Some. perspectives on dynamical aspects of the origin of asteroids

A. W. Harris (Jet Propulsion Laboratory, Caltech, Pasadena, CA, USA)

This paper is not intended to be a review of the general topic of asteroid origin, nor even complete in its scope, as I would not pretend to be a leading expert in the chemical half of the topic, relating cosmochemistry to meteorites. Instead the paper will be more of a "conference summary" of the current state of research into the dynamical aspects of asteroid origin, and a commentary on some of the issues that I regard as current problem areas or fruitful avenues of further research. A topic which has seen great activity since the last ACM is asteroid rotations. An entire population of slowly rotating, "tumbling" asteroids has been discovered, which as yet remains unexplained in physical terms. At the other end of the spin spectrum, we now have sufficient statistics to see what appears to be a "barrier" to spin periods shorter than ~ 2¼ hours, suggesting that most asteroids are "rubble piles," with no tensile strength to avoid "flying apart" if they were to spin faster. All across the spin-rate spectrum, attempts have been made to define sub-populations with differing mean spin rates, and infer that these populations represent "primordial" vs. "collisionally evolved" objects. I am skeptical that such distinctions can be made on the basis of rotation rates, since the rotational outcome of accretional collisions is very nearly the same as that of erosive or disruptive collisions, thus there is not a good theoretical basis to expect rotational differences between two such populations. Another topic which has shown great progress is the process of elimination of NEAs from Earth-crossing orbits. It now appears that a substantial fraction may fall into the sun rather than impact the terrestrial planets, and if most NEAs are indeed "rubble piles," then tidal disruption as a result of close passes by planets is a more probable first step in their evolution than impact as whole bodies onto the terrestrial planets. These processes have implications for the rates of supply and elimination of NEAs from the main asteroid belt, and for the equilibrium size-~~oj]l]l:ttic)ll (Distribution of NEAs compared to MB asteroids,