entered through hand-set switches. The same master deck is used until there is cause to change the atomic field. A deck of blank cards is introduced into the punch feed and the integration proceeds. Both interval change and integration procedures are good to sixth differences. Six or more figures are carried throughout. Allowance is made for the rapid growth of the wave functions for large values of the angular momentum, so that one procedure is applicable to all cases. No change whatever in the instructions to the machine is necessary if exchange is to be included. However, the exchange terms must be precomputed. They may be punched in either the master deck or the blank deck, the choice being made on the basis of the particular program of the moment. Not only the function but also its first and second derivatives and certain auxiliary quantities are punched. This information enables rapid computation of the dipole moment, momentum, and acceleration as part of the program of testing the probable physical reality of the results. It also aids effective numerical checking. At most, the deck on which the wave functions appear will require three handlings, one each for punching exchange, computing, and checking. Results of the first run of the machine, on *Ca II*, are being worked up at present.

*Strawbridge Observatory,
Haverford College,
Haverford, Pa.*

Hagen, John P. A study of the effect of the solar atmosphere on the emission of short radio waves.

The monochromatic effective temperature of the quiet sun measured at radio wave lengths varies between the limits of 6700°K at 8 mm wave length to 10⁶ degrees K at 200 cm wave length. This is to be expected when the opacity of the sun's atmosphere at radio wave lengths is considered and when a proper temperature distribution for the corona and chromosphere is assigned.

The opacity of the solar atmosphere for the various radio wave lengths was computed, the coefficient of absorption being a function of the electron density, the wave length, the temperature, and the refractive index of the gas according