the temperature of the moon was 256°K; at 1300 Mc the temperature of the moon was 254°K.

Further data were gathered for half a lunation between first and third quarter of lunar phase. With the same accuracies quoted above no change in temperature at 3000 Mc was measured during this series of observations. Additional data will be taken at 3000 Mc to determine the variability of lunar temperatures over several lunations.

Surface and Brightness Temperatures from the Central Intensities of the Balmer Lines. GUISA CAYREL, *Mt. Wilson and Palomar Observatories* (introduced by JESSE L. GREENSTEIN).—According to the local thermodynamic equilibrium picture, the pseudocontinuum formed by the central intensities of strong saturated lines (the first Balmer lines, for instance) is given by the energy distribution of a blackbody at the surface temperature T_0.

Surface temperatures have been derived by this method for 33 stars. They are in reasonable agreement between spectral type B5–F8 with expected surface temperatures from model atmospheres.

Using a few eclipsing variables we have checked this method and derived the radii of these variables when their parallaxes are known. We have calculated also the limb-darkening constants of the 33 stars.

Model Atmospheres and Conventional Curve of Growth Analysis. ROGER CAYREL, *Mount Wilson and Palomar Observatories* (introduced by JESSE L. GREENSTEIN).—Possible systematic differences between abundances derived from the conventional curve of growth analysis and from detailed model atmosphere computations have been investigated. They have been found to be small, usually less than the sum of the errors arising from observational inaccuracy and incorrect assumptions in the theory.

The main advantage of using models seems, therefore, to be confined to the use of more observational data to determine the physical parameters, temperature and gravity. Color, Balmer jump, and profiles of the Balmer lines are such examples. In addition, the use of models removes the uncertainty in the connection between the excitation and ionization temperatures.

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Harvard 21-Cm Maser Observations of Galaxies. B. F. C. COOPER, E. E. EPSTEIN, S. J. GOLDSTEIN, JR., J. V. JELLEY, AND M. A. KAFTAN-KASSIM, *Harvard College Observatory*.—A three-level solid-state ruby maser has been installed on the 60-foot Harvard radio telescope. The maser was constructed primarily for a study of the 21-cm hydrogen-line radiation. The sensitivity of the maser has permitted a study of galaxies which are relatively nearby in space.

The maser radiometer is a switched or Dicke type that measures the difference in total power available from the antenna and a reference load. In this case, the reference load is maintained at liquid-helium temperature. The antenna and reference-load temperatures can be balanced by adding noise to the reference load from an argon noise source. The maser radiometer is balanced at the beginning of each observation in order to minimize the effects of radiometer gain changes.

The total noise temperature of the radiometer is approximately 100°K, made up of 70°K because of ohmic losses in the switch, circulator, and coaxial cables, 20°K because of the side lobes of the antenna, and 10°K because of the remainder of the receiver. The input switch is a Y-type circulator with a reversible magnetic field; the phase-sensitive detector uses a relay with gold-plated contacts. Both the switch and the detector operate at 3.5 cycles/second. The radiometer bandwidth is 1 Mc for continuum observations and 200 kc for observations on the line; the integration time is 50 sec, and the antenna beamwidth is 55 minutes of arc.

Each of the observations is a drift curve, half an hour long for sources near the celestial equator and longer at higher declinations. For each source, a minimum of three reliable drift curves were obtained at a frequency corresponding to the uncorrected redshift given by Humason, Mayall, and Sandage. A minimum of three drift curves were obtained at a frequency substantially removed from the redshift frequency.

Three of the galaxies observed by the Leiden group, NGC 3031, 4258, and 6822, are alike in that their redshifts are within the range of velocities of hydrogen in our own galaxy. Detectable signals for each of these sources exist at the optical position and velocity. However, only in the case of NGC 6822 does the radiation have a small enough angular size to make it certain that the external galaxy is the source. Confirmation of Leiden observations on NGC 5194, 5457, and 6822 was obtained.

Hydrogen emission from NGC 2403, 4214, 4631, 5236, and IC 10 has been observed. Continuum emission has also been detected for NGC 5236.

The galaxies in our list not previously observed were selected on the basis of large angular size in the Shapley-Ames catalogue or from the presence of emission regions reported by Humason, Mayall, and Sandage. This program is continuing and is supported by the National Science Foundation.

