the general science journal

Interpretations of Solar System Phenomena according to the Transformation Hypothesis

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Introduction

A previous paper presented a framework whereby planets can be viewed as end products rather than by-products of stellar evolution.(1) It was pointed out that Descartes first proposed this hypothesis in the 17th century but for reasons also briefly discussed therein, his idea was lost to all but historians of science. Nonetheless, I suggested that the central idea animating Descartes' planetogony – what is being called the "transformation hypothesis" - holds the key to understanding how planets form. Unlike the nebular or "derivative hypothesis," as I call it, in all of its permutations, which proposes that planets form from material derived from proto-stars in one process, the transformation hypothesis views individual planets as later stages in the evolution of individual stars. Thus, the transformation hypothesis can be viewed as the natural history of stellar objects as they evolve through various stages. While the purpose of the previous paper was to lay the general groundwork of the transformation hypothesis, this paper will interpret specific phenomena in our own Solar System according to it.

The Angular Momentum Problem

Although the Sun constitutes over 99% of the total mass in the Solar System, its slow rotation only accounts for less than 2% of the system's total angular momentum. Given the orbital velocities of the planets, the Sun should be spinning much faster. In fact, Jupiter, which comprises 70% of the planetary mass in the system, accounts for about 60% of the total angular momentum while Saturn accounts for another 25%. A solution for this apparently puzzling discrepancy of the Solar System's angular momentum has been one of the most refractory problems with which the proponents of the derivative hypothesis have had to deal. Hannes Alfven proposed a solution to the problem with his concept of "magnetic braking," a magnetohydrodynamically-driven force that operated during the initial stages of the Sun's formation through which most of its angular momentum was transferred to the planets. Subsequently elaborated upon by Fred Hoyle, this solution has since gained great currency in the astrophysical community.

However, while magnetic braking may have been a factor in slowing down the Sun's rotational spin to its current rate, its role as a medium for angular momentum transfer is meaningless with respect to the orbital and rotational motions of the planets. Since the planets are not derivative products of the Sun's formation, the transfer of angular momentum to them from it could not have occurred. And, for this reason, it comes as no surprise that the derivative hypothesis-based adherents of magnetic braking, despite its popularity, still cannot provide a quantitative model that explains the variety of rotational and orbital periods exhibited by the planets in the Solar System. The transformation hypothesis, on the other hand, recognizes that the orbital and rotational periods of the planets are historical results that are determined by complex factors related to their own natural histories.

This variety of orbital and rotational motions leads us to the inevitable conclusion that they are historically conditioned results. And, while it is true that the distance of each planet from the Sun determines its orbital velocity and, therefore, the quantity of its orbital momentum, each one arrived at its position after the Sun had already formed. Further, from the perspective of the magnetic braking hypothesis, the varying rotational periods of the planets are perplexing, particularly with respect to Venus, Uranus and the Pluto-Charon system, all of which have retrograde rotations. Magnetic braking cannot explain how these peculiar retrograde motions and the prograde motions of the other planets came about. We can only extricate ourselves from this theoretical muddle by realizing that the Sun's formation and the orbital and rotational periods of the planets require two entirely different explanations. But, let us take a more in depth look at retrograde motion.

Retrograde Motion

As mentioned above, conventional derivative theories of the Solar System's formation find great difficulty in explaining how Venus, Uranus and the Pluto-Charon system, the latter now demoted to Kuiper Belt Object (KBO) status, acquired their retrograde rotations. Moreover, numerous moons orbiting the gas giants have retrograde orbits. Two of the most prominent amongst this group are Saturn's irregularly shaped moon Phoebe and Neptune's spherical moon Triton. Numerous comets also describe retrograde orbits. Working on the hypothesis that the system developed from one uniform process, these various retrograde anomalies raise doubt as to the accuracy of this assumption.

