Dynamics of Spiral Galaxies. HOWARD D. GREYBER, *Northeastern University*.—Recent radio astronomy research by F. D. Drake (Annual Report of the National Radio Astronomy Observatory, 1959), at NRAO and F. J. Kerr in Australia, has revealed very interesting detail on the inner structure of our galaxy. Based on the remarkably small central galactic core observed and an assumed general dipole magnetic field whose axis roughly coincides with the galactic axis of rotation, a new theoretical model for the steady-state dynamics of a spiral galaxy has been constructed. The model predicts the very thin galactic gas disk observed and a sporadic but continuous production of spiral arms. Comparison with the evolutionary concepts of galactic dynamics are made.

On a Correlation between the Radial Velocities of Optical and Radio Interstellar Lines. WILLIAM E. HOWARD, III, AND DONAT G. WENTZEL, *The University of Michigan Observatory*, and RICHARD X. MCGEE, *CSIRO*.—The radial velocities of the interstellar K line of Ca II in a total of 39 high-latitude stars ($|b| > 15^\circ$) having single interstellar line components have been analyzed in conjunction with the corresponding H I radial velocities of the 21-cm line profile. The correlation coefficient is found to be $+0.65 \pm 0.09$ (m.e.). No radial velocity in the sample, either radio or optical, exceeds ± 12 km/sec. When the H I radial velocity is subtracted from the corresponding optical value and a histogram of the points is plotted, the mean value of the difference ($\langle \Delta V \rangle$) is $+0.3 \pm 0.6$ (m.e.) km/sec, showing that the large-scale motions of H I and Ca II are statistically the same. The standard deviation of the ΔV histogram is 3.5 ± 0.4 (m.e.) km/sec. After this figure is corrected for instrumental effects, we find a cosmic dispersion of approximately 3 ± 1 km/sec, which we attribute in varying degrees either to cloud rotation, to differential Ca-H streaming, or to turbulent motions on a scale that is smaller than the solid angle of the 2° radio beamwidth but large enough to include the optical solid angle through the interstellar cloud. The last alternative seems the most probable.

From the area under the 21-cm line profile we can derive the number of H I atoms per cm^2 in the line of sight (N_H). Then, by adopting a hydrogen-to-calcium abundance ratio, we can estimate N_{Ca} (cm^{-2}). The optical lines are unsaturated with K/H ratio ~ 1.6 . We can derive $N_{Ca \text{ II}}$ (cm^{-2}) from the usual curve-of-growth analysis given by Strömgren (Strömgren, B., *Astrophys. J.* **108**, 242, 1948). The range of the ratio $N_{Ca}/N_{Ca \text{ II}}$ over ten stars is $190/XY$ to $4500/XY$, with a mean value of $1400/XY$; the same ratio predicted theoretically is $83 Z/n_H W$, where X =the factor by which calcium is underabundant

compared to the solar value ($N_H/N_{Ca} = 6.5 \times 10^5 X$); Y =the total H I optical depth/H I optical depth in front of the star; Z =the factor of overionization compared to Seaton's estimate, viz.,

$$\frac{n_{Ca \text{ III}} n_e}{n_{Ca \text{ II}}} = 0.025 Z \text{ cm}^{-3}; \quad N_{Ca \text{ III}} \cong N_{Ca};$$

W =the ratio of true-to-estimated electron density ($n_e = 3 \times 10^{-4} n_H W \text{ cm}^{-3}$).

Most of the fluctuation in the observed ratio of $N_{Ca}/N_{Ca \text{ II}}$ may be attributed to fluctuations in either the neutral hydrogen density n_H or the ionization field Z from star to star. However, on the average, the observed and predicted values disagree considerably in the sense that less Ca II is observed than is predicted. An underabundance of calcium could account for this disagreement. A repetition of this analysis over five stars shows agreement between the observed and predicted $N_{Na}/N_{Na \text{ I}}$ ratio. We note with interest that Spitzer and Routly (Spitzer, L., Jr., and Routly, P. M. *Astrophys. J.* **115**, 227, 1952) have shown that calcium is underabundant relative to sodium in low-velocity interstellar clouds.

Aberrations and Field Errors of the Sproul 24-inch Objective. PHILIP A. IANNA, *Sproul Observatory*.—On-axis and off-axis Hartmann tests, using 103a-G plates and a Wratten minus blue (No. 12) filter, have been made to investigate the aberrations of the Sproul 24-inch objective as a function of the cooling of the lens and the position of the telescope. The tests show considerable variation in the lens during the course of a night. Longitudinal spherical aberration is positive and may be as large as seven times the Rayleigh criterion (0.7-mm difference in focus between the marginal and paraxial rays) at the beginning of the night. It normally decreases to within the Rayleigh criterion in about six hours, and even becomes negative in the morning hours if the dome temperature remains constant.

Primary coma and astigmatism also vary with the state of temperature adjustment of the objective. The astigmatic difference remains less than 2 mm. Coma varies from slightly negative to positive values producing a comatic flare of the order of 0.5 mm in the corners of the field. Both off-axis aberrations tend to be large when the spherical aberration is large.

Plates taken through a coarse-wire objective grating show a magnitude-coma scale effect of -0.00008 ± 0.00001 (p.e.) per magnitude at full aperture, and -0.000015 ± 0.00001 at 12-inch aperture.

Direct plates show that a reduction of aperture to 12 in. is accompanied by a decrease of scale of 0.0005. There is some evidence of slight flexure effects.