Temperature Effects in Photomultipliers. J. D. FERNIE, *David Dunlap Observatory*.—A photoelectric photometer employing an unrefrigerated EMI 6094A photomultiplier is in use with the 19-inch aluminized reflector of the David Dunlap Observatory. Transformation equations from this instrumental system to the *UBV* system have been determined in both summer and winter at average temperatures of $+70^\circ$ and -5°F , respectively. No significant variations in the transformation coefficients are found over this range in temperature. It is considered unlikely that effects of mirror-aging can be compensating for a temperature effect, although this possibility remains to be examined observationally.

Wave Propagation and Screening in a Dense Two-Component Plasma. J. S. GOLDSTEIN, *Brandeis University*.—We consider the propagation of small-amplitude waves in a dense degenerate plasma ($\rho \sim 10^6\text{--}10^9$ g/cc, $T \sim 10^8\text{--}10^9$ °K) such as may exist in the core of presupernova, or in very dense white dwarfs. The effect of ion motion is included. The results may be extended to zero frequency to obtain the screening length; the results of Cameron (AECL Chalk River, Do PD-312, 1959) on nuclear reaction rates at high density are confirmed. For nonzero frequencies, the dispersion relation is obtained for the medium. At low frequencies, the principal propagation mode is in the ion plasma, while at high enough frequencies, propagation in the electronic component dominates. The role of zero sound is considered, and may be expected to become important in the case of a neutron core, and in some cases in the presupernova core. The formation of shock waves in these media is discussed.

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Absorption Lines Produced in Interstellar Grains. J. MAYO GREENBERG AND PEARL R. LICHTENSTEIN, *Rensselaer Polytechnic Institute*.—The wavelength dependence of extinction has been computed for various size distributions of spherical particles using the best available estimate of the wavelength dependence of the complex index of refraction for "dirty ice." The computations are made with Mie theory results for the total cross sections of spheres of arbitrary size. The effect on the index of refraction produced by a small admixture of material having a resonance line in the neighborhood of $\lambda 4430$ has been estimated by assuming the order of one atom of *Ca* per thousand water molecules in a grain. For distributions of particles which give a ratio of total to selective extinction equal to 3, it

is shown to be possible to produce an extinction line whose strength is of the order of that observed for the $\lambda 4430$ line. The strength of the line decreases with increasing A/E and, as is to be expected, becomes an emission line for sufficiently high A/E .

Redshift of the Radio Source 3C 48. JESSE L. GREENSTEIN, *Mount Wilson and Palomar Observatories*, AND THOMAS A. MATTHEWS, *Owens Valley Radio Astronomy Observatory*.—The radio source 3C 48 has been announced to be a star because of its small radio diameter and stellar appearance on direct plates. The recent discovery of the Balmer series in 3C 273 by Schmidt and Oke and the consequent large redshift $\Delta\lambda/\lambda_0$ of 0.158 suggests the possibility of a large redshift for 3C 48. On this basis a number of emission lines have been identified with lines of *Mg II*, [*Ne III*], [*Ne V*], and [*O II*]. The redshift is 0.3675 or 110 200 km/sec.

The possibility that the source is a nearby ultra-dense star of radius near 10 km and containing neutrons is ruled out from a spectroscopic point of view. Interpreting 3C 48 as the core of a peculiar galaxy, the distance is estimated to be 1.1×10^9 pc. The absolute visual magnitude, corrected for redshift effects, may be as bright as -26.3 , at least 10 times brighter than the brightest elliptical galaxies. In the visual spectrum 3C 48 radiates about 50 times more powerfully than 3C 295 or Cyg A, but comparably with 3C 273. As a radio source 3C 48 is rather similar to 3C 295 and Cyg A. Due to its small angular diameter the surface brightness is very high. The integrated radio emission of 3C 48 is comparable with that from 3C 295, being 4×10^{44} ergs/sec. At a distance of 1.1×10^9 pc the radio and optical emission must be confined within a diameter 5500 pc.

Theoretical Photometric Function for the Lunar Surface. BRUCE HAPKE, *Center for Radiophysics and Space Research, Cornell University*.—A formula which describes the observed photometric properties of the lunar surface is derived theoretically. Functions for both the differential and integral brightness are obtained. The model surface on which the derivation is based consists of a semi-infinite, porous layer of randomly placed, obscuring objects; these objects are suspended in depth in such a manner that the interstices which separate them are interconnected. A layer of fine, loosely compacted dust is in the category of surfaces described by this model, but volcanic foam is not. The shape of the photometric curve depends on the fractional void volume. Bulk densities of the order of one-tenth that of solid rock are implied for the upper layers of the surface of the moon.

