N89 - 15043

EXPERIMENTAL CONSTRAINTS ON THE ORIGIN OF CHONDRULES

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Chondrule formation must have been an important (perhaps ubiquitous) process in the early solar system, yet their origins remain elusive. Some points, however, are clear. The precursor material of chondrules (dust?) was rapidly heated at rates of perhaps thousands of degrees per second and was cooled more slowly (0.1-1.0^{o}C/sec), (also see Nuth, Nucleation Experiments. . . ., This report).

We propose to investigate chondrule formation in the Space Station environment via a "dust-box" - a chamber (~1 m^{3}) in which dust can be suspended, heated, and cooled. A microgravity environment is conducive to this kind of experiment because of the significant retardation of settling rates compared with a terrestrial laboratory environment. These long-duration experiments might require the development of technologies to counteract even the small, but finite and permanent gravitation field of the Space Station.

Simple, but interesting experiments on dust suspensions immediately present themselves. For heating events of less than 1 second (using a laser, multiple lasers, or electrical discharge), what dust density is required to produce large

(0.1-1.0 mm) objects? Is the density so large that chondrules cannot cool quickly? What conditions are necessary to mimic observed textures in chondrules?