In order to save the appearance that the system formed in one process, theorists have postulated that catastrophic events were responsible for the retrograde rotations of Venus and Uranus. Taking a different approach to explain the retrograde orbits of the gas giants' moons and the Pluto-Charon system, it has been assumed that, due to gravitational disturbances, these objects were somehow freed from the Kuiper Belt and subsequently captured by the gas giant planets. They further assume that the Pluto-Charon system, thought to have once been captured by Neptune, succeeded in breaking free of its gravitational grasp by unknown causes and took up an independent orbit around the Sun.

Neither the catastrophic event or Kuiper Belt capture scenarios are inconsistent with the transformation hypothesis, which recognizes that the Solar System is essentially unstable and subject to change. Indeed, in order to explain the various anomalous motions cited above, derivative-oriented theorists have been compelled to recognize that over time the configuration of the Solar System must have undergone some fundamental changes. Although the causes of the disturbances that led to the retrograde rotations of Venus and Uranus, and the "freeing" of the KBOs are not known, we are left with the undeniable conclusion that the Solar System has had a dynamic history.

Stellar Characteristics of the Gas Giant Planets

Since the transformation hypothesis envisions an evolutionary process whereby stellar objects become planetary objects, our attention is naturally drawn to those planets in the Solar System that most resemble the Sun since, being the youngest planetary objects in the system, they are closest in age to it. These are the gas giant planets - Jupiter, Saturn, Uranus and Neptune. Even though we have gained a great deal of knowledge about them over the past few decades - knowledge that continually challenges conventional notions about their nature - the consensus view of what they are and their origins has not substantially changed. The reasons for this conservative position, however, become clear once we consider the dominance of the derivative hypothesis and its rigidly held position that there is a qualitative distinction between stars and planets.

Energy Production

Since the mid-1950's, astronomers have known that Jupiter is a source of intense radio emissions, although the cause of these emissions is still not clearly understood. Nonetheless, as technology progressed with the advent of more powerful Earth and space-based telescopes and inter-planetary probes, the discovery that Jupiter emits more energy than it absorbs from the Sun is now an undisputed fact. It was suggested at various times that the source of these emissions is caused by escaping residual heat from the time of Jupiter's formation, nuclear fission or the gravitationally induced contraction of its core. It was even suggested that the energy might be due to deuterium-deuterium fusion reactions.(2) The various mathematical models constructed to demonstrate the viability of all these possible causes, however, have not adequately accounted for the tremendous output of energy that is observed. The source of this energy still remains a mystery.

Subsequent to the discovery of Jupiter's energy production, Saturn and Neptune were also found to be emitters of energy. Saturn's energy production is comparable to Jupiter's, while Neptune's is lower, but still represents a net amount over and above the energy it receives from the Sun. But, no energy production has been detected from Uranus. However, this null result might be due to a combination of Uranus' extreme axial orientation and the inability of Voyager 2's sensors to acquire and measure the output. It is reasonable to assume that Uranus also produces energy from the same mechanism operating in the other gas giants.

Although the gas giants most noticeably exhibit this essential characteristic reminiscent of stars, several of the other objects in the system also manifest evidence of an internal energy source. This is certainly true of Earth, Venus, Jupiter's moon Io, Saturn's moon Enceladus, and Neptune's moon Triton. Also, data gathered from seismometers placed on the Moon during the Apollo missions demonstrated that it, too, is active, particularly with respect to events occurring deep in its core. This seismic evidence suggests that some residual energy source is still operative even though the Moon is one of the more ancient objects in the system. One rule of thumb of the transformation hypothesis recognizes the continuing diminution of internal activity as objects age. However, in the case of Jupiter's moon Io, for example, allowance must be made for the possibility that some internal activity is initiated by an external cause.

Chemical Similarities of the Sun and the Gas Giant Planets

The chemical similarities between the Sun's atmosphere and the gas giants' atmospheres are consistent with the transformation hypothesis. All of these objects exhibit great abundances of hydrogen and helium. Although the ratio of hydrogen to helium in the atmosphere of each object varies, the range of variation is very small. The Sun has 74% hydrogen to 24% helium, Jupiter 80% hydrogen to 20% helium, Saturn 75% hydrogen to 25% helium, Uranus 82% hydrogen to 15% helium and Neptune 74% hydrogen to 25% helium.

