distribution in the extreme ultraviolet solar continuum has been determined from the spectra obtained on April 19, 1960. The radiation temperature decreases gradually from 5000°K at 2080 Å, to 4700°K at 1750 Å. From 1510 to 1280 Å the level lies between 4700° and 4750°K. Below 1280 Å the continuum rises rapidly in the wing of Lyman-alpha as the line center is approached. The wings of Lyman-alpha are nearly symmetrical in terms of intensity, but not in radiation temperature. Shortward of Lyman-alpha the temperature level drops to a minimum of about 5100°K at 1180 Å, then rises gradually to 5800°K at 1000 Å, and this rise appears to continue throughout the region of the Lyman series, although only a trace of exposure was obtained. The Lyman continuum level from 912 to 880 Å was determined as $6680^\circ \pm 100^\circ \text{K}$. Smooth regions of slightly increased radiation temperature below 1526 and 1101 Å suggest enhancement from the ionization continua of SiII and ClI, respectively. The absence of Fraunhofer lines shortward of 1526 Å indicates that the continuum is entirely chromospheric below this wavelength. Here the continuum, like the emission lines, is enhanced in plane regions.

Behavior of Absorption Features in the Spectra of Mira Variables. A. J. DEUTSCH, P. W. MERRILL, and P. C. KEENAN, *Mount Wilson and Palomar Observatories and Perkins Observatory*.—Comparison of coudé spectrograms of Mira (Me) variables and of normal red giants has established several regularities in the complex behavior of their absorption spectra:

(1) *Temperature* types of M stars later than about M5 can be improved by comparing relative strengths of their molecular bands (TiO and VO) rather than absolute intensities. The reason is that even the vibrational levels of TiO are far enough apart to have appreciably different populations at temperatures of 3000 K and lower.

(2) Consistent differences in the ratios of the bands of YO, ScO, and AlO appear to reflect real differences in the *abundances* of these metals in certain Mira variables. Strengthening of YO and ScO indicates a tendency towards spectral type S; in such stars AlO is often weak.

(3) A striking characteristic of the spectra of many Mira variables is the *weakness* of many absorption lines in comparison to their strength in nonvariable stars of type M. The weakening is most noticeable in the range of types M0e to M5e, while many of the coolest Mira variables (R Leo) can scarcely be distinguished from ordinary giants. The line weakening is most pronounced in the blue and visual regions, and tends to disappear in the ultraviolet below 3900 Å. In any one variable the weakening can *vary* greatly from one cycle to another.

The lines *least* weakening arise from: (a) Ions of elements with ionization potentials less than about 6 eV (BaII, SrII). (b) Low levels of neutral atoms (Fe, Ti, Co) that have higher ionization potentials.

The differential behavior of these lines suggests that the Mira variables have atmospheres in which both pressure and temperature are lower than in normal giants of the same spectral type. They differ from supergiants, however, in having weaker lines (higher opacity) and in the absence of pronounced turbulent broadening of lines.

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Coma Formation and an Artificial Comet Experiment. BERTRAM DONN, *Astrophysics Branch, Goddard Space Flight Center, National Aeronautics and Space Administration*.—Inherent difficulties of observing comets have left such fundamental properties as nuclear structure, composition, and activation uncertain. Facilities for space research suggest additional ways for studying comets. Whipple's model can be simulated by putting several hundred pounds of an appropriate ice mixture into a terrestrial orbit.

Calculations of coma development and luminosity indicate the feasibility of an artificial-comet experiment. The analysis also applies to comet flares. For a 1-m sphere, density 1 g/cm³, weight 1300 lb, comparison with Halley's comet, which may underestimate luminosities, leads to the following: 4.8 mag. at 10 000 km; 7.4 mag. at 36 000 km.

If the thermodynamic properties of the nucleus are similar to ammonia and only solar thermal radiation acts, the coma forms in a few hours and in about a 1° diameter. The duration is 11 days for a 2.5-mag. decrease, 13.5 days for 4 mag.

A suggested nonreactive composition consists of ammonia (NH₃), cyanogen (CN)₂ and methyl acetylene, C₃H₄. The inclusion of micron-sized non-volatile grains would be desirable.

In this experiment, dimensions, structure, composition, and external environment would be known. The correlation of predicted and observed behaviors plus comparison with actual comet phenomena would test the validity of the model and provide information for extending or revising it. Atomic and spectroscopic data with solar excitation would also be obtained. If a suitable orbit can be attained, tail phenomena may also be studied.

Observations would mainly be by conventional methods and cooperation of astronomers, for complete observational coverage will be necessary. Space-borne radiation and particle detectors appear possible.

A modified experiment employing chemical

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*,