releases from rockets can be used for the interpretation and identification of comet spectra.

Star Catalogues on Punched Cards. JULENA S. DUNCOMBE and DORRIT HOFFLEIT, *U. S. Naval Observatory and Maria Mitchell Observatory*.—Yale University Observatory and the U. S. Naval Observatory have cooperated in key punching and verifying 41 star catalogues. These catalogues include the AGK₂ catalogues, $+90^\circ$ to $-2^\circ.5$; the Yale catalogues, $+90^\circ$ to $+85^\circ$, $+60^\circ$ to $+50^\circ$, and $+30^\circ$ to -30° ; the Cape Zone catalogues, -30° to -64° ; and the *Catalogue of 5268 Standard Stars 1950.0* based on the system N30 (*Astron. Papers Am. Ephemeris* **13**, Part III).

In punching these catalogues 122 major errors were detected. Also numerous other discrepancies were noted. It is planned to assemble in a single list the catalogue errors detected here as well as errors from all other sources and to publish this list in the *Astronomical Journal*.

Crab Nebula Occultation Measurements and the Structure of the Solar Corona. WILLIAM C. ERICKSON, *Convair Scientific Research Laboratory*.—The Crab nebula was observed during occultation by the solar corona in June, 1960, with fan-beam aerials operating at 26.3 Mc. These observations indicate an absence of refraction of decameter radio waves in the outer corona, and an increase in the apparent angular size of the source at closest approach to the sun. In addition, they definitely indicate a strong decrease in the integrated flux during the occultation. This confirms the observations of S. Gorgolewski and A. Hewish (*Observatory* **80**, 99, 1960).

A model of the corona consisting of radially aligned, filamentary structures similar to that proposed by J. A. Högbom (*Monthly Notices Roy. Astron. Soc.* **120**, 530, 1960) is assumed. The anisotropic scattering caused by such structures may explain decreases in the integrated flux. The 1960 observations as well as those of previous years are interpreted with respect to such a model.

Can the Jupiter Emission be Cyclotron Radiation? GEORGE B. FIELD, *Princeton University Observatory*.—Recent observations of the polarization, spectrum, angular extent, and time variation of the Jovian decimeter emission are compared with a theoretical model based on cyclotron radiation by nonrelativistic electrons trapped in a dipole field. The polarization, spectrum, and angular extent can be fitted by a model which has an equatorial field strength of 0.6 gauss and a polar field strength of 1.6×10^5 gauss.

On the other hand, the observed slow decay of the emission during 1959 appears to be inconsistent

with the model. One finds that the decay due to radiation loss alone would have only one-hundredth of the observed duration if we suppose an instantaneous electron injection. On the other hand, continuous electron injection would result in a much steeper spectrum than is observed. We conclude that at least our simple model based on cyclotron emission is inconsistent with observation.

Synchrotron radiation by relativistic electrons appears to provide a better model. Qualitatively one can explain the polarization, spectrum, and angular extent of the emission, while now the decay period is longer owing to the much smaller field strengths required. Thus, a model with electrons of 5 to 10 Mev trapped in a field of 2 gauss provides roughly the observed spectrum and decay period, assuming the electrons were instantaneously injected sometime prior to April, 1959. The polar field is now only about 100 gauss.

Luminosity Distribution of the Spiral Galaxy NGC 5055. ROBERT A. FISH, *Yerkes and McDonald Observatories*.—The luminosity distribution of NGC 5055 was studied with photographic photometry on the *UBV* system. On comparison of the luminosity distribution with the mass distribution found previously (Burbidge, E. M., Burbidge, G. R., and Prendergast, K. H. *Astrophys. J.* **131**, 282, 1960), the mass-to-light ratios in each color are observed to rise at first, then decrease steadily on proceeding outwards from the nucleus. The over-all photographic M/L ratio for the galaxy out to $150''$ is 5.46.

Three different indices of asymmetry are constructed from the photometric information. They reveal that the light distribution within $50''$ of the nucleus is inherently asymmetric, but that beyond $50''$ the three-dimensional light distribution is nearly axially symmetrical.

Due to scattering and absorption of light the observed isophotes deviate widely from ellipses. If the albedo of the obscuring material is low, the intrinsic M/L ratios must vary only slowly from $50''$ outwards; if it is high the measured change of M/L by a factor of 5 between $50''$ and $150''$ represents very nearly the intrinsic change. The null effect of scattering on the average luminosity of NGC 5055 results from the inclination angle of the galaxy.

If high scattering efficiency is a universal property of the obscuring matter in spiral galaxies, then very little light is degraded into the infrared, and photons entering the scattering layer are simply redirected toward normal emergence. Because of this redirection a face-on spiral must appear brighter and bluer than it would if no obscuring matter were present. The magnitude of this effect is evaluated by means of Holmberg's photometry (*Lund Medd. Ser. II*,

No. 136, 1958); it is about 0.42^m in total photographic brightness and 0.04^m in color. The redirection of photons should be most prominent in the dusty regions of the face-on galaxy, creating an anomalous relative brightness and blueness of the spiral arms.

