M. I. T.—The ultraviolet-pumping model (Litvak, M. M., McWhorter, A. L., Meeks, M. L., and Zeiger, H. J., *Phys. Rev. Letters* **17**, 821, 1966; URSI Meeting, Washington, D.C., April 1966; *Astron. J.*, to be published) for interstellar 18-cm OH emission and anomalous absorption has been extended to include the effects of thermal electron collisions, varying amounts of overlap of the Doppler-broadened ultraviolet hyperfine-split absorption lines, and selective far-infrared absorption. In the presence of strong electron collision rates, far-infrared or ultraviolet continuum pumping and selective absorption can produce, respectively, 1612 or 1720 MHz emission, with the remaining three transitions becoming anomalously absorbing [similar to data of W. M. Goss (Ph.D. thesis, Berkeley, 1967)]. For weaker electron collision rates and for kinetic temperatures high enough to cause overlap of the hyperfine-split ultraviolet pump absorption lines, all four hyperfine transitions are inverted over the same region in the OH cloud; but for cooler clouds, the inversion regions for the different transitions become separated, especially for 1667 and 1665 MHz.

Similar calculations on SH indicate that Λ -doublet population inversion is also possible for this species. For relatively slow thermalization of OH molecular velocities and for propagation nearly parallel to the pump, the ultraviolet selective absorption produces an unsaturated gain-frequency profile, which may be narrower than the Doppler width and which may have a dip at line center. A stability analysis for pure circular polarization is considered for cases of saturated *broad-band* maser emission between states with Zeeman frequency splittings which are *larger* than the inverse lifetimes of the states. [This is contrary to the cases considered by C. V. Heer (*Phys. Rev. Letters* **17**, 774, 1966; *Phys. Letters*, to be published) and by P. L. Bender (*Phys. Rev. Letters* **18**, 562, 1967).] The analysis involves Raman-type cross-saturation, combination-tone generation and magnetoplasma propagation.

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Formation of Planetary Nebulae. LEON B. LUCY, *Columbia University*.—It is suggested that planetary nebulae originate from extreme red giants that have become dynamically unstable. This instability arises when the mass contained in the hydrogen ionization zone is sufficient to reduce the effective ratio of specific heats for the envelope below $\frac{4}{3}$. An approximate calculation shows that for a star with mass $M=1M_{\odot}$, with a radiative core of mass $=0.3 M$, and with $X=0.7$ in the envelope, the instability first occurs at a radius $R\sim 10^3 R_{\odot}$.

If we make the crude assumptions of adiabatic changes and homologous displacements, we may follow the growth of the instability using the virial theorem. With these assumptions, we find for the above example that the envelope is ejected from the star and that its final kinetic energy of expansion is $\sim 2\times 10^{45}$ erg. This energy and that required to overcome the gravitational binding of the envelope come from the energy released as ionized hydrogen and helium atoms in the envelope recombine.

In this example, the predicted kinetic energy of expansion corresponds to a velocity ~ 17 km/sec, which agrees well with the observed expansion velocities of planetary nebulae. We also note that this suggestion seems to meet the conditions inferred about the origin of planetary nebulae by Abell and Goldreich (*Publ. Astron. Soc. Pacific* **78**, 232, 1966).

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Use of Overlap Conditions in Astrometric Plate Reductions. CARL F. LUKAC AND NANCY J. LEWIS, *U. S. Army Map Service*.—The positions of about 600 stars reaching to $14^m.5$ in the Pleiades Cluster are being determined from measurements on 14 plates by utilizing sophisticated reduction methods in order to derive the best possible values contained in the observations. The reduction considers the correlation of plate constants among mutually overlapping plates.

There are 105 stars being used as reference stars. This large number permits an accurate determination of the relationship between plates.

The plates not only overlap but contain multiple exposures so that on the average, a star is recorded eight times on a single plate. The mean error of one star position from this material should not be more than $0''.02$, but rather nearer to $0''.01$.

Since this is the first extensive treatment of the Pleiades using elaborate techniques, some attention is given to the reduction procedure.

Be Stars in Open Clusters. DARRELL J. MACCONNELL, *The University of Michigan*.—Hiltner, Morgan, and Neff (*Astrophys. J.* **141**, 183, 1965) listed slit spectral types for 25 members in NGC 6530 of type B3 and earlier and classified 18 as of type Be, but mentioned that their spectra may be contaminated by the strong $H\alpha$ emission of M8. Three of the 18 stars are known Be stars; No. 58 is LkH α 112 (Herbig, *Astrophys. J.* **125**, 654, 1957), No. 65 is MWC 280, and No. 100 is No. 25, Table I, Tonantzintla-Tacubaya **13**, 12. Four- and ten-degree $H\alpha$ objective prism plates of NGC 6530 taken with the Curtis Schmidt-type telescope of The