SOLAR SYSTEM FORMATION BY ACCRETION IS IMPOSSIBLE

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For more than two centuries there has been the evolutionary belief that the planets and moons of the solar system, as well as the sun itself, formed out of a vast cloud of gas and dust. This earliest-existing ("primordial") cloud is called the *primordial nebula* or the *solar nebula* (Lat. *nebula = cloud*). Celestial bodies allegedly formed when gas and dust particles adhered or coalesced in a condensation called *accretion*, forming *protoplanets* or *planetesimals*. **The *accretion theory* is a part of the *nebular hypothesis* of solar system formation.**

However, **accretion has not been demonstrated to be a physical reality in laboratory simulations.** Besides, God created the heavenly bodies by His *spoken* word (Ps. 33:6), not by a process, rapid or not, conforming to the post-creation laws of science. Some experimental challenges to the accretion concept are presented here.

I. LAB SIMULATIONS DO NOT SHOW ACCRETION

Case #1

In one experiment (Arnold, 1971, pp. 519-522), nickel-iron alloy condensate grains were grown at low pressure (10^{-4} atmospheres, taken to be the pressure in the *pre-solar nebula*) to submicron size in an enclosed environment with no turbulence.

What do these conditions have to do with actual accretion? Surprisingly, the author's conclusion is *not much*: "the direct growth from the gas of large grains or droplets is very difficult, under any conditions familiar to us," Arnold (1971, p. 523) writes. Hope is nevertheless held out that accretion can somehow occur under hypothetical conditions not yet simulated: "Undoubtedly there are astrophysical situations, as there are terrestrial ones, where these special conditions are and large masses can grow directly by condensation from the vapor. It is hardly imaginable, however, that they could extend widely through the solar system. Donn and Sears [1963, p. 1208] have discussed this question in detail" (p. 523).

Donn and Sears proposed a number of *ad hoc assumptions* necessary to make accretion appear plausible, such as hypothetical crystal growth at alleged "screw dislocations" caused by putative radiation damage under supposedly less-than-normal supersaturation regimes. Even the assumed supersaturation in the primordial nebula is ad hoc, since this would require a prior high concentration of material, which is what the theory is trying to produce in the first place.

In sum, Arnold acknowledged in a roundabout way that his terrestrial "simulation" really had no bearing on the "special conditions" needed for solar system accretion, and that he did not know what the required special conditions might be. Further, to make planetary evolution by accretion appear plausible, Arnold needed to invoke highly technical conditions, since he had shown that "simple" conditions would not work.

Case #2

Planetary scientist William K. Hartmann (1993, p. 134) noted that, "Ordinary evidence suggests that **if neighboring, sun-orbiting rock particles hit at low speeds, they would simply bounce apart without sticking; if they hit at high speeds, they would shatter each other instead of combining. ...** Kerridge and Vedder (1972, pp. 161-162) designed an experiment with silicate particles hitting each other at speeds of 1.5 to 9.5 km/s (typical of collisions in today's asteroid belt) to test whether any sticking or impact welding occurred. They found none; the particles shattered." While noting that **actual physical experiments failed to show that bodies such as asteroids could have formed by accretion,** neither Hartmann nor other evolutionists have given up the idea that accretion must have occurred.

Kerridge and Vedder (1972, p. 161) rationalized much slower hypothetical approach velocities. The velocity became an *adjustable parameter* which might hypothetically allow accretion to occur. The question is not so much, could such velocities exist, but *did* they? Of course no one can say.

Even so, R. Greenberg et al. (1978, p. 1) ran computer simulations at the lower velocities and concluded that under these hypothetical conditions, accretion was possible. But this type of "confirmation" is an example of *ad hoc assumption formulation* in which **the lower velocities required by accretion theory were assumed in order to justify the theory.** *This is reasoning in a circle*.

Case #3

Comet expert Fred L. Whipple (1985, pp. 200-203) described the laboratory tests of Mayo Greenberg (1922-2001) at the Leiden Observatory in the Netherlands (Greenberg et al., 1972, pp. 425-436; Greenberg and Li, 1998, p. 96). Greenberg tried to simulate the formation and growth of interstellar dust grains in *molecular clouds*. He exposed the types of gases in such a cloud at about 20 kelvins (-253°C) to ultraviolet radiation of the intensity thought to be similar to typical dim starlight.

However, **no coalescence of gas molecules occurred without introducing two artificial conditions:** (1) the use of a "cold finger" (a surface which is super-cooled to cryogenic temperatures) as a *nucleation* site for the initiation of coalescence; and (2) the use of gas concentrations higher than would actually exist in a molecular cloud. The second condition was especially important, since molecular clouds have too low a concentration of gases to allow spontaneous nucleation even at a temperature as cold as 20 kelvins.

