COSMIC SPHERULES, ASTEROID COLLISIONS AND THE SOLAR CONSTANT

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ABSTRACT

In 1980 (Phil. Trans. Roy. Soc. 297, 495) and in 1983 (Geophys. Jour. Roy. Astr. Soc. 75, 473) it was proposed that cosmic spherules are formed as splash ejecta in asteroidal collisions. The Poynting-Robertson effect size-sorts the spherules as they spiral to Earth in circular orbits. The time taken in My is given by

$$\Delta t = 3.5 \times 10^{-7} D\delta \ (a^2 - 1)$$

where a (in AU) is the collision distance from the Sun, D (in μm) is the diameter of the spherules and δ (in kg/m^{-3}) its density. In the 1983 paper, we tested the hypothesis by plotting the size of all the iron spherules (≥ 43 μm diam.) against time for two dated N. Pacific cores. Sloping lines, giving a ~ 2.1 AU, could be discerned; but their existence could be disputed - see figure 6.

In current work, all the spherules from core V21-65 have been cracked open to find δ. Out of 220 spherules, 65 have rusted metal globules and these (Dδ) points give a confused plot, because of inaccurate δ-values. However, 66 spherules have their metal globules well preserved. Since globule diameter and %Ni can be accurately measured, δ can be calculated. These (Dδ) points show two sloping lines with some clarity, giving a ~ 3.4 AU; also, there are vague lines, giving a-values well within the main asteroid belt.

To establish the hypothesis, wide cores are needed, giving an abundance of undamaged spherules. To obtain accurate a-values, the Robertson formula requires correction because of the spherule's "hummocky" oxide surface. Also, any waviness in the sloping lines could be a measure of a variable solar constant.

A new kind of iron spherule was found because of the cracking; 13 enclose opaque beads of true glass (rich in Fe, Ni and Si, no Mg) instead of metal globules. Crushed bits are deep ruby-red and nonmagnetic.

R. H. Giese and P. Lamy (eds.), Properties and Interactions of Interplanetary Dust, 183.