now permits much more reliable analyses of grains to be carried out than were previously possible.

We consider the simplest case of growth of pure crystals without reactions. Molecular impact frequencies, surface lifetimes and diffusion rates are calculated. Growth rates and shapes are estimated according to which of the two crystal growth mechanisms is appropriate, (1) trapping with little mobility, producing nearly spherical particles, or (2) dislocation trapping yielding nonspherical grains. Process 2 requires a significant diffusion distance. At 50°K all abundant metals except aluminum, iron, and nickel would diffuse and tend to develop irregular particles. At 20°K process (1) would apply to all metals. Molecules of hydrogen with carbon, oxygen, and nitrogen would probably diffuse. At 5°K only molecules more volatile than CO₂ undergo diffusion.

Platelets permit sufficient mass for water, ammonia, methane, or graphite grains to produce interstellar extinction. At 20°K the expected surface diffusion of hydrogen compounds is about 1 mm in 10⁵ yr. Carbon atoms on the hexagonal graphite face appear to be similar. Trapping occurs on crystal edges, and platelets should tend to form. A small number of screw dislocations would lead to highly irregular whisker arrays. Exponential growth rates occur. For platelets with $N(H)=1/\text{cm}^3$, r reaches 10⁻⁵ cm in about 3×10^8 yr or 3×10^7 yr if $N(H)=10$.

Inclusion of chemical reactions, heterogeneous composition, and radiation chemical effects should make growth less favorable. Also recent extinction measurements in the ultraviolet cannot be explained by uniform grains. Consideration should be given to extinction by Platt-type grains.

The Reflectivity of Venus and Jupiter in the Middle Ultraviolet. D. C. EVANS, A. BOGGESS, III, AND R. SCOLNIK, *Goddard Space Flight Center, NASA*.—Spectra of Venus (~35 Å resolution) and Jupiter (~50 Å resolution) were obtained using objective grating spectrographs in the 2300–3700 Å wavelength range. The geometric reflectivity of Jupiter, as a function of wavelength, lies in the range 0.15 to 0.25; that of Venus, 0.08 to 0.40.

No narrow absorption features are apparent in the Venus spectra. A broad feature, beginning at 3300 Å and reaching maximum absorption at 2500 Å can be explained by assuming the presence of 0.03 cm atm of ozone ($0.01 < O_3 < 0.1$) above a reflecting cloud layer. Geometric reflectivity, p , of 0.08 ($0.06 < p < 0.12$) at 2500 Å, indicates an upper boundary of ultraviolet ozone absorption that must be deep in the atmosphere, where the total pressure P will exceed 0.1 atm ($0.06 < P < 0.2$). Comparison to vertical distribution of ozone in theoretical CO₂:N₂ atmos-

pheres for Mars and the earth's atmosphere indicate an ozone maximum about 20 km deeper than the 2500 Å absorption level. The pressure at the ozone maximum would therefore be 1.0 atm ($0.6 < P < 2.0$), corresponding approximately to the accepted value for the pressure at the visible cloud surface. Since the ozone maximum is approximately at the cloud level, photodecomposition of H₂O associated with these clouds could be a likely source for the ozone. The proposed abundance of ozone is greater and much deeper in the atmosphere than the amount expected when compared to theoretical studies of CO₂:N atmospheres for Mars.

The Jupiter spectra, including an absorption feature at 2600 Å, is consistent with photoelectric spectra obtained by Stecher which he interprets in terms of Rayleigh scattering from 10 km atm of molecular hydrogen above a cloud layer.

The spectra were obtained on Aerobee flight 4.126 GG, 10:15 UT, 22 August 1964, peak altitude 122 km.

Distance from Earth to Moon for Laser Studies of Differential Heights. MARY P. FRANCIS, *TRW Space Technology Laboratories*.—The probable error in the predicted distance from a station on the earth to the surface of the moon is considered. Knowledge of the variation of this error with time is critical for a statistical evaluation of topographic height measurements from laser pulses.

The absolute range error is found to be approximately $|\Delta\rho| = \pm 117 + 1.3 \Delta c$ (m), where Δc is velocity of light uncertainty in m per sec. Corresponding uncertainty in predicted round-trip light time to the reference surface is independent of Δc and is less than 1 μsec. Topography uncertainties will cause errors in predicted round trip light time of two-thirds of a microsecond per 100 m uncertainty. Gate widths of a few microseconds will be required.

The rate of change of lunar range error is found to lie within the bounds $1 \text{ m/h} < (d/dt)|\Delta\rho| < 10 \text{ m/h}$. Hence for differential lunar height accuracies of ± 2 m, a significant differential range prediction error occurs for measurements separated by more than a few minutes. Errors which may be averaged out by measurements before and after meridian transit are not included in the above estimate. For correlation of data points separated by more than a few minutes an improved short term ephemeris will be required—possibly to be obtained from laser data taken during the experiment.

Microwave Spectra of OH in the Direction of the Galactic Center. E. J. GUNDERMANN, S. J. GOLDSTEIN, JR., AND A. E. LILLEY, *Harvard Col-*