DISK WINDS AND THE FORMATION OF CHONDRITE PARENT BODIES.

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Chondrite meteorites are believed to represent the building blocks of the solar nebula, out of which our solar system formed. They are a mixture of silicate and oxide objects (chondrules and refractory inclusions) that experienced extremely high temperatures, set in a matrix that remained relatively cold. The prevalence of chondrites suggests that they formed through a very general process, closely related to stellar and planet formation, however the nature and properties of the responsible mechanism have remained unclear for many decades.

The evidence for a hot solar nebula provided by meteoritic inclusions is seemingly at odds with astrophysical observations of forming stars. These strongly indicate that protostellar disks – the inspiralling disks of gas and dust out of which stars and planets form – are relatively cool, and exhibit typical temperatures that are insufficient to melt and vapourise silicate minerals at the radial distances sampled by chondrule-bearing meteorites in the main asteroid belt.

The Stardust sample of comet Wild-2 contains high temperature mineral fragments that can be matched to inner solar system chondrules and refractory inclusions. This strongly suggests that inner solar system materials have been redistributed around the solar system. The X-wind and other models suggest that such launching can occur close to the proto Sun, but launching from this region has several difficulties relating to the proportion of material that can be ejected and to the constancy of chondrite compositions.

We have recently proposed [1,2] that disk winds could be an important contributor to heating refractory materials to melting temperatures, and to redistribute material in the early solar system. A key feature of disk winds is that they can operate out to 1 a.u. from the Sun while the disk is still actively accreting to the Sun. As such, chondrule production and chondrite aggregation can occur in relatively close proximity.

References:

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[2] Salmeron R. and Ireland T. R. 2012. *Meteoritics & Planetary Science* 47: 1922-1940.