stars and measures of surface luminosity and color allow a reconstruction of the recent history of star formation in certain small irregular galaxies. Neglecting dynamical effects, it is possible to work out a series of pictures of each galaxy showing how it looked at various times in the past, up to times of approximately 5×10^8 yr ago for the nearest. An interesting result is the way in which star formation in many cases has proceeded rapidly around the outer edges of a galaxy, like a brush fire. Some late-type spirals are also studied in this way and occasional gross asymmetries in the pattern of recent star formation are conspicuous.

Formation of Planetary Systems as a Universal Phenomenon. SU-SHU HUANG, *Goddard Space Flight Center and Catholic University of America*.—From the observed distributions of rotational velocities for main-sequence stars of different spectral types, it has been shown that all stars must have been braked in various degrees in their early stage of evolution. As a result of braking, the stellar angular momentum is transported outward to the surrounding nebula that may be regarded as the remnant of star formation. That there is a nebula in the neighborhood of the star can be inferred from the fact that any efficient braking requires its existence. When the angular momentum of the star is transferred to the nebula, a rotating disk will inevitably be formed from which a planetary system may emerge. Since all stars have been more or less braked (Huang, S.-S., *Astrophys. J.* **141**, in press) and especially since all main-sequence stars later than F5 have been completely braked, occurrence of planetary systems must be a common phenomenon in the galaxy or even in the universe.

It is consequently found that planetary systems associated with the early-type stars (O,B,A) cannot possess planets as massive as Jupiter. On the other hand, they can have terrestrial-like planets somewhere in the region between 10 and 100 a.u. from the stars. It has also been shown that our own planetary system is of an ordinary size expected for a solar-type star.

It is obvious that rotation of component stars in binary systems of large separation must have been likewise braked. It follows that planetary systems are not necessarily confined to single stars.

An Analysis of the Atmospheric Trajectories of 413 Precisely-Reduced Photographic Meteors. LUIGI G. JACCHIA, FRANCO F. VERNIANI, AND ROBERT E. BRIGGS, *Smithsonian Astrophysical Observatory*.—The analysis covers the same Super-Schmidt meteors for which orbital data have been analyzed

by Jacchia and Whipple (*Smithsonian Contrib. Astrophys.* **4**, 97, 1961). Heights, lengths, decelerations, and magnitudes are related to such parameters as velocity, angle of incidence, mass, ablation coefficient and fragmentation index; the latter two are in turn related to geometric and physical characteristics. A comparison with classical meteor theory shows again and again that fragmentation is the most important factor in causing the wide discrepancies between theory and observation.

We confirm essentially all of Jacchia's results from previously published partial analyses of the same material. In addition we find that fragmentation causes a decrease in the luminous efficiency of meteors. Nevertheless, the maximum brightness of strongly fragmenting meteors is greater than for those which are less fragmentable; Super-Schmidt meteors are, on the average, half a magnitude brighter at maximum than predicted by single-body theory and are about $\frac{1}{3}$ shorter in duration and length. The breakup of meteors showing an abrupt beginning follows the relation $\rho v^3 = \text{const}$ (ρ is the air density, v the velocity).

Using Verniani's (*Smithsonian Astrophys. Obs. Special Report* 145, 1964) value, 1.0×10^{-19} zero mag $\text{g}^{-1} \text{cm}^{-3} \text{sec}^4$, for the photographic luminous-efficiency τ_{op} , we find that the density of the average Super-Schmidt meteor is 0.26 g cm^{-3} ; a zero visual magnitude meteor with a velocity of 40 km/sec and zenith angle of 45° turns out to have a mass of 0.69 g. Among showers we find that the Geminids are four times denser than the average meteor, but crumble just as easily, while the Southern Taurids have normal densities, but do not fragment much; the Draconids are unique in their extraordinary fragility.

A search for meteors of asteroidal origin has shown that only one of our 413 meteors possesses all the requisites to qualify as a member of this group.

Departures from Equilibrium in an Idealized Hydrogen Atmosphere. HOLLIS R. JOHNSON AND DANIEL A. KLINGLESMTIH, *Indiana University*.—The coupled steady-state and radiative transfer equations are solved in a self-consistent fashion for a model hydrogen atom in an idealized atmosphere having constant temperature, density, and chemical composition. We treat a model hydrogen atom having three bound levels ($n=1, 2$, and 3) and a free state. Electron and total hydrogen densities are 10^{12} cm^{-3} , $T=10^4 \text{ }^\circ\text{K}$, and the composition is pure hydrogen.

To solve the transfer problem, we employ two different procedures. For the resonance lines, we solve the linear integral equation for the source function, and thus obtain the net radiative bracket. For the subordinate line and all the bound-free con-