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The Role of Ice in Planet Formation

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It has been long speculated that water ice plays an important role in the process of planet formation, in particular the initial phase in which dust aggregation dominates. One suspicion is that the density of solids near the so-called "ice line" in the disk may have been much higher than elsewhere, leading to preferred conditions for dust aggregation. Another suspicion is that dust grains with ice mantels have better sticking properties than bare dust grains, possibly even enhanced by the process of sintering near the "ice line". In earlier work we have developed a sophisticated numerical tool set for modeling time-dependent dust coagulation and transport in the first few Megayear of the solar system. The input physics of this model is based on laboratory experiments. It was found that dust aggregation tends to halt at 1 mm size aggregates, if the dust particles are bare silicate grains. In this project we wish to find out if water ice can help overcome this stalling of the growth, and what the predictions are for various solar system constraints on the presence and transport of water in the primitive solar nebula.

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