Therefore, Greenberg's "simulation" of dust grain formation was not really a simulation at all. **Two special conditions which would not be true in nature were imposed by the "human intelligence" conducting the experiment,** a situation analogous to the claim that only Divine intelligence, not natural processes, could accomplish creation of the cosmos.

Blum (1995, p. 39) likewise emphasized that accretion conditions are *assumed*, not *known* to have existed, when he wrote: **"The theoretical considerations and their predictions for the development of the solid bodies in the early solar system strongly depend on a couple of**

assumptions, the validity of which can only be proven experimentally. Among the processes to be determined empirically [are] the low velocity collision behavior of single dust grains and aggregates including simulation experiments on the long-term dust aggregation [sticking] …" (Blum, 1995, p. 39). The reader should note that, according the Blum, **the existence of the required conditions – *low velocity* and *aggregation* – have not yet been observed in empirical (laboratory) settings.** Thus Armitage (2008, paragraph 4) concludes: "For pairwise collisions to work fast enough, meter sized objects need to efficiently stick together upon collision rather than breaking up. **This has not been demonstrated in laboratory experiments …"**

In short, **experiments have failed to show that the mere *collision* of particles can make them stick and grow into larger bodies *under the conditions believed to exist in the early solar system.*** Have theorists therefore considered the accretion theory to be falsified? The answer is *No*. Instead, the concept of *gravitational instabilities* was introduced to explain how colliding particles might be *forced* to adhere despite their natural tendency not to, with Goldreich and Ward (1973, p. 160) claiming, "[S]izable planetesimals can accrete directly from dust grains by … gravitational instabilities."

Goldreich and Ward continued, "Thus, the fate of planetary accretion no longer appears to hinge on the stickiness of the surfaces of dust particles." So the obstacle of colliding particles not sticking was overcome. *Or was it?* In a staggering admission, Goldreich and Ward wrote: "Although we have dismissed the sticking of dust grains as unnecessary to the planetary accretion process, there is a more fundamental reason for disregarding it altogether. That is, **even if the dust grains tended to stick together upon impact, the growth of solid bodies by this process would be much slower than by the gravitational instabilities we have described."**

In other words, **even if colliding particles could stick, the resulting growth into planetesimals would be *extremely* slow and would take *longer* than the millions of years allotted for it.** Slusher (1980, p. 18) estimated that 30 billion years would be required for a single interstellar grain to form by a simple collision process – on the order of *ten times* the age of the solar nebula. Harwit (1982, p. 394) estimated 3 billion years as the time for a grain to grow to 10^{-5} cm. This is why more recent accretion theories have relied on factors other than simple collision to promote planetary formation.

Another factor suggested to cause particle accretion was the *bistability phenomenon* (BP), in which a nebula could exist in certain chemical states which would promote the growth of dust grains. But Shalabiea and Greenberg (1995, pp. 779, 787) concluded that "the assumptions *required* for the existence of the BP are inconsistent with fundamental astrophysical observations of atomic abundances. … It appears highly unlikely and probably impossible that bistability plays any role in interstellar chemistry."

Theoretical innovations have so far failed to explain how accretion could have happened. Dorch (2008, paragraphs 1-2) lamented, **"[C]urrent scenarios and theories fail to provide satisfactory explanations for many aspects of planet formation.** The situation appears to often be characterized by comparisons of two (or more) scenarios, where the inadequacies of one is taken as evidence (or even 'proof') in favor of another, while the possibility that none of them is correct is not considered seriously enough. … [A] variant of this approach is to argue that 'since we are here - terrestrial, gas and ice planets and all, one of the considered scenarios must have worked, and since I can show it wasn't scenario A, it must have been B!' " The fallacy of promoting a doubtful theory simply because an even more doubtful theory has been discarded is taken up further in Section IV.

Given the lack of experimental confirmation of accretion spanning several decades, what are we to make of confident descriptions of accretion such as the following? Dominik et al. (2009, p. 1) claimed, "Small particles easily stick when they collide and form aggregates with an open, often fractal structure, depending on the growth process. Larger particles are still expected to grow at collision velocities of about 1 m/s. Experiments also show that, after an intermezzo of destructive velocities, high collision velocities above 10 m/s on porous materials again lead to net growth of the target."

The reader of such words could be forgiven for concluding that accretion has finally been demonstrated in the laboratory. *But not so*. **The "experiments" to which Dominik et al. referred were actually *computer simulations* in which the necessary collision velocities were *assumed* in order to ensure accretion,** as in older studies. The lack of genuine empirical data still holds.

