tinuum were measured photoelectrically using a cooled RCA 7102 tube at several locations in the corona with 1' and 5' circular apertures. Wavelengths scans were obtained by tilting a 16 Å bandpass interference filter. The results are compared with theoretical estimates made on the basis of collisional and radiative excitation of the upper level of the $\lambda 10747$ line.

Mercury: Anomalous Absence of a Variation with Phase in the 3.4 mm Radio Emission.

EUGENE E. EPSTEIN, *Aerospace Corporation*.—The dark-side brightness temperature of $220 \pm 35^\circ\text{K}$ which we recorded at 3.4 mm (88 GHz) during the April 1965 inferior conjunction of Mercury and the brightness temperatures recorded at longer wavelengths led us to expect a large variation with phase in the 3-mm emission of Mercury. This expectation was based on the assumption that Mercury's surface layers behave as do those of the moon. We made observations on 34 days at 3.4 mm with the 15-ft, 3 arc min beamwidth antenna of the Space Radio Systems Facility of Aerospace Corporation from 16 July through 17 October 1965; these observations cover almost a complete revolution of Mercury. We also made frequent observations of Venus and Jupiter to verify the over-all system reliability. In addition, special observations indicated that there were no detectable effects in the Mercury data due to antenna sidelobe reception of solar radiation.

The Mercury brightness temperatures were only $\approx 200^\circ\text{K}$, even when as much as 95% of the illuminated hemisphere was visible, and exhibited no significant variation with phase.

This work was supported by the U. S. Air Force under Contract AF 04(695)-669. A full account of the material covered by this abstract will appear in *Science* 151, 445, 1966.

Starlight Energy Density in the Metagalaxy.

JAMES E. FELTEN (introduced by Robert J. Gould), *University of California, San Diego*.—The mean metagalactic energy density of thermal radiation, ρ , which is of interest in several astrophysical investigations but cannot at present be measured directly, is treated from a semiempirical point of view. Difficulties in experimental and theoretical determinations are discussed. Dimensionally ρ may be written $\rho = A\sigma t_h$, where A is a dimensionless factor, σ is the mean thermal emission per unit volume of space, and $t_h = H^{-1}$ is the Hubble time. An estimate of the factor σt_h is derived from local observations of galaxies; its value is independent of the astronomical distance scale but depends upon the assumed mean bolometric correction for galaxies. The need for more photometric data in the infrared and ultraviolet is emphasized. The factor A is dependent upon the choice of

cosmological model, but $A \approx \frac{1}{2}$ (within a factor of 2) for a wide variety of models (Whitrow and Yallop, *Monthly Notices Roy. Astron. Soc.* 127, 301, 1964; 130, 31, 1965). The corresponding estimate of the starlight energy density, $\rho \approx \frac{1}{2}\sigma t_h \approx 1 \times 10^{-2} \text{ eV cm}^{-3}$, is probably also correct within a factor of 2.

Radiation Temperature of Space at $\lambda 2.6$ mm.

GEORGE B. FIELD, G. H. HERBIG, AND JOHN HITCHCOCK, *University of California, Berkeley, and Lick Observatory*.—The equivalent widths of the $R(0)$ and $R(1)$ lines of interstellar CN were measured on six high-dispersion spectrograms of ζ Oph obtained by Herbig, and were found to be $9.20 \pm 0.1 \text{ mÅ}$ for the $R(0)$ and $3.37 \pm 0.1 \text{ mÅ}$ for the $R(1)$. The corresponding excitation temperature of the rotational level $J=1$ is $3.22 \pm 0.15^\circ\text{K}$ if the lines are unsaturated. A reasonable upper limit on the degree of saturation implies a lower limit of 2.75°K for the excitation temperature.

It is shown that the only reasonable mechanism for the observed excitation is absorption of pure rotational quanta at $\lambda 2.6$ mm. Consideration of various possible sources of such quanta indicates that previously identified sources (stars, free-free emission, nonthermal emission) are inadequate, and that a new radiation component must be postulated. The implied effective blackbody radiation temperature for such a component, $3.2(+0.2, -0.5)^\circ\text{K}$, may be compared with that of a component at $\lambda 7.4 \text{ cm}$, $3.5 \pm 1.0^\circ\text{K}$, recently found by Penzias and Wilson (*Astrophys. J.* 142, 419, 1965). If the components are in fact identical, the present observations verify the approximate blackbody nature of the spectrum over a 28:1 wavelength interval. The relevant wavelength studied here is not far from the expected blackbody maximum at $\lambda 0.8 \text{ mm}$. This interpretation is consistent with the suggestion by Dicke, Peebles, Roll, and Wilkinson (*Astrophys. J.* 142, 414, 1965), that blackbody radiation of approximately the observed temperature should be present as the result of processes occurring much earlier in the history of the universe.

Metallic Continuous Absorption Coefficients in the Solar Ultraviolet.

OWEN GINGERICH, *Smithsonian Astrophysical Observatory* AND JOHN C. RICH, *Harvard College Observatory*.—Computations with a hydrogenic approximation for the bound-free absorption coefficient from various neutral metals and with the Goldberg-Müller-Aller abundances indicate that silicon and magnesium should predominate over all other metals in the solar ultraviolet. New shock-tube results for silicon show that the experimental cross section for the ground state is $37 \times 10^{-18} \text{ cm}^2$, almost a factor of 10 larger than the hydrogenic value. For the first excited level (1D), the experi-