EPSC Abstracts,
Vol. 4, EPSC2009-265, 2009
European Planetary Science Congress,

What can we learn about solar planetary construction and early evolution of the inner members of the system from their present dynamics? Importance of a 2-stage scenario

M. F. Osmaston
The White Cottage, Sendmarsh, Ripley, Woking, Surrey GU23 6JT, United Kingdom (miles@osmaston.demon.co.uk)

It has repeatedly been pointed out [1] that a single contracting solar nebula (SCSN) is dynamically incapable of forming both the Sun and the planets, due to the 6 degree tilt of the planetary plane and their huge (x 137,000) 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 event, from a common body of material, as the near-parity of the solar spectrum has seemed to imply.

To address the a.m. problem, hitherto unresolved, we report here on the development of a two-stage scenario [2 - 5]. 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 'coating' of fresh material and establishes a disk in which the planets are formed. This basic scenario provides for (1) the possible input of material unconstrained by canonical nebular collapse times, (2) receipt of short-life nuclides from a near-by stellar event at any time along the traverse, (3) the enhanced metallicity characteristic both of the Sun and of many exoplanet-harbouring stars.

Our scenario implements the hypothesis [2 - 5], arising from the author's ongoing work in fundamental physics [5], that a gravitation-related radial electric field, the G-E Field, exists around the Sun (and drives stellar winds generally, supervening radiation pressure) and that this dominated the acquisition dynamics of the second-cloud material. There resulted a dense in-at-the-poles, out-near-the-equator flow, within which CAIs were formed and then took up to 2 m.y. to spiral outward to the asteroid belt, where chondrules were being formed. Related additions to the supra-tachocline zone of the Sun, an unmixed star, made its composition compare well with the planets. Protoplanets were gravitationally nucleated successively close to the Sun, where magnetic coupling slowed solar rotation about 5-fold, providing their observed systematically prograde spins, and dust shielded them from solar radiation; a close-in position currently exposed by many exoplanets. Each was then pushed outward by the plasma-driven Protoplanetary Disk Wind (PDW), with smaller material moving past them as feedstock which, with gas-drag help, they accreted by tidal capture, thus preserving their spin directions.

The purely radial G-E Field force offers a unique (and demonstrably quantitative) resolution of the planetary a.m. problem - the a.m. grew as radius from the centre increased, and none of it came from the Sun. To achieve an individual planet's a.m., both the

EPSC Abstracts,
Vol. 4, EPSC2009-265, 2009
European Planetary Science Congress,

protoplanet and its feedstock must have acquired similar a.m., so planetary growth must be largely completed while the PDW is present. This conflicts with the current belief, based on time-demanding models for iron core formation by percolation, that accretion had continued for long after nebular departure.

In our new scenario, however, the infall, being from a very cold (~10K) second-cloud source, and much of the flow having been dust-shielded from solar heat (preserving the CI composition), yielded a disk at <600K, a low temperature which thermodynamically ensured oxidized material (e.g. FeO) for planetary construction. So their iron cores were rapidly formed, not by percolation but by 'subducting' Fe that resulted from chemical reduction of volcanically erupted FeO **while** the nebula was present, thus generating the solar system's water [3, 6] - as long favoured (1960-1978) by A.E. Ringwood to resolve this still-extant problem. Hf-W and other exchanges took place later across the CMB, so do not constrain the duration of core formation. Asteroids were too small for core-generating convective overturn, so meteoritic irons must come from near-surface positions.

Prograde orbits predominate in the satellite populations of the Giant Planets (GPs). This tells us their 8-18M_E silicate 'cores' were completed by tidal capture of the retrograde counterparts [6], and that their massive gas envelopes, plus some of the ices around the satellites, were final acquisitions as the nebula and water were expelled from the inner solar system by the G-E field. The prograde vorticity imposed on this material by that G-E field action appears to have spun up the GPs in proportion as it shrank onto them, Jupiter the most. The asteroids, together with many of the GP satellites, may be representatives of the in-transit feedstock population as the nebula departed. Individually, most must have grown by impact, contrasting with the tidal mechanism of the protoplanets. Viewed overall, and allowing for the inwards-decreasing growth time, the spacing and silicate core masses of the solar planets crudely profile the cloud density during the traverse.

The circularity and coplanarity of the Earth's orbit, retained since nebular departure, denies that the Moon can be the product of a giant impactor. But one certainly hit Mercury (tilted and eccentric orbit, deficient mantle). The Earth would need to have captured tidally less than 2.7% of the resulting ejecta to assemble the Moon in a prograde orbit, barely affecting that of the Earth. Ejecta captured in a retrograde manner would have coalesced with the Earth, slowing its rotation; some may have done the same to Venus, slightly reversing its rotation. Related impact cratering rates at Mars were probably very low.

[1] Jeans, JH, (1919), Problems of cosmogony and stellar dynamics, Adams Prize Essay, Univ. Oxford, Clarendon Press, 293 p. Lyttleton, RA, (1941) On the origin of the solar system: *MNRAS*, **101**, 216-226. Gold, T, (1984) The early solar system and the rotation of the Sun: *Phil.Trans. R. Soc.Lond.* **A313**, 39-45.

[2] Osmaston, MF (2000). A new scenario for formation of the solar planetary system; dynamics, cores and chemistry. Goldschmidt 2000, Oxford, UK. *J. Conf. Abstr.* **5** (2) 762.

[3] Osmaston, MF (2006) A new scenario for forming the Sun's planetary system (and others?): dynamics, cores and chemistry (pt 2):

EPSC Abstracts,
Vol. 4, EPSC2009-265, 2009
European Planetary Science Congress,

Goldschmidt 2006, Melbourne. *GCA* **70** (18S) A465.

[4] Osmaston, MF (2009) A new, mainly dynamical, two-stage scenario for forming the Sun's planetary system and its relation to exoplanet findings. *Geophys. Res. Abstr.* **11**, EGU2009-12204-2.

[5] Osmaston, MF (in press) Continuum Theory: what can CT do that GR cannot? Fundamental illumination of the dynamical construction and evolution of well-observed spiral galaxies and planetary systems. *In*: Proc. 11th Int. Conf. on Physical Interpretations of Relativity Theory (PIRT XI), Imperial College, London, Sept. 2008, PD Publications, Liverpool.

[6] Osmaston, MF (2002) Lunar constraints on core formation: a new model with many implications: Goldschmidt 2002, Davos. *GCA* **66** (S1) A571.