Nucleosynthesis during the Early History of the Solar System. WILLIAM A. FOWLER, JESSE L. GREENSTEIN, and FRED HOYLE, *California Institute of Technology, Pasadena, California*.—Abundances in terrestrial and meteoritic matter indicate that the synthesis of D^2 , Li^6 , Li^7 , Be^9 , B^{10} , and B^{11} , and probably C^{13} and N^{15} occurred during an intermediate stage in the early history of the solar system. In this intermediate stage, the planetary material had become largely separated from the hydrogen which was the main constituent of primitive solar material. Appropriate physical conditions were satisfied by solid planetesimals with dimensions from 1 to 50 m consisting of silicates and oxides of the metals embedded in an icy matrix. The synthesis occurred through spallation and neutron reactions simultaneously induced in the outer layers of the planetesimals by the bombardment of high-energy charged particles accelerated in magnetic flares at the surface of the condensing sun. Recent studies of the abundance of lithium in young, T Tauri stars serve as the primary astronomical evidence for this point of view. The observed abundances of lithium and beryllium in the surface of the sun are discussed. The isotope ratios $D^2/H^1 = 1.5 \times 10^{-4}$, $Li^6/Li^7 = 0.08$, and $B^{10}/B^{11} = 0.23$ are the basic data leading to the requirement that 10% of terrestrial-meteoritic material was irradiated with a thermal neutron flux of 10^7 n/cm²-sec for an interval of 10^{14} sec. The importance of the (n, α) reactions on Li^6 and B^{10} is indicated by the relatively low abundances of these two nuclei. It is shown that the neutron flux was sufficient to produce the radioactive Pd^{107} and I^{129} necessary to account for the radiogenic Ag^{107} and Xe^{129} anomalies recently observed in meteorites. It is not necessary to postulate a short time interval between the last event of galactic nucleosynthesis and the formation of large, solid bodies in the solar nebula.

An Eclipsing "Astronaut." SERGEI GAPOSCHKIN, *Harvard College Observatory*.—The star of position, $12^h 7^m 5^s$, $+37^\circ 28'$ (1855) ($12^m 7$) or $12^h 12^m 16^s$, $+36^\circ 56'$ (1950) was discovered by Humason and Zwicky as an interesting blue star. It was found a no less interesting object with variable radial velocities by Greenstein, and it is now established as a spectroscopic binary and an eclipsing system of exceptional character.

On the basis of 24 spectrograms taken with the Hale telescope (200 inch), offered to me by Green-

stein and measured by myself, I found the following spectroscopic elements: $P = 3^d 5281$, $e = 0.00?$, $K_1 = 140$ km/sec, $K_2 = 180?$ km/sec, $\gamma = -20$ km/sec, $SP_1 = B_2$, $SP_2 = B_1?$, $(a_1 + a_2) \sin i = 15.75 \times 10^6$ km, $(m_1 + m_2) \sin^3 i = 12.10 \odot$.

On the basis of 327 photographic estimations made on the plates of the Harvard Patrol collection the photometric light curve and the elements of this star were found: max. = $12^m 92$, $m_1 = 13^m 17$, $A_1 = 0^m 25$, $m_2 = 13^m 07$, $A_2 = 0^m 15$, period = 3.5821 (assumed), no ellipticity (assumed), $D_1 = 0^p 18$, $D_2 = 0^p 18$ (assumed), $r_1 = 0.270$ A, $k = 0.72$, $i = 82^\circ 4$, $L_1 = 0.55$.

Combining the photometric and the spectroscopic elements, and assuming that there is no interstellar absorption, I find the following basic data on both stars (solar units for R and $\mathfrak{M}$):

$$R_1 = 6.18, \mathfrak{M}_1 = 7.04, Mv_1 = -2^m 39, T = 17\,900^\circ.$$

$$R_2 = 4.44, \mathfrak{M}_2 = 5.48, Mv_2 = -2.31, T = ?.$$

Another well-established method leads to the similar results: $\mathfrak{M}_1 = 8.1$, $R_1 = 7.0$.

The apparent visual magnitude is assumed to be $12^m 92$. The modulus is then 15.97. The distance of the star 15 630 parsecs.

How could the star hurtle itself that distance up? It would not have had time for this, for it should have left the center of the galaxy some billions of years ago, while the star's life itself could not have been longer than one hundredth part of this span of time.

Atomic Transition Probability Calculations. R. H. GARSTANG, *National Bureau of Standards, Washington, D. C.* (on leave from *University of London Observatory*).—As part of a program to fill some of the gaps in our knowledge of forbidden-line transition probabilities, calculations have been performed on $[FeII]$. Theoretical formulas, including spin-orbit interaction and configuration interaction, have been fitted to the observed spectroscopic energy levels, and estimates of the relevant quantum-mechanical parameters obtained. These have been used to compute magnetic dipole transition probabilities, and similar calculations for electric quadrupole probabilities are approaching completion. The agreement between theoretical relative intensities and rough estimated intensities in η Carinae is excellent.

Some results have also been obtained for electric dipole transitions of the type $p^2 - ps$ in carbon, silicon, germanium, tin, and lead. The main point of interest is the calculation of the transition probabilities for certain intercombination lines and, where possible, comparison with experimental determinations. For carbon and silicon excellent agreement is obtained.