A new scenario for forming the Sun's planetary system (and others?): dynamics, cores and chemistry (pt 2)

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Jeans (1919) showed that a single contracting solar nebula (SCSN) is dynamically incapable of forming both the Sun and the planets, due to the 6^o tilt of the planetary plane and their huge (x 137,500) mean specific angular momentum (a.m.) relative to the Sun's. Yet the SCSN model is still pursued by cosmochemists and astronomers believing them to have been formed in a single sequence, from a common body of material.

I report further development of my new (two-stage) scenario, first outlined at Goldschmidt 2000 [1]. In this the protoSun is formed as a star (possibly in an SCSN mode) in one nebular dust cloud, subsequently traversing a second, from which it acquires a layer of different material and establishes a disk in which the planets are formed. This basic scenario provides for (1) the possible input of material for much longer than canonical nebular collapse times, (2) receipt of short-life radionuclides from a stellar event at any time along the traverse, (3) the enhanced metallicity characteristic both of the Sun and of exoplanet-harbouring stars, (4) the tilt of the planetary plane, a relic of the motions within the second cloud.

Recognition [1] that a radial electric field exists around the Sun (and drives stellar winds generally, supervening radiation pressure) dominates the acquisition dynamics of this second-cloud material. There resulted an in-at-the-poles, out-near-the-equator flow, within which CAIs were formed and took up to 2 Ma to spiral outward to the asteroid belt, where chondrules were being formed. The outer part of that flow, at low temperature from the 10K cloud, and dust-shielded from solar heat, preserved the CI composition. The disk, at <600K and very much denser than in SCSN, provided oxidized material for planetary construction, their iron cores being rapidly formed, not by percolation but by convective transport following nebular reduction of erupted FeO while the nebula was present, generating the solar system's water [2].

The ~$10M_E$ silicate 'cores' of the Giant Planets were completed by tidal capture [2], their massive gas envelopes being final acquisitions as the nebula was expelled from the inner solar system. This escapes the Jovian mass problem. Finally, the outward blast of the electrically plasma-driven disk wind offers unique resolution of the planetary a.m. problem. The planets were successively nucleated close to the Sun and were pushed outward aerodynamically, growing from smaller material that passed them. Their spacing and silicate core masses crudely profile the cloud density during the traverse.

References

[1] Osmaston, M.F. (2000). *J.Conf. Abstr.* 5 (2) 762.
[2] Osmaston, M.F. (2002) *GCA* 66 (S1) A571.