The rotation rates of very small asteorids: Evidence for "rubble pile" structure. A. W. Harris, Jet Propulsion laboratory. Caltech.

A rotating sphere will be in a state of compression if the rotation frequency does not exceed the surface orbit frequency. 'J-his is equivalent to saying that the surface gravity is greater than the centrifugal acceleration at the equator. This concept can be generalized for a prolate spheroidal body spinning about a short axis by considering the centrifugal force *vs.* gravitation] acceleration at the tip of the long axis. Thus reduced to practical units, we can write an approximate relation between the rotation period, $P$, and the critical density, $\rho_c$, below **which the body** would "fly apart":

$$\rho_c \approx \left(\frac{3.3^h}{P}\right)^2 \left(\frac{a}{b}\right) \approx \left(\frac{3.3^h}{P}\right)^2 (1 + \Delta m),$$

where $a/b$ is the axis ratio of the prolate spheroid and $\Delta m$ is the amplitude of lightcurve variation of' the body, which is very roughly related to the axis ratio as indicated. In a recent analysis of an expanded data set of the rotation rates and amplitudes of variation of 1 07 asteroids smaller than 1 0 km in diameter, 1 note a distribution of rotation rates which appears truncated, rather than smoothly dropping to zero, at a rotation period below about 2.5 hours. In a plot of all 688 known asteroid rotation periods *vs.* amplitude of lightcurve variation, one can draw lines of constant $\rho_c$, to observe that there appears to be a barrier. somewhat parallel to the curves at a value of $\rho_c \approx 2.5$ gm/cm$^3$. That is, the very fastest spinning asteroids are actually rather spherical, since more elongated bodies spinning that fast would fly apart. 1 conclude from these lines of evidence that most, if not all, asteroids. even down to the very smallest ones sampled (<1 krn in diameter), are not monolithic. Indeed the apparent density threshold suggested of $\sim$ 2.5 gm/cm$^3$, indicates that even small asteroids have a substantial bulk porosity, thus they may be "rubble piles" rather than fairly solid bodies.