particular interest are: $f(t)$, characterizing the time variability in the frequency of crater formation on the moon; and $p(x;t)$, the distribution of sizes of craters formed at various epochs. It is hoped that the comparison of the theoretical $\xi(x;t)$ with empirical distributions will provide information on $f(t)$ and $p(x;t)$. However, numerical calculations of the limiting $\xi(x;\infty)$ performed starting with very different systems (f,p) indicated that the dependence of $\xi(x;\infty)$ on (f,p) is very weak. The conclusion is that only counts of clean craters in relatively new areas A can furnish information on subjects of primary interest $f(t)$ and $p(x;t)$.

Dynamical Evolution of Strömgren Spheres Associated with Gravitationally Contracting Stars.

WILLIAM G. MATHEWS AND PETER BODENHEIMER, *University of California, Berkeley*.—Detailed numerical integrations have been carried out on a series of five partial differential equations describing the nonsteady gas flow in young $H\ II$ regions. The initial density of the neutral gas has been taken as constant. Recombinations of hydrogen and collisional excitation of $O\ II$ are included as cooling mechanisms, except that recombinations to $n=1$ of hydrogen are ignored—equivalent to assuming “on the spot” absorption of the diffuse radiation. In the early calculations the star, assumed to be a black body, was turned on instantaneously in the neutral gas. The run of gas velocity, density, temperature, degree of ionization, and the (stellar) ionizing flux with distance from the star are qualitatively in general agreement with Vandervoort (*Astrophys. J.* **138**, 426, 1963), but the ionization front, calculated in detail, allows for continuance of the calculations beyond the time when the front is R -critical. Shocks are treated with artificial viscosity. Estimates of the Kelvin contraction times of high-mass stars indicate that the assumption of a sudden turn-on of the star is not accurate. To provide a better representation of the stellar ultraviolet luminosity as a function of time, the gravitational contraction path of a star of 30 solar masses ($X=0.68$, $Y=0.30$, $Z=0.02$) has been computed by the Henyey method, starting at an effective temperature of 4000°K and a radius of $700R_\odot$ and ending at the main sequence where $T_e=40\,000^\circ\text{K}$. The contraction path runs at essentially constant luminosity because of the effect of electron scattering opacity, and the time scale is approximately 3×10^4 yr, which is of the same order of magnitude as the time for formation of the “initial Strömgren sphere.”

More refined calculations of $H\ II$ regions are being made with a time-dependent stellar ultraviolet luminosity and mean (stellar) photon energy in which the absorption coefficient and mean photon

energy are treated as functions of optical depth from the central star.

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Secular Variation of the $\lambda 9.4$ cm Radio Emission from Discrete Sources.

C. H. MAYER, T. P. McCULLOUGH, AND R. M. SLOANAKER, *E. O. Hulburt Center for Space Research, U. S. Naval Research Laboratory*, AND F. T. HADDOCK, *Radio Astronomy Observatory, University of Michigan*.—Observations have been published which show that the $\lambda 3.7$ meter flux density from the radio source Cassiopeia A decreases with time (Hoğom, J. A., and Shakeshaft, J. R., *Nature* **189**, 561, 1961), and have been followed by confirmatory evidence at $\lambda 21$ cm (Heeschen, D. S., and Meredith, B. L., *Nature* **190**, 705, 1961). These observations are consistent with the identification of the Cassiopeia A source with a galactic supernova remnant of relatively short lifetime (Minkowski, R., *Paris Symposium on Radio Astronomy*, edited by R. N. Bracewell, Stanford University Press, Stanford, California, p. 315, 1959), and the calculations of Shklovsky (*Astron. Zh.* **37**, 256, 1960) which predict a detectable decrease over a few years time of the radio emission from the supernova remnants Cassiopeia A and Taurus A.

Early observations, in 1953, of the $\lambda 9.4$ cm radio emission from the discrete sources using the 50-ft reflector at the Naval Research Laboratory, Washington, D. C. (Haddock, F. T., Mayer, C. H., and Sloanaker, R. M., *Astrophys. J.* **119**, 456, 1954) provide an opportunity to test the decrease with time of the radiation at this wavelength. Further observations were made in 1962, again using the 50-ft reflector at the same wavelength to allow a comparison of the measured flux densities over a span of 8.8 yr. The observed flux density from Cassiopeia A shows a decrease of $10.0\pm 2.3\%$ (m.e.) over this time interval, which agrees well with the rate of decrease found at the longer wavelengths. The observed flux densities for the other sources (Taurus A, M17, the Orion Nebula, Centaurus A, and Virgo A) did not change by an amount that is significant with respect to the measurement uncertainty.

Optical Spectra from Fast Ion Beams.

A. B. MEINEL AND S. BASHKIN, *Steward Observatory*.—Bashkin and Meinel have explored the method proposed by Bashkin to use a van de Graaff accelerator as a source of optical electronic transitions in ionic species. The production of excited states is by stripping a fast beam of ions by means of a carbon