stage of terrestrial planets' growth determined many of their fundamental properties, including their thermal properties and petrology; their large masses, and possibly the existence of the Moon. A critical result of the late-stage models, which bears on observable properties, is the size of the largest planetesimals that grew near, and later impacted, those that became full-size planets. Previous models were flawed by analytical errors and unreasonable assumptions regarding relative velocities. The latter category includes neglect of the decrease in relative velocity as control is transferred from the largest to the second-largest body in an accretion zone. Evidence that Venus helped stir Earth's planetesimals is now compelling. While models are corrected, the results still depend strongly on uncertain initial conditions. The size of the second largest planetesimal in the Earth's zone might range from 3,000 km to 2,500 km, with corresponding accretion times of 7 × 106 yr and 1 × 107 yr, respectively. Both extremes are generated from plausible initial conditions and both seem consistent with observed planetary properties.

8.23 Asteroid Rotation Rates and Shapes. J.A. Burns, Cornell Univ., and A.W. Hefets, Jet Propulsion Lab. We consider asteroid spin rate and lightcurve amplitude versus asteroid size for the - 150 numbered asteroids, 1 confirmed rotation periods; sizes are determined using standard methods when available but otherwise are estimated from asteroid albedos, selected depending on taxonomic type or orbital position. Least squares fits to linear logarithmic functions are made for various subsets of the data. We find from these fits that, although for the entire sample there is an apparent shortening of rotation period with smaller size, there is little change in rotation period with size when either C asteroids alone, or the remainder of the sample, is considered. Within a taxonomic type there is nevertheless a slight tendency for smaller asteroids to spin faster but this is attributed to selection effects. The C asteroids appear to rotate with P - 10-11 hr whereas non-C's have P - 8 hr. These observations are in agreement with a collisional theory by Harris (1979 Icarus, in press) and suggest that the C's are less dense or less strong than other asteroid class members. The generation of rotations by interparticle collisions is also implied by showing that the dispersion of rotation rates about the mean apparently fits a three-dimensional Maxwellian distribution, such as would be developed in a collisionally evolved system. Asteroid rotation axes thus are randomly oriented in space. Known data on shape from lightcurves show that the minor planets of our survey become more irregular when smaller; selection effects may account for this result, which is in disagreement with some photometric survey results. Shapes do not seem to depend on taxonomic type.

8.24 Dynamical Features of Minor Planet Satellites. T.G. Van Flandern, U.S. Naval Observatory. The confirmation of a satellite of 512 Nysa during the occultation of SAO 120774 on 7 June 1978 led to the realization that secondary events reported both photoelectrically and visually during each of eight occultations of stars by minor planets are probably also satellites. There are now 17 known or suspected satellites of 2 Pallas, 3 Juno, 6 Hebe, 129 Antigone, 433 Eros, and 532 Herculina. No minor planet has been observed to occult a star and not show evidence of a satellite. This paper explores the gravitational, collisional, and tidal stability of such systems. The principal conclusions are that the gravitational spheres of influence of minor planets are approximately 100 times their diameters, even for meteorite-sized bodies. Therefore, all satellites discovered so far are gravitationally highly stable. Collisional lifetimes depend critically upon the asteroidal space density and the size distribution power law. For extreme assumptions, mean lifetimes between collisions which can de-orbit the satellites would be as low as 106 years or as high as 1011 years. For tidal coefficients similar to the Mars-Phobos case, large minor planet satellites would be so strongly interacting with their primaries that substantial tidal evolution would take place in only 106 years. The result would be predominantly circular, co-planar satellite orbits. Many satellites would have tidally de-orbit a satellite of a minor planet on the surfaces of their primaries. It seems possible that comets and meteoroids could be similar close-by-multiple-body systems.

Session 8 (continued)

International Ballroom, 1:30-2:45 p.m.

8.25 Evolutionary Models Of The Smaller Planets Involving Electrical Induction In A T-Tauri-Like Solar Wind. F. Herbert, and C. P. Sonett, Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona, 85721. Parallel evolutionary models with electrical induction heating were constructed for Mercury, the Moon, and the asteroids. The calculations assumed transverse magnetic induction in the D.C. limit. Electrical conductivity functions were based on the following: The initial asteroidal composition was assumed similar to carbonaceous chondrite, whereas the Moon and Mercury were taken to be ferromagnesian silicate. Over a wide range of plausible solar and planetary parameters, the maximum model central temperatures increase in the order: Ceres, Pallas, Vesta. Most parameterizations that lead to melting or near-melting temperatures for Vesta produce roughly 100°C or more.

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