But Dominik et al. have confidence that their computer simulation correctly shows that, "Considerations of dust-gas interactions show that collision velocities for particles not too different in surface-to-mass ratio remain limited up to sizes about 1 m, and growth seems to be guaranteed to reach these sizes quickly and easily." Again there is the assertion of particle growth, *but only up to 1 meter*. Beyond the 1 meter particle size, problems develop which not even the theoretical models have been able to solve:

"For meter sizes, **coupling to nebula turbulence makes destructive processes more likely.** Global aggregation models show that in a turbulent nebula, small particles are swept up too fast to be consistent with observations of disks." In other words, even computer modeling *designed* to demonstrate accretion shows that **particles 1 meter and larger are more likely to be destroyed than to grow.**

Dominik et al. therefore supposed that, "An extended phase may therefore exist in the nebula during which the small particle component is kept alive through collisions driven by turbulence which frustrates growth to planetesimals until conditions are more favorable for one or more reasons." **This "extended phase" has been detected neither empirically nor in theoretical modeling.** In other words, **empirical data do not support the belief that accretion could occur, and neither does theoretical modeling.**

Yet dust and debris fills the expanses of the solar system, the Milky Way galaxy, and the universe at large. Within the Milky Way, this debris is the *interstellar medium* (ISM); between

galaxies, it is the *intergalactic medium* (IGM). If these dust particles did not form by accretion, where did they come from?

At one time theorists, in line with the accretion theory, believed that *primordial dust formation* had occurred to form the ISM and IGM (Henry, 2003a, p. 37; Zirin, 1952, p. 20). When the Big Bang theory was proposed in the 1940s, it was assumed that all elements first formed as Big Bang products, not in stars (Burbidge, Hoyle, and Narlikar, 1999, p. 38). Then these primordial atoms must have accreted to form dust grains. This dust was the ISM/IGM. This meant that the ISM/IGM was a *primordial product*. Exemplifying this view, Cernuschi (1947, p. 241) wrote that, "To explain the origin of the cosmic grains, we suggest that they were formed in the early stages of the expansion of the universe ..." Astronomer H.C. van de Hulst (1955, pp. 77-78) concluded, "It is not hard to picture how dust grains might grow in space."

But it soon became obvious that the Big Bang could not account for most isotopes, so stars were invoked as the source (Burbidge et al., 1957, p. 550; Burbidge and Hoyle, 1998, p. L1). The failure of the Big Bang to account for all but the lightest elements (in fact it cannot account even for those; Henry, 2006d, pp. 66-67), coupled with the failure of dust grains to accrete, means that **the ISM/IGM cannot be leftover debris from the primordial cosmos.** Now the ISM/IGM is viewed as a product of stellar instability. **The shift of the ISM/IGM from an *accretion product* to a product of *stellar instability* was a challenge to the accretion theory.** Yet despite the removal of the ISM/IGM as evidence for accretion, the accretion theory and its larger framework, the nebular hypothesis, continue to be widely accepted.

II. NEBULAR HYPOTHESIS: NO SUPPORTING DATA

French mathematician Pierre Simon Laplace (1749-1827) proposed the nebular hypothesis in the last few pages of his *Exposition of the System of the World* (Laplace, 1796, pp. 360-366). He presented the nebular hypothesis as an *unproved idea* offered "with that distrust which every thing ought to inspire which is not the result of observation or calculation …" (Laplace, 1796, p. 365). Even so, the nebular hypothesis was "generally accepted" in the first part of the nineteenth century (Brush et al., 1983, p. 3). **But in the mid-1800s the nebular hypothesis fell on hard times because the physicist James Clerk Maxwell** (1831-1879) ***discredited*** **it.**

Maxwell's critique was so devastating that the nebular hypothesis was largely abandoned for nearly a century, until the 1940s. During this time, evolutionists put forth a variety of alternative solar system origins theories, all of which were discredited and are of only historical interest today (Abhyankar, 1998, pp. 339-448). When the nebular hypothesis was finally advocated again, it was not because Maxwell's critique had been overturned, but because all the other evolutionary theories had failed.