Radio Survey of Shapley-Ames Galaxies. D. S. HEESCHEN AND C. M. WADE, *National Radio Astronomy Observatory*.—A radio Survey at 750 and 1400 Mc/sec of all galaxies in the Shapley-Ames Catalogue north of declination $-19^{\circ}23'$ (1963.0) is in progress with the 300-ft telescope. The survey is essentially complete down to a photographic magnitude of 11.5 and a radio flux density of 0.5×10^{-26} W m $^{-2}$ (cps) $^{-1}$. Radio sources have been detected at the positions of more than half of the Sb, Sc, and Ir galaxies brighter than $m_{pg}=11.0$. A preliminary analysis of the relationships between the radio and other properties of galaxies is presented.

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Photographic Photometry (*U, B, V*) of Two Stellar Groups near NGC 2244. ARNOLD M. HEISER, *Dyer Observatory*.—Photographic magnitudes in three colors (*U, B, V*) have been determined for two groups of stars within one degree of the galactic cluster NGC 2244. Photoelectric observations of some of the stars in this cluster (Johnson, H., *Astrophys. J.* 136, 1135, 1962) were used as standards for the photographic material, all of which was obtained with the Dyer Observatory 24-inch reflector-corrector. Color luminosity arrays have been used in an attempt to determine not only the reality of these two groups but also their possible relation to NGC 2244.

Emission-Line Stars in an Obscured Region in Chamaeleon. KARL G. HENIZE, *Dearborn Observatory*.—In the course of the Michigan-Mount Wilson southern $H\alpha$ survey a group of ten emission-line stars were found in an obscured area in Chamaeleon centered on R.A. $11^{\text{h}}04^{\text{m}}$, Dec. $-76^{\circ}5'$ (1875) (Henize, thesis, 1954). Hoffmeister (*Trans. IAU XIA*, 268, 1961) has found a concentration of RW Aurigae type variables in this same region. A search for emission-line stars on objective-prism plates taken with the Uppsala Schmidt telescope at Mount Stromlo Observatory has been completed to mag. 15.0. Within an area of two square degrees 27 stars with certain $H\alpha$ emission and six with probable $H\alpha$ emission have been found. Of these 33 stars, 12

show irregular light variations and 5 are probably variable.

Slit spectra have been obtained of the five brightest members with the Mount Stromlo 74-inch reflector. Classifications together with preliminary photometric data are given in Table I.

Assuming HD 97300 to lie on the zero-age main sequence the apparent modulus of the group is 7.4, the true modulus is 6.2, and the distance is 170 pc. Although the spectrum of LH α 332-21 is T Tauri like in that strong hydrogen emission through $H12$ is visible together with strong H and K emission, it does not completely qualify as a T Tauri star since neither *Fe I* nor *S II* emission is present. However, there seems little doubt that many of the fainter stars will be found to be typical T Tauri stars and that this group may be classed as a T association.

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Search for Residual Traces of the T Tauri Phenomenon in Normal Stars: Lithium in G-Type Dwarfs. G. H. HERBIG, *Lick Observatory*.—A lithium abundance a few hundred times the solar value appears to be characteristic of the T Tauri stars. In present models of contracting stars near $1 M_{\odot}$, the effective depth of the convection zone passes through a maximum during contraction. Therefore if *Li* present initially is to be destroyed, this must happen before the star reaches the main sequence, since the convection zone in models of the present sun does not extend deep enough to have produced the observed depletion of *Li* in 5×10^9 years. Consequently, the *Li* abundance in main-sequence stars of about $1 M_{\odot}$ should be comparable with the solar value.

This expectation is not fulfilled. The *Li* abundance in some 50 G0-G8 dwarfs near the sun shows a major dispersion, from values comparable with the T Tauri stars down to values like that of the sun.

Evidence that this is an age effect (in the sense that the *Li* abundance decays with time) is:

(i) All six G0-G4 dwarfs that have been observed in the Hyades (age: 5×10^8 yr) have moderately strong *Li*; their mean *Li/Ca* ratio is about 30 times the solar value (see following abstract by Wallerstein, Herbig, and Conti).

(ii) The brightest G dwarf in the Pleiades (age: 6×10^7 yr) has a comparable *Li* abundance.

(iii) The relative numbers of G dwarfs in the solar neighborhood as a function of *Li* abundance, on the assumption of a constant rate of formation over the past 15×10^9 yr, are in approximate agreement with expectation from a simple theory of *Li* decay.

(iv) The stars with the strongest *Li* lines all have low space velocities. The velocity dispersion increases to lower *Li* abundances.

TABLE I. Classifications and preliminary data.

Star	Spectrum	<i>V</i>	<i>B</i> - <i>V</i>
HD 97048	A0e α	8.44	+0.36
HD 97300	A0V	8.98	+0.41
CPD - 76°652	G11ep	10.60	+1.18
LH α 332-21	G8e	10.94	+1.11
LH α 332-20	K0e	11.3	...