Duncan, John C. Galactic nebulae photographed in red light.

Diffuse nebulae in the regions of Orion, Sagittarius, and Cygnus were photographed by the author in 1948 with the 18-inch Schmidt camera on Palomar Mountain and the 60-inch and 100-inch reflectors on Mount Wilson, using rapid red-sensitive emulsions and filters which confined the light employed to a band within about 200 angstroms of $H\alpha$. At the Ottawa meeting eighteen of these photographs are presented in the form of lantern slides; also, for comparison, a few photographs made earlier in blue light.

In Orion, faint nebulosity fills the region south of the Belt and including the Sword, and exhibits remarkable and beautiful forms. Shown in great detail are the great Orion nebula, M 42-43; the region of the dark Horsehead, Barnard 33; and the nebula east of ζ Orionis, NGC 2024. South of σ Orionis is a nearly straight edge, 20 or more light-years long, which divides a brighter and a fainter nebulous field (Plate I).

In Sagittarius, faint extensions are shown around M 8. Farther north, similar extensions appear around M 17, M 16, and an uncatalogued nebula in Serpens.

More than 100 square degrees of the sky, extending from η Cygni on the south beyond Deneb and NGC 7000 to ω Cygni on the north, is filled with faint nebulosity, the brightest part of which is the nebulous region around γ Cygni, discovered by Barnard. The small curved nebula NGC 6888 is particularly strong in red light; likewise an uncatalogued S-shaped nebula situated about halfway between γ and σ Cygni.

A remarkable feature of some nebulae, strongly revealed on red photographs, is a dark core from either side of which extend plumes or brushes of luminous nebulosity. This appearance is shown in the space between M 42 and M 43 Orionis, in NGC 2024, in the brightest nebula near γ Cygni, and in NGC 6334 Scorpii, a nebula photographed by the author and reported to the American Astronomical Society in 1940.

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Edmondson, Frank K. The minor planet program at the Goethe Link Observatory.

The minor planet program at the Goethe Link Observatory was started on January 6, 1949. Up to the present time (June 15) 169 plates have been taken.

The object of the program is to recover objects on the critical list that are specifically assigned to us by Dr. Herget. Probably our most significant re-discovery so far is (1192) Prisma, which had not been observed since 1931. The residual from the ephemeris was $+13^m.7$ and $-44'$ on February 18th.

We have also picked up (1362) Griqua, in excellent agreement with a special ephemeris computed by Dr. Brouwer. (1452) 1938 DZ₁, which had not been observed since its discovery in 1938, was recently picked up with a residual of $-10^m.8$ and $+1^\circ 53'$.

A new object, 1949 DA, was found on plates taken on February 18th in an attempt to find (1273) Helma. Seventeen asteroids were found on a single plate, taken on April 3rd for the purpose of getting an accurate position of (459) Signe for Dr. Herget. Probably 15 of these objects are new.

The instrument used on this program is a 10-inch Cooke triplet loaned to us by the University of Cincinnati. The mounting was made by Fecker, and the guide telescope is provided with a micrometer which we use to guide on the expected motion of the asteroid. A 30-minute exposure on a 103a-O plate shows star No. 33 of the polar sequence as easily visible ($m_{pg} = 17.1$) and star No. 36 as barely visible ($m_{pg} = 17.8$). Hence, 18th magnitude asteroids should be detectable on hour exposures made with this instrument.

The main financial support for this program comes from a contract with the Office of Naval Research.

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Elvey, C. T. and Don Williams. Recent spectroscopic observations of the aurora, night sky and twilight.

Spectroscopic observations of the aurora, night sky and twilight are being made as part of a program to investigate the physics of the upper atmosphere. A prism spectrograph is used and has an $F/0.7$ camera giving linear dispersions from 150Å/mm at 4000Å to 1080Å/mm at 7000Å. Observations have been made at College, Alaska, and in the vicinity of the Naval Ordnance Test Station at China Lake, California. This is a preliminary report on the observations and final studies will be published as soon as the measurements and analyses are made.

Visual inspections of the material indicate:

Plate I. Central region of Orion, photographed by John C. Duncan with the 18-inch Schmidt camera on Palomar Mountain, 1948 October 3. Exposure 45 minutes on Eastman 103aE film through red Plexiglas filter No. 160. The gaseous nebula M 78 appears at the upper left corner. The north edge of the great nebula M 42 is at the lower border, at right of center.

(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,
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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.

1. R. S. Richardson and M. Schwarzschild, *Ap. J.*, **108**, 373, 1948.
2. *On the Physical and Chemical Composition of the Sun*, Ph.D. dissertation, Columbia University, 1948.
3. P. Ledoux and C. L. Pekeris, *Ap. J.*, **94**, 124, 1941.
4. S. Chandrasekhar, *An Introduction to the Study of Stellar Structure*, p. 324 and p. 59.
5. A. S. Eddington, *The Internal Constitution of the Stars*, p. 182, and M. Schwarzschild, B. Schwarzschild, and W. S. Adams, *Ap. J.*, **108**, 207, 1948.

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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.

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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.

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