Radio Observations of Supernovae Remnants. D. E. HOGG, *National Radio Astronomy Observatory*.—Observations of four supernovae remnants—HB21, HB9, S147, and CTA1—have been made at 750 and 1400 Mc/sec; the first three have in addition been studied at 3000 Mc/sec. The spectral indices derived from these and earlier observations are all small, supporting the theory that old remnants have flat spectra. In no case was a positive spectral index found.

Four smaller objects (diameter 10'–15') which have previously been suggested as supernovae remnants have also been detected. With the possible exception of NGC 2359, these all appear to be normal thermal sources.

The correlation between the optical and radio brightness distributions in the two strong sources HB21 and IC443 is discussed.

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Relative Positions and Proper Motions in the Region of M37. WILLIAM H. JEFFERYS, III, *Van Vleck Observatory*. (See *Astron. J.* 67, 532, 1962.)

Behavior of Neutral Sodium in the Sun. HOLLIS R. JOHNSON, *Yale University Observatory*.—The behavior of neutral sodium in a model solar atmosphere is studied theoretically. We obtain a self-consistent solution to the steady-state problem, so that, throughout the atmosphere, the radiation field produced by the atom is consistent with the radiation field in which the atom finds itself. A model atmosphere compounded of the Minnaert model photosphere and the High Altitude Observatory model of the low chromosphere is used. Turbulence is neglected. Numerical results include values for the populations of the atomic energy levels (3s, 3p, 3d, 4s, 4p), absorption coefficients, and source functions throughout the photosphere and low chromosphere. Departures from local thermodynamic equilibrium are found in the sense that the atomic energy levels are overpopulated (relative to equilibrium) in the region $\tau_0 < 0.001$, underpopulated in the region $0.001 < \tau_0 < 1$ and attain their equilibrium values for $\tau_0 > 1$. These results are explained in terms of the opacities in the resonance line and the first and second bound-free continua. The excellent agreement between these results and the excitation temperatures found using Pecker's semiempirical method provides evidence for the validity of the latter.

Structure of NGC 5128. HUGH M. JOHNSON, *National Radio Astronomy Observatory*.—High-contrast printing of four plates in the blue and red reveals peculiar structure in the northeast by southwest extensions of the image of NGC 5128 over a total length of about one degree. Comparison of the brightness of the extensions in radio and optical frequencies argues against their being synchrotron radiation. Other possibilities are considered.

A study of the extremities of the dust belt suggests that it is an helix of variable pitch. It may be related to the extensions above.

The study is made possible through the kindness of Dr. B. J. Bok and Dr. B. E. Westerlund of the Mount Stromlo Observatory, who took some of the plates with the Schmidt camera of the Uppsala Southern Station, and permitted the writer to experiment with them. Other plates were borrowed from the Harvard College Observatory by courtesy of the Director.

M-R-L Relation and Contraction Time Scale for Convective Stars of Low Mass. SHIV S. KUMAR, *Goddard Institute for Space Studies* AND EDWARD K. L. UPTON, *Princeton University*.—We attempt to derive a theoretical M-R-L relation for stars in the mass range 0.1 to $0.4M_\odot$, for application to main sequence structure and convective contraction. In previous work on this problem the hydrogen molecules have been neglected. Here they are included in the equation of state, and their contribution to opacity is assumed to be Rayleigh scattering only. Since the molecules are inefficient scatterers, the mass absorption coefficient is substantially lowered due to the combination of hydrogen atoms into molecules. This raises the effective temperature and luminosity for a star of given mass and radius. The lowering of the temperature gradient in the outer convection zone, through the presence of molecules, also has an effect in the same direction.

Calculations have been made for the Schmidt-Kaler composition ($X=0.62$, $Y=0.35$, $Z=0.03$). The surface layers are represented by grey atmospheres in which, besides H and H_2 scattering, H and H^- opacities are included. The atmosphere is fitted to an adiabatic curve either at the point where the criterion of Hoyle and Schwarzschild is satisfied or at $\tau=1$, whichever is deeper. We have also studied the effect of fitting at $\tau=2$. The asymptotic behavior of the adiabat in the deep interior gives the scaling for representation of that region by a model of polytropic index 1.5.

The theoretical M-R-L relation thus obtained gives effective temperatures on the main sequence about 15% higher than those obtained by Johnson