A Method of Computing Stellar Interior Models. A. N. COX, D. L. BOWERS, AND R. R. BROWNLEE, *Los Alamos Scientific Laboratory, Los Alamos,* *New Mexico.*—A method of stellar model construction is described which allows easy steps from one model to the next in the course of evolution of a stellar mass. The equations which are solved simultaneously at each time step by using the IBM 704 are the following: the radiation flux equation, an approximate convective flux equation, the electron heat conduction equation, the equation of momentum conservation, and the conservation of energy equation. The calculation is done in a Lagrangian coordinate system making the conservation of mass equation very simple. Standard energy generation expressions are used. We have calculated the equations of state and opacities as needed. These data include, among other details, the effects of radiation pressure and energy, and those of electron degeneracy. Solution of these simultaneous equations at each time step allows one to watch the one-space-dimensional relaxation of stellar mass to its equilibrium in all the nonlinear nonadiabatic detail. Some results for one solar mass are given.

***H*-Beta Photometry for the Association I Lacertae.** D. L. Crawford, *Kitt Peak National Observatory and Arthur J. Dyer Observatory, Vanderbilt University.*—The association I Lacertae has been studied recently by R. H. Hardie and C. K. Seyfert (1959, *Astrophys. J.* **129**, 601). They utilized objective prism spectra and *U*, *B*, *V* photometry to obtain an H-R diagram. The present paper may be considered an extension of that work, employing new observational data.

All stars earlier in spectral type than A0 were measured with conventional *H*-beta filter (Crawford, D. L., 1958, *Astrophys. J.* **128**, 185). In addition, a few stars later than A0 and lying above the observed main sequence were measured as a test for membership. Membership of some late B-type stars in the dispersed area of the association has also been tested.

A revised list of members is presented, and a new H-R diagram shown.

The Extreme Ultraviolet Spectrum of the Sun. C. R. Detwiler, J. D. Purcell, and R. Tousey, *U. S. Naval Research Laboratory.*—Spectra obtained with a normal incidence grating spectrograph on April 19, 1960 confirmed all the emission lines appearing in the March 13, 1959 spectrum and added many new lines, extending to 500 A. The identified lines are almost all resonance and low excitation potential lines of the abundant light elements through sulfur. About 30 lines have not yet been identified. Limb effects can be seen in several lines. New lines include the resonance lines of *Si*XII at 499 and 520 A.

The 1960 spectrum was obtained free from stray light by double dispersion. It reveals a solar continuum extending to 1000 A. The intensity is enhanced near Lyman-α and this may be the charge transfer continuum of H_2^+. Below 1525 A the continuum is free of Fraunhofer lines. However, it shows H_2O absorption bands produced by water from the rocket. The Lyman continuum is also present, and shows absorption by N_2.

Two New Applications of 21-Cm Absorption Measurements. Nannielou H. Dieter, *Air Force Command and Control Development Division, L. G. Hanscom Field, Bedford, Massachusetts,* and Bruce C. Murray, *Air Force Research Division, L. G. Hanscom Field, Bedford, Massachusetts.*—The annual and diurnal motions of the earth produce corresponding variations in the observed frequency of 21-cm absorption lines present in the spectra of discrete radio sources. These lines result from absorption by neutral hydrogen clouds lying between the discrete source and the observer, and at a central frequency corresponding to the relative radial velocity of the earth and the absorption cloud. Lilley and Brouwer are already instrumenting an observation of the annual frequency shift to obtain an improved value of the solar parallax. The present paper proposes two other new applications of precise frequency variation measurement.

Measurements of both annual and diurnal frequency variations can yield apparent positions of the absorbing hydrogen clouds. The apparent positions of the clouds include, however, the aberration due to the relative motion of the cloud with respect to the earth. Measurements by long-wavelength interferometry, on the other hand, yield apparent positions of the same discrete sources which include aberration caused by the relative motion of the source with respect to the earth. Consequently, comparison of Doppler-derived apparent source positions with those obtained by interferometry will give the difference in proper motion between the source and cloud.

An indirect test of the transverse Doppler effect predicted by the special theory of relativity is also proposed. This test is based upon a comparison of the measured annual frequency variation with that corresponding to the value of the astronomical unit obtained independently by improved radar-ranging techniques.

A Uniform Statistical Analysis of Jovian Decameter Radiation, 1950–1960. James N. Douglas, *Yale University.*—A permanent IBM-card catalogue has been initiated of all of the known Jupiter decameter radio noise storms, kindly made available by C. Shain, B. Burke, K. Franklin, R. Gallet, J. Kraus, G. Reber, A. Smith, and T. Carr, and supplemented with four years of multichannel observations at Yale. Uniform statistical analysis of this material establishes the radio (presumably also the solid-body)