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Probing the solar accretion disk using the properties of dust filtering at gaps in the early Solar System

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During the formation of the Solar System, Jupiter and Saturn played an important role in modulating and controlling the dust dynamics through the formation of gaps in the protosolar accretion disk that acted as dust traps. This is reflected in the distribution of chondrules and calcium-aluminum inclusions (CAIs). CAIs are almost exclusively present in chondrites arriving from the outer Solar System, and there are clear isotopic finger prints showing that while inner Solar System chondrules where transported to the outer Solar System, no outer Solar System chondrules returned to the inner Solar System. A dust trap can only stop particles above a certain size, while small particles are well coupled and flows through the gap with the gas. To investigate the roles of Jupiter and Saturn we combine a large suite of numerical models of the protocolar accretion disk with embedded planets with a systematic cosmochemical search for CAIs in inner Solar System chondrite slabs. This allow us to put new limits on the surface density of the accretion disk where Jupiter formed, the relative sizes of the dust reservoir in the inner and outer Solar System, the probable orbital geometry of the gas giants in the early solar system, and inform us about the recycling of material in the formation region of ordinary chondrites.

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