How did Maxwell discredit the nebular hypothesis? He began by studying the processes that had formed Saturn's rings. The result was that "he showed that the tendency toward conglomeration into a single satellite, suggested by the nebular hypothesis, would be effectively counteracted by the dynamical factors involved in the revolution of the particles around the central massive body" (Brush, 1983, pp. 20-22). In other words, **the debris in Saturn's rings could never come together into a single moon, because the forces of dissolution were stronger than the forces of attraction.** But what was true of Saturn's rings would also be true for the solar system as a whole. **The sun, planets and moons of the solar system could never have formed from coalescing gas and dust because the forces of dissolution are too strong.**

Maxwell was aware that he had demolished the credibility of the nebular hypothesis (Brush, 1983, p. 77). Describing Saturn's rings, he wrote: "We have now to take account of variations in the form and arrangement of the parts of the ring, as well as its motion as a whole, and we have as yet no security that these variations may not accumulate till the ring entirely loses its original form, and collapses into one or more satellites, circulating around Saturn. In fact such a result is one of the leading doctrines of the 'nebular theory' of the formation of planetary systems ..." (Maxwell, 1859, p. 8). But as noted, **Maxwell concluded that Saturn's rings could not coalesce to form new moons.** This is significant, because Laplace had used the Saturn's rings to illustrate the nebular hypothesis ("Laplace ... incorporated the rings in his suggestive theory of the origin of the solar system," Brush, 1983, p. 2). **What could not happen on a small scale for Saturn could not happen on a larger scale for the solar system.**

Even so, after almost a century of futile search for a workable solar system formation model to replace the nebular hypothesis, German physicist von Weiszacher (1912-2007) adjusted the equations for the nebular hypothesis in order to make it produce a solar system arranged according to Bode's law (Abhyankar , 1998, p. 343; Gamow, 1953, pp. 285-286), thus matching our solar system. But extra-solar planetary systems do not follow Bode's law, and the nebular hypothesis has not explained them, a point discussed below.

From the 1940s onward, Von Weiszacher's efforts were generally accepted as making the nebular hypothesis scientifically acceptable. But was this really the case? The answer is *No*, because as we will see, observational evidence for it is lacking. **And as with accretion theory, the nebular hypothesis has become more complex with time because the simple theory did not work.** The nebular hypothesis is now considered to include (1) an accretion stage; (2) a planetesimal formation stage; (3) a planetary core (*planetary embryos*) stage; and (4) a *planetary migration* stage (Chambers, 2004, pp. 244-249). The planetary migration stage is necessary because, according to theory, once planetary cores have formed, they are in the *wrong places* to resemble a planetary system, and so must be made to "migrate" to their proper location. We have seen that **observational evidence for the accretion stage is absent, but so are data confirming the other stages of the nebular hypothesis.**

There Is No Evidence That the Solar Nebula Existed

If the solar system formed from the solar nebula, particles of primordial debris should still be falling into the sun's upper

atmosphere, producing an easily detectable infrared glow as they burn. Measurements during the eclipse of July 11, 1991, showed no such glow (Petis, 1991, pp. 386-387; Hodapp et al., 1992, pp. 707-710). In other words, **dust from the nebula is absent, signifying that there was no nebula.**

On the other hand, observations of *debris formation* are common in astronomy, especially in cases of *stellar instability* discussed below. **The cosmos seems to be undergoing dissolution rather than evolving.** This is why theorists have been unable to explain how the solar nebula – *even if it had existed* - could collapse into the celestial bodies we see today. For instance, at the end of a long review of nebula collapse theories (also known as *cloud formation theories*), one theorist could say only that "there is no complete theory of cloud formation yet" (Elmgreen, 1993, p. 121). Jeffrys (1976, p. 367) had earlier lamented, "To sum up, I think that **all suggested accounts of the origin of the Solar System are subject to serious objections.** The conclusion in the present state of the subject would be that the system cannot exist."

Has this assessment changed? The answer is *No*. **Evolutionary theorists still do not have a theory of solar system formation which is satisfactory *even to them*.** The easiest way to see this is to examine news reports of current space missions. Many of these news items hold out hope that the new data forthcoming will *finally* lead to an understanding of how the solar system came to be. A news item about a Japanese mission to an asteroid optimistically said, "Examining asteroid samples is expected to help unlock secrets of how celestial bodies were formed," because asteroids are supposed to be similar to the debris in the solar nebula as it existed originally billions of years ago ("Japanese probe to try landing on asteroid twice," 2005, paragraph 45).

Likewise, a report about a mission to Mars acknowledged, "Piecing together a definitive history of Mars is far from over, scientists say," and held out hope that the mission had "geologic promise" with "more clues about the planet's past" ("Spirit Rover turns 2 tomorrow!," 2006, paragraph 17). And a report about the Cassini mission to Saturn's rings said, "Scientists hope the mission will provide important clues about how the planets formed" (Boyle, 2004, paragraph 21).

