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Chondrule Formation:

Nebular Gas Confinement of Impact Splashes

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The formation of chondrules is one of the oldest unsolved mysteries in meteoritics. One of the theories states that they are formed as a result of collisions between plan- etesimals in which the impact melt forms small droplets which solidify to become chondrules. Some constraints from meteoritics suggest that the material reaccreted rather soon after these chondrules were formed. However, immediate gravitational re-accretion of impact splashes is hard if the collision happened at very high ve- locity. On the other hand, low velocity collisions can only produce impact melt if the planetesimals were already nearly fully molten by 26Al decay before impact. In this paper we study the effect of the decelleration of the impact splash caused by the sweep-up of nebular gas. We model the ejecta as surviving pre-impact dust particles from the original bodies (matrix) and pebbles of 0.3 mm radius (newly formed chondrules), and compute the problem of gas dynamics coupled to these two pressureless components. We find that, if the nebular is dense enough, this can cause the ejecta cloud to be compressed into a shell with density above the

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