Chondrule size matters

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The origin of chondrules—silicate spherules ubiquitous in primitive meteorites—remains enigmatic [1-6]. While much effort has been devoted to their thermal history ([1-2]), little attention has been paid to the constraint posed by their size ([7] and references therein). However, not only do chondrules exhibit narrow size distributions in single meteorites [8], their mean size does not vary by more than a factor of 6 accross the different "classical" chondrite groups [7]. This should be very constraining in view of the few-Ma age range of chondrules [5] and the likely diversity of chondrite formation locations [4], from which order-of-magnitude variations of many potentially controlling astrophysical parameters may be expected. Yet it is unclear at which stage of the chondrule "lifecycle" (prior to accretion) this size was determined, as it could *a priori* as well result from the chondrule-melting process itself (e.g. [7],[9]), be inherited from the precursors, or be due to some aerodynamic sorting (e.g. [8]). I have thus set to examine these different possibilities in terms of their analytical size predictions [10].

Among the examined processes, I found that only growth by sticking [11] or turbulent concentration [8] were likely to reproduce the limited observed variability of chondrule size. Independently of the size variability constraints, I also argued that the considerable compositional variability of chondrules [12], indicative of nebular fractionations, and compound chondrule statistics (e.g. [13]) ruled out significant size modifications during chondrule-forming events. Likewise, the complementary relationships between chondrite components in carbonaceous chondrites [6] argues against sorting processes preceding accretion. I thus infer that chondrule size was inherited from precursors grown in the disk, that is, that *chondrule-forming events melted nebular aggregates*.

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