But if the nebular hypothesis has truly accounted for the solar system's origin, *why is hope held out that finally its past will be understood?* Theorists realize that the nebular hypothesis has not truly explained the history of the solar system. Even so, **statements of belief in the nebular hypothesis are frequently expressed because the only viable alternative is to say that the solar system was created.**

There Is No Evidence of Any Nebula Collapsing Now

If the nebular hypothesis were true, astronomers should be able to observe clouds of debris elsewhere in the galaxy collapsing, like the solar nebula is supposed to have done. Each of these *giant molecular clouds* is supposed to be like the solar nebula was billions of years ago, before it collapsed to form the solar system. A giant molecular cloud is a nebula (plural *nebulae*), or is considered part of a larger nebula. Like the solar nebula is supposed to have been, giant molecular clouds (GMCs) are many times larger than the solar system. They are typically *hundreds* of light-years across. **A beam of light would take centuries to cross a typical GMC, but can cross the solar system in only hours.** And whereas the solar nebula is supposed to have produced only *one* solar system, theorists speculate that GMCs have enough gas to produce hundreds of thousands of suns and a planetary system for each.

But do these nebulae give any support to the claim that a solar nebula collapsed to form the solar system? They do not, because "No astronomer has ever observed the process of cloud collapse" (Edelson, 1979, p. 13); "no one has caught a molecular cloud in the act of collapsing" (Peterson, 1990, p. 409). Furthermore, for clumps in clouds that have been observed, Blitz (1993, p. 155) says, "*None* of the clumps in the clouds ... observed are gravitationally bound [collapsing]. ... Because the clumps are so far from being gravitationally bound ... **the clumps must be expanding."** Not surprisingly for Blitz (1993, p. 155), "This conclusion is difficult to accept." **So giant molecular clouds exist, but their *non-collapse* is telling astronomers that the solar system could not have formed from the collapse of a nebula.**

There Is No Evidence of Stars Forming

If the nebular hypothesis were true, astronomers should be able to see stars forming from debris contracting inward, like the sun is supposed to have done. But the truth is that "no one has unambiguously observed material falling onto an embryonic star, which should be happening if the star is truly still forming" (Peterson, 1990, p. 409).

Accordingly, theorists have concluded that, "Giant molecular clouds are not collapsing dynamically and have, in fact, generally a very low efficiency for stellar genesis" (Shu et al., 1993, p. 20). In other words, **giant molecular clouds cannot be expected to collapse to form stars, despite the widespread belief that they are doing so.**

Gravitational collapse cannot happen in a diffuse, rarified gas cloud to form a star. It is not dense enough. "The only way for a … cool interstellar cloud to contract from nebular to stellar dimensions is to be dense enough so that the gravitational attraction of its particles for each other is strong enough to start it contracting ..." (Hartmann, 1993, p. 93). In other words, **theorists recognize that a giant molecular cloud cannot begin collapsing on its own.** There must be an *external force* to bring the gas cloud up to a density high enough to make the collapse begin.

What could this force be? Having ruled out the relevance of a Creator to cosmic origins, evolutionary theory can only suppose that this force is provided by another physical body, such as *other clouds already in collapse* or *unstable stars* sending shock waves into the surrounding space. In other words, **the theory presumes the pre-existence of a successfully-collapsing cloud or an already-formed star,**

which is what the theory is trying to explain in the first place. As theorists themselves have said, "Star formation can also be induced [or] triggered by a mechanism external to the clump. ... Shocks, which can be due to supernovae [unstable stars] or to cloud-cloud collisions, have been invoked frequently as a mechanism for inducing star formation" (McKee et al., 1993, p. 361).

In other words, "The general model requires some mechanism to trigger a cloud's collapse: a supernova explosion, a shock wave from the galaxy's spiral arms, cloud collisions, or stellar winds. **Why clouds don't collapse on their own ... is still a 'great mystery' "** (Edelson, 1979, p. 12). Another theorist wrote, "Since the 1960s, in numerical models of protostellar collapse, thermonuclear ignition temperatures are not attained solely by the in fall of matter; an additional shock wave-induced sudden flare-up is assumed" (Hernden, 1998, p. 456). **In the nebular hypothesis, it takes a star to make a star. The nebular hypothesis has still not explained how stars first formed.**

Since the nebular hypothesis has been fashionable off and on for over two centuries, but has not explained the origins of stars or planetary systems, why don't its advocates give it up? One reason has already been mentioned, that the only viable alternative is biblical creation. Another reason is that the nebular hypothesis is a *model*, a way of visualizing the cosmic past. As a model, science *alone* cannot disprove it, since any necessary ad hoc assumptions can be generated as needed, a point considered in the next section. **Supposing the existence of collapsing clouds and functioning stars to trigger the collapse of new clouds is an ad hoc assumption.** In fact, "If stars did not exist, it would be easy to prove that this is what we expect," as theorist Geoffrey R. Burbidge once quipped (Sears and Brownlee, 1965, p. 577).

