138, 1013, 1963). The decrements of $H\text{ I}$ and $He\text{ II}$ are too flat as compared with theory; e.g., H30 is too bright by a factor of 7. Accordingly, I have examined the available H , $He\text{ II}$, and $He\text{ I } nD-2P$ series lines in 33 planetaries and the Orion Nebula. In some objects, it has been possible to observe up to H33. A detailed comparison of the H and $He\text{ II}$ line intensities with the theoretical decrements of Seaton (*Monthly Notices Roy. Astron. Soc.* **119**, 90, 1959) and Pengelly (*Monthly Notices Roy. Astron. Soc.* **127**, 145, 1964) and of the $He\text{ I}$ line intensities with Seaton's (*Monthly Notices Roy. Astron. Soc.* **120**, 326, 1960) theoretical intensities shows that: (1) The high Balmer lines and the corresponding lines of other series can show marked deviation from theory. Roughly half the objects considered show some deviation. (2) Lines produced by transitions from the upper level n in H and $He\text{ II}$ show the same percentage deviation from theory. (3) Lines produced by transitions from levels of H , $He\text{ I}$, and $He\text{ II}$ which have the same number of J states show the same percentage deviation. (4) The theoretical decrements appear to predict lower limits to the observed intensities. (5) There is no correlation between degree of deviation and the physical parameters of the nebulae, except possibly filamentary structure. (6) There is no known cause of the deviations.

Departures from LTE in a Model Atmosphere.

W. KALKOFEN AND E. H. AVRETT, *Harvard and Smithsonian Observatories*.—The assumption of LTE is investigated in a model atmosphere composed of atomic hydrogen, with an effective temperature of $10\,000^\circ\text{K}$ and a surface gravity of $g=10^4$.

Model atmospheres are constructed (a) under the assumption of local thermodynamic equilibrium and (b) with departures from LTE permitted in the populations of the two lowest bound levels. We illustrate the influence of Lyman- α radiation on the populations of these two levels and, hence, on the continuous flux.

The following models are compared: (1) LTE, no lines; (2) Non-LTE in the two lowest levels, no lines; (3) LTE, with Lyman- α line; (4) Non-LTE in the two lowest levels, with Lyman- α line.

The models (1), (2), and (4) have approximately the same boundary temperature, whereas the LTE model (3) with the Lyman- α line has a very low boundary temperature.

The two LTE models (1) and (3) have the same emergent continuous flux. The flux of the two non-LTE models is depressed in the Lyman continuum relative to the LTE models by a factor of approximately 4, and the ratio of the monochromatic emergent fluxes on the red and blue sides of the

Balmer absorption edge is reduced by approximately 15%. Thus on the basis of the LTE model, the effective temperature of a star would tend to be overestimated.

The two non-LTE models (2) and (4) differ in the population of the ground state which in case (2) is in LTE at $\tau_{5000} = 10^{-6}$; in case (4), where the Lyman- α line is included, the ground state is underpopulated by approximately 10% $\tau_{5000} = 0.1$.

Semiregular Red Variables with High Velocities and Balmer Emission.

PHILIP KEENAN AND WARREN YOUNG, *Perkins Observatory*.—Spectrograms taken for the classification of red variable stars revealed one, CZ Del, which has one of the largest radial velocities yet observed for a semiregular variable of class SRb (and spectral type M or S). In the General Catalogue of Kukarkin and Parenago the SRb variables are defined as roughly periodic, with small amplitudes, and having the mean luminosities of ordinary giants as distinguished from the supergiant variables of group SRC. Very few of them have large space motions, only two having published radial velocities in excess of 100 km/sec.

Radial velocities have been measured on Coudé spectrograms of CZ Del and KN Aql ($V_r = -140$ km/sec in Mount Wilson Catalogue) taken at the Palomar Observatory in August 1963. Velocities determined from the stellar lines and the interstellar D_2 line are:

	Spectrum	V_r (km/sec)	V_r'	No. of lines	Interstellar V
KN Aql	M5.5e	-149.3 ± 0.7	-138	14	-15.2
CZ Del	M5e	-162.0 ± 0.5	-150.5	72	-8.8

V_r' is the peculiar radial velocity, assuming the basic solar motion. Both stars lie near the direction of galactic rotation, and the large negative velocities are to be expected if the stars belong to the high-velocity population.

Both KN Aql and CZ Del showed variable Balmer emission which sometimes disappears but in 1963 was quite strong. Emission had not previously been reported in CZ Del. The third of the high-velocity SRb variables, V UMi, has been observed extensively in the past without showing noticeable emission lines. Balmer emission is less common in stars of group SRb than in SRa variables, which are intermediate in several characteristics between normal semiregular variables and Mira stars.

Our results suggest that the SRb variables with high-velocities tend to resemble SRa variables in