It is interesting to point out, and of no great surprise, that brown dwarf stars are also similar to the Sun and the gas giant planets in terms of the relative abundances of hydrogen and helium that are found in their atmospheres. According to standard stellar formation theory brown dwarfs coalesce from clouds of gas and dust, just as fusing stars do, but they do not accrue enough mass that is required to initiate and sustain nucleosynthesis. Irrespective of this shortfall of mass, their formations are believed to be the result of a primary process. On the other hand, conventional theory holds that gas giant planets form from a secondary or derivative process.

Thus, according to conventional theory, nature apparently makes a distinction between how it forms brown dwarf stars and gas giant planets. Brown dwarfs form directly from clouds of gas and dust like ordinary stars while gas giants form from material cast off during the formation of stars. Current theoretical estimates put the lowest mass limit for a brown dwarf object at approximately thirteen Jupiter masses, or 2.46X10^28 kg. If the cloud of raw building material does not equal or exceed this lower limit, we should anticipate an eventual dissipation of the entire gaseous and dusty mass, since any further accretion will produce a gas giant planet. And, that can't occur because planets only accrete as secondary or derivative formations.

But, the above scenario begs the following questions. At what point does the process of brown dwarf formation cease if a particular cloud of gas and dust proves to contain insufficient mass to sustain further accretion? And, once having begun to form, why should this accretion process suddenly cease? Isn't it logical to assume that the accretion process would simply continue with the eventual production of a sub-brown dwarf object? But, that would place such an object in the gas giant planet category and, according to the conventional wisdom, as was already pointed out, gas giant planets are the derivative objects of primary formations. They, like all other planets, are the products of secondary formations. It is clear that conventional theory has broken down at this point with the formation of brown dwarf stars.

Differential Rotation

Although it may seem insignificant to point out that the atmospheres of the Sun and the four gas giant planets exhibit differential rotations - this being a common characteristic of a rotating fluid body in hydrostatic equilibrium - it rises to significance if we consider the standard explanation given for the formation of the gas giants out of the original cloud of gas and dust from which the

Sun formed. According to current theory, based on the derivative paradigm, the gas giant planets formed by "core accretion" in which rocky cores coalesced from 1 to 100 kilometer-sized planetesimals composed of refractory elements that were present in the gas and dust cloud during the initial stages of the Solar System's formation. When these gas giant rocky cores reached a critical mass their inertia attracted volatile elements from which gaseous envelopes were formed around them.

This mechanism was apparently not working, however, with respect to the formation of the inner rocky planets. Having formed closer to the Sun, they were not able to attract volatiles to build up extensive atmospheres like the gas giants since the lighter elements in their local spaces were boiled off by the solar wind. Thus, by virtue of their relative proximity to the forming Sun, the inner planets now lack the signature extensive gaseous envelopes of the more distant gas giant planets.

Thus, standard theory's explanation for the formation of the Solar System's gas giant planets apparently includes a minimum distance requirement. Those proto-planets that formed within this minimum distance were not able to accrete volatile elements around their rocky cores because the Sun's winds swept them from that volume of space. Further out, however, in that volume of space where the proto-gas giants were forming, the volatiles were relatively immune from dissipation by the solar winds, thereby allowing their accretion around the rocky cores of these objects. The problem with this model is that it does not jibe with facts related to the recent discovery of gas giant planets orbiting other stars.

Exoplanets

Many of these exoplanet gas giants have orbits very close to their primaries. And, ceteris paribus, we expect that their extensive atmospheres exhibit differential rotations, just as the Jovians do in our own Solar System. The problem is how did these extensive atmospheres accrete over the rocky cores of these exoplanets? Why didn't the solar winds of their primaries dissipate the volatile elements from which they were constituted?

It should be pointed out, however, that although current detection techniques favor the discovery of gas giant exoplanets orbiting relatively close to their primary stars, other objects of similar size have been discovered at greater distances from their primaries, more in line with the distances of the gas giant planets in our own Solar System. Therefore, the formations of their extensive atmospheres, complete with differential rotational properties, agree with the model relied upon to explain the formation of our own gas giant planets. But, those closely orbiting "hot" giant exoplanets tend to make a muddle of the model.