Burbidge understood that a model can incorporate *any* observations and can *never* be disproved by any of them. This is also why advocates of the nebular hypothesis can continue to say, "There is strong evidence that star formation is going on at the present time" (Harwit, 1982, p. 149). **It is easy to confuse theoretical or popular *assertions* of the truth of the nebular hypothesis with *observational evidence*, which is absent.**

There Is Evidence of Cosmic Dissolution

Astronomers observe debris in space *expanding*, but not nebular material collapsing, with the outcome that, "The theory for the expansion [of nebulae] has been progressing steadily ... but the theory for the collapse is in a poor state" (Elmegreen, 1993, p. 120). **When theorizing about expansion, theorists are describing a process which actually happens, but in attempting to theorize about collapse, they are trying to explain a process which does not and has evidently never occurred.**

Rather than forming new stars, giant molecular clouds appear to be the debris from the dissolution of existing stars. This is a fairly common process, and astronomers have noted that "Classical novae [unstable stars] ... are sporadically injecting material processed by explosive nucleosynthesis into the interstellar medium" (Gehrz et al., 1993, p. 75). Likewise, **the process of star death is observed, but not star formation.** That is why, "Exactly how a star like the sun [is] born, no one yet knows; the death of stars is better understood" (Edelson, 1979, p. 12). Rather than imagining *stellar evolution*, *star birth*, and other ideas built on the assumption that the nebular hypothesis is true, a better view is that, "The entire life of a star is an aging process. ... Instead of stellar evolution, it might better be called stellar decay, degradation, or degeneration" (DeYoung, 1994, p. 74).

There Is No Evidence of Planetary Systems Forming

Besides giant molecular clouds, the debris near some stars is supposed to be another place where accretion occurs. New planets and new planetary systems are supposed to be forming in so-called *accretion disks* near these stars. The term *accretion* disks presumes that the accretion of debris into planets is a reality. However, observational evidence shows that stellar debris is expanding *away* from stars, not collapsing into more compact bodies, a fact already mentioned.

Further, the earth was cool, not molten in the beginning as it should have been if the nebular hypothesis were true for planets. The nebular hypothesis claims that interior heat within planets is consistent with the planets having been molten at the beginning of their evolution. But if this were true, then *all* the planets should be releasing internal heat into space because, according to the nebular hypothesis, all of them experienced the same evolutionary origin.

Most of the planets – and some moons – are indeed continuing to release internal heat. The earth still has volcanic eruptions, each of which releases internal heat. Most of the outer planets are losing heat *faster* than they receive it from the sun. Mars and even the moon have a heat flow outward from their interiors. **But Uranus does not have a flow of any detectable heat from its interior** (Henry, 2001, p. 87). Even if the solar system were as old as the evolutionary chronology claims, this would not be enough time for Uranus to have lost its internal heat – assuming it actually evolved in the way the nebular hypothesis supposes. **The lack of internal heat flow out of Uranus shows that the internal heat remaining in most planets (and moons) cannot be the result of an evolutionary process.** In other words, **this heat wasn't in the moons and planets from the beginning.** Thus the nebular hypothesis cannot be true.

But wasn't the earth molten when it first formed? This is the conventional wisdom, but this idea actually arises from the nebular hypothesis. As mentioned, the nebular hypothesis assumes that planets and moons were molten when they began evolving because accretion involved the conversion of kinetic energy for rapidly in-falling particles into heat. But as we have also seen, **laboratory experiments have failed to show the occurrence of accretion as a real physical process.**

Further, there are evidences that the solar system and the earth are *too young* for the nebular hypothesis to have had the billions of years it requires. In 1969, the first astronauts to

land on the moon placed a system of mirrors on the lunar surface. By measuring the time for a laser beam to travel from the earth to these lunar mirrors and back, the distance between the earth and the moon can be precisely known. It has been verified that the moon is receding from the earth by a small amount each year in a process called *lunar recession.* **Because of lunar recession, the moon can be at most 1.3 billion years old, or it would have left earth orbit altogether** (Henry, 2006e, p. 67). This time limit places no constraint on the biblical chronology, but it is too short for the 4.6 billion years which the evolutionary chronology presumes for the age of the moon.

Even more severe chronological constraints exist. Asteroids are presumed to be primordial material which failed to coalesce into a planet, implying that asteroidal material must be as old as the solar system. But the existence of asteroidal "moons" suggests that the upper limit on their age may be as low as 100,000 years, less than one ten-thousandth their conventional age (Henry, 2006a, p. 2)

No matter how old the moon is, the nebular hypothesis cannot account for its existence, and "astronomers still have to admit shamefacedly that they have little idea as to where it came from. This is particularly embarrassing, because the solution of the mystery was billed as one of the main goals of the US lunar exploration programme" (Hughes, 1987, p. 291). Other lunar origins theories have been proposed, but each has failed (Henry, 2006e, p. 65). Lunar scientist Irwin Shapiro used to joke that "the best explanation [of these difficulties] was observational error - the Moon does not exist" (Lissauer, 1997, p. 328). Despite additional theorizing, the situation has not changed, for lunar scientist Jack Lissauer recalled this anecdote as continuing to apply (Lissauer, 1997, p. 328).

Not surprisingly, **even advocates of the nebular hypothesis sometimes express doubt that it can explain the origin of any planet or moon in the solar system,** let alone the formation of *extra-solar planets* (also known as *exoplanets*) found in orbit around other stars. One scientist described the nebular hypothesis as the "best fit" to the observations, but added, "The argument is highly speculative and some of it borders on science fiction" (Reeves, 1978, pp. 1-3).

Another scientist noted, "The nebular hypothesis has three fatal flaws. First, it is very difficult to think of a way for the gaseous material [of the nebula] to coalesce into planets. **It is much more likely that the pressure of the gas would cause the material to disperse into space.** A second, very serious problem is that **this theory predicts that the Sun would end up with most of the angular momentum in the solar system, instead of the very small amount it does have.** The reason for this is that the material must have been rotating quite rapidly to have thrown off rings as it collapsed. Since most of the material ended up in the Sun, not in the planets, the Sun should still be spinning very fast. Finally, **the nebular hypothesis does not explain the differences in composition between the giant and the terrestrial planets"** (Robbins, 1988, p. 109).

Claims that these difficulties have been resolved are unreliable. For example, the angular momentum problem has been solved, according to McKee et al. (1993, p. 365), but in fact **"a proper understanding of the angular momentum evolution [of the sun] has not been reached"** (Brun et al., 1998, p. 913). Discoveries of many *trans-neptunian objects* (TNOs) farther from the sun than Pluto (one of the larger TNOs and of large TNOs, the closest to the sun) have made the case for the nebular hypothesis even more difficult. For example, some TNOs exist as *binary pairs,* but (as with the planets) their angular momentum is too high to allow formation from a nebula (Oard, 2005, p. 11). And even though the nebular hypothesis led astronomers to expect that extra-solar planets must be forming around countless stars, detection of these planets has not helped the theory. Instead of matching the characteristics of our solar system, with its variety of terrestrial planets and cold gas giants, **extra-solar planetary systems seem to bear little resemblance to the solar system** (Henry, 2003b, p. 39).

III. MODELS OF THE SOLAR SYSTEM'S PAST

Since lab simulations and observational data fail to support accretion theory and the nebular hypothesis, why are they still accepted? The reason is that they are *models* which provide a way of visualizing the past history of the solar system. The *creation model* is another way of visualizing solar system history. We cannot observe what actually happened in the past, of course, so **neither model of solar system history can be proved or disproved from *scientific observations* alone.**

Table 1. WHICH MODEL IS "BETTER"?

Model	Characteristic	Status
Accretion	Requires ***more*** ad hoc assumptions	Inferior
Creation	Requires ***fewer*** ad hoc assumptions	Superior

Even so, models can be evaluated as *inferior* or *superior* (*Table 1*). An inferior model requires a greater number of ad hoc assumptions to bring its predictions into agreement with observations. **But an inferior model can never be *scientifically* disproved because ad hoc assumptions can be introduced as necessary to make the model "work."** For example, the accretion model uses velocities of colliding particles *appropriately chosen* to show that accretion occurred. **Use of particle velocities chosen to allow accretion is an ad hoc assumption arising from the belief that accretion has occurred.** Ad hoc assumptions generally exemplify *circular reasoning* in which the assumption is justified by an a priori belief in the model which the ad hoc assumption is supposed to be justifying. **The creation model, on the other hand, is premised on an origin not constrained by natural law, thereby eliminating the need for ad hoc assumptions.**

Though models cannot be confirmed or rejected from scientific data *alone*, **biblical revelation may approve or condemn a model.** For example, the Bible approves a creation model with God supernaturally *speaking* critical aspects of the cosmos into existence over six days (Henry, 2006b, pp. 17-18), not through a long process of cosmic evolution. Thus the Bible *dis-confirms* accretion theory and the nebular hypothesis. **When the Bible speaks to a model, that model has been confirmed or disconfirmed by *revelation,* not by scientific observation.** So revelation provides guidance which science cannot.