It would appear that the model is incorrect and gas giant planets can form at any distance from a primary. Taking this line of reasoning further, it would seem that Solar System theorists must now explain how the inner rocky planets avoided becoming gas giants, since distance from a primary star is not a critical factor.

The solution to this problem lies in the abandonment of the derivative hypothesis. Inconsistencies such as the one just discussed spring from the application of this erroneous premise. According to the transformation hypothesis, gas giant planets represent an earlier phase of stellar evolution. At later times, when these objects lose their enormous fluid envelopes, the solid cores lying beneath them are revealed.

Concluding Remarks

It is clear that the angular momentum problem, the apparent Alfven-Hoyle solution notwithstanding, is a false problem from the perspective of the transformation hypothesis. This problem only arose because of the belief that the Sun and the planets constitute a primordial system sharing a common origin. If this were so, the apparent disparities found in the distribution of angular momentum amongst the constituent objects would indeed constitute a "problem" needing a solution. But, since the "system" is the result of an historical process – a process, I should add, that is subject to further change – explanations regarding how the planets came to exhibit various rotational and orbital motions must be sought in an understanding of this historical process as it pertains to each object in the system. At the present time, however, the acquisition of such knowledge is not possible. But, with the ongoing exploration of the Solar System, our knowledge of the planets' natural histories is bound to increase.

The problem of retrograde motion is similar to the angular momentum problem. It has proven impossible to explain the anomalous motions of the several objects mentioned above on the basis of the derivative hypothesis. Attempts to solve this problem were made by introducing an element of instability into the system. Although astronomers have long understood that a certain amount of chaos is inherent in the Solar System – one need only reflect on the "3-body problem" – the relative predictive power of Newton's celestial mechanics rendered the problem moot. Nonetheless, this inherent chaos has afforded astronomers the conceptual ground upon which they could attempt to explain the anomalous motions we observe in the Solar System. The conclusion arrived at is the idea that since planet orbits are unstable interactions that have occurred between them over the course of the Solar System's history have been responsible for causing these anomalies. Needless to say, the transformation hypothesis not only agrees with this assessment, it heartily embraces it as one of the basic premises underlying the Solar System's formation.

We have also discussed some similarities between the Sun and the gas giant planets with respect to energy production, chemical composition and atmospheric differential rotation. And, it is interesting to mention that conventional theory is beginning to regard gas giant planets – particularly Jupiter – as failed stars. Therefore, there is no bone of contention on this researcher's part with conventional theorists' acquiescence that these large yet "sub-fusing" spheres of gas should bear some visible resemblance to the stars that they might have become. The point should be repeated, however, that the Solar System's gas giants bear some resemblance to the Sun precisely because they were once stars and, in their relative youth – as compared to the older rocky planets - still retain some of the more obvious stellar characteristics.

The subject of exoplanet formation was also briefly touched upon as it relates to the formation of the planets in this Solar System. Based on the exoplanet data thus far collected, it was argued that since gas giants can form at any distance from their primaries, it is incumbent upon derivative hypothesis-based theorists to explain why the inner rocky planets in our own Solar

System didn't form into gas giant planets like the outer gas giants did. It was further pointed out that the inconsistency in the conventional exoplanet-formation model stems from its reliance on the derivative hypothesis. Once that shaky edifice is abandoned and replaced by the transformation hypothesis, it is clear that the mass and outer chemical composition of a planet has nothing to do with the distance from which it orbits its primary.

Footnotes

1. Abruzzo, Anthony, J., "Are Planets the End Products Rather than the By-Products of Stellar Evolution?," *The General Science Journal*, August 15, 2008

2. Ouyed, R., Fundamenski, W.R., Cripps, G.R., and Sutherland, P.G., "D-D Fusion In the Interior of Jupiter," *Astrophysical Journal*, 501: 367-374, July 1, 1998

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