The biblical view is that the creation began in a highly ordered state and has since degraded (*Table 2*), as presented in Romans 8:20-22 (Henry, 2006c, pp. 162-163). Accretion theory and the nebular hypothesis, on the other hand, claim that the solar system began in a chaotic state and has evolved into a more complex condition. This is not the reality which we experience every day. In real life, things spontaneously break down, decay, and experience degradation, dissolution and death. **Thus the accretion theory and the nebular hypothesis not only lack observational support from science, but are inconsistent with biblical revelation and with everyday experience.**

Table 2. TWO MODELS OF SOLAR SYSTEM CHANGE

Model	Change	Observed?
Accretion	Simple-to-complex	No
Creation, Curse	Complex-to-simple	Yes

IV. COULD GOD HAVE GUIDED RAPID ACCRETION?

Read straightforwardly, Genesis 1 sets out certain *creation events* spanning six days which are unlike present natural processes. In other words, a simple inference from Genesis 1 is that **the Creation Week involved events and processes which cannot be observed today.** As an example, one of the most familiar laws of science is the Law of Conservation of Matter and Energy which states, "Matter and energy cannot be created or destroyed." Today this is true, but matter and energy *were* created in Genesis 1. Since natural law says that today creation *cannot* occur, yet Genesis 1 says it *did*, then Genesis 1 must *not* be a description of what natural law can do. **The creation events of creation in Genesis 1 were not natural law processes.** They did not follow natural law, and natural law cannot describe them.

Yet belief in the accretion theory has become so popular that there is the temptation to believe that God must have used it, possibly speeding it up "supernaturally" to turn it into a viable process. But there are difficulties with inserting present-day processes, even at vastly accelerated rates, into the Creation Week. **We do *not* know that God employed any *creative* event during the Creation Week which wholly followed present-day natural law.**

Further, we do *not* know that anything God did during the Creation Week was "catastrophic." Assuming catastrophism in the Creation Week imposes our present-day visualization of "big and rapid" processes as *necessarily catastrophic* onto God's work during the Creation Week. We humans are prone to projecting our limited understanding of the present onto ancient historical events, but **one of the most serious mistakes one make in the study of history is to see the past through the filter of modern prejudice.** Since God was powerful enough to create and control the entire cosmos, there is no reason to think that during the Creation Week He did not accomplish His huge changes smoothly and calmly, instead of catastrophically. Non-catastrophic creation events are consistent with His being a God who desires that we do all "decently and in order" (1 Cor. 14:40). Since He wants us to behave this way, why would He have worked via catastrophes during the Creation Week?

The Flood, on the other hand, was a judgment, and as such involved turbulence, destruction and catastrophe on a global scale. **But extrapolating a Flood-style catastrophic scenario to the uplifting of the land and other mega-events in the Creation Week is unwarranted.**

Even so, if accretion theory and the nebular hypothesis cannot explain the origin of the solar system, don't creationists need to propose an alternative model? Actually, **the creation model *is* an alternative model,** but this question usually means, "Don't creationists need to offer an alternative *naturalistic* model?" The answer is *No*. **Showing that a theory is not workable does not impose the requirement to provide a replacement.** Refuting Darwinism, science investigator Richard Milton said, "Some people have said to me, how can you criticize a theory if you don't have something to replace it with? Well, I don't accept that. If the emperor hasn't got any clothes on, then the emperor hasn't got any clothes on. It's not my fault. It seems to me that if Darwinism is wrong, then somebody has got to point the finger" (Cheshire and Cotes, 1996, segment 1).

Even more fundamentally, there is no reason *other than personal preference* why the replacement for accretion theory and the nebular hypothesis must be a naturalistic model. The creation model is not a naturalistic model, and it does not need to be turned into one. **"A mistaken alternative is to assume that naturalistic processes can be reconciled with fiat creation by shortening the timescale to fit within a literal Creation Week.** A naturalistic process impossible over eons is less likely over days, and to say that God accomplished the naturalistic process quickly is to verge on a kind of 'theistic naturalism.' Naturalistic origins theory … should be seen for what it is—an attempt to rob God of the glory of creating His universe by mechanisms not subject to natural law and which natural law will never explain" (Henry, 2006d, p. 58).

Ironically, accretion theory and the nebular hypothesis also require conditions that natural law has not been shown to be capable of providing. Outside of scientific discussion, such conditions are called *miracles*. In other words, the origin of the heavenly bodies was a supernatural event, a claim which the Bible has made for millennia.

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