WORK-IN-PROGRESS (NOVEMBER 29, 2013) PARALLEL CHART FOR

57:6 ("The Solar System Stage—The Planet-Forming Era")

Endnotes and most Urantia Book cross-references have been deleted to enhance readability.

Source for 57:6

(1) Sir James Jeans, M.A., D.Sc., LL.D., F.R.S., *The Universe Around Us* (New York: The Macmillan Company, 1929)

Key

(a) Green indicates where a source author first appears, or where he/she reappears.

(b) Yellow highlights most parallelisms.

(c) Tan highlights parallelisms not occurring on the same row, or parallelisms separated by yellowed parallelisms.

(d) An underlined word or words indicates where the source and the UB writer pointedly differ from each other.

(e) Blue indicates original (or "revealed") information, or UB-specific terminology and concepts. (What to highlight in this regard is debatable; the highlights are tentative.)

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29 November 2013

PAPER 57 — THE ORIGIN OF URANTIA

IV: CARVING OUT THE UNIVERSE (Jeans 184)

THE DEVELOPMENT OF BINARY SYSTEMS (Jeans 213)

Tidal Friction. (Jeans 213)

6. THE SOLAR SYSTEM STAGE—THE PLANET-FORMING ERA

57:6.1 Subsequent to the birth of the solar system a period of diminishing solar disgorgement ensued. Decreasingly, for another five hundred thousand years, the sun continued to pour forth diminishing volumes of matter into surrounding space. But during these early times of erratic orbits, when the surrounding bodies made their nearest approach to the sun, the solar parent was able to recapture a large portion of this meteoric material.

57:6.2 The planets nearest the sun were the first to have their revolutions slowed down by tidal friction.[1]

Such gravitational influences also contribute to the stabilization of planetary orbits while acting as a brake on the rate of planetary-axial revolution, causing a planet to revolve ever slower until axial revolution ceases, leaving one hemisphere of the planet always turned toward the sun or larger body,

SOURCE OR PARALLEL	URANTIA PAPER 57
Although a sun and planet do not form a binary system in the strict technical sense, they are necessarily subject to the same forces as true binary systems. Thus we can see the operation of tidal friction in the fact that Mercury always turns the same face to the sun, and that Venus rotates so slowly on its axis that it turns the same face to the sun day after day, and probably also week after week (J 213-14).	as is illustrated by the planet Mercury[2]
In the same way, tidal friction has in all probability been mainly responsible for the present configuration of the earth-moon system, driving the moon away to its present distance from the earth and causing it always to turn the same face towards us.	and by the moon, which always turns the same face toward Urantia.
Tidal friction must of course still be in operation. The moon is responsible for the greater part of the tides raised in the oceans of the earth; these, exerting a pull on the solid earth underneath, slow down its speed of rotation, with the result that the day is continually lengthening, and will continue to do so until the earth and moon are rotating and revolving in complete unison. When, if ever, that time arrives,	57:6.3 When the tidal frictions of the moon and the earth become equalized,
the earth will continually turn the same face to the moon, so that the inhabitants of one of the hemispheres of the earth will never see the moon at all, while the other side will be lighted by it every night.	the earth will always turn the same hemisphere toward the moon,
By this time the length of the day and the month will be identical, each being equal to about 47 of our present days. Jeffreys has calculated that this state of things is likely to be attained after about 50,000 million years (J 214).	and the day and month will be analogous—in length about forty-seven days.

SOURCE OR PARALLEL	URANTIA PAPER 57
[contd] After this,	When such stability of orbits is attained,
tidal friction will no longer operate in the sense of driving the moon further away from the earth.	tidal frictions will go into reverse action, no longer driving the moon farther away from the earth
The joint effect of solar and lunar tides will be to slow down the earth's rotation still further, the moon at the same time gradually lessening its distance from the earth.	but gradually drawing the satellite toward the planet.
When it has finally, after unthinkable ages, been dragged down to within about 12,000 miles of the earth,	And then, in that far-distant future when the moon approaches to within about eleven thousand miles of the earth,
the tides raised by the earth in the solid body of the moon	the gravity action of the latter
	will cause the moon to disrupt, and this tidal-gravity explosion
will shatter the latter into fragments (p. 234 below),	will shatter the moon into small particles,
which will form a system of tiny satellites revolving around the Earth in the same way as the particles of Saturn's rings revolve around Saturn, or as the asteroids revolve around the Sun (J 214-15).	which may assemble about the world as rings of matter resembling those of Saturn
	or may be gradually drawn into the earth as meteors.
Roche's Limit. (Jeans 232)	
	57:6.4 If space bodies are similar in size and density, collisions may occur.
If the two bodies were of equal density,	But if two space bodies of similar density are relatively unequal in size,
	then, if the smaller progressively approaches the larger,

SOURCE OR PARALLEL	URANTIA PAPER 57
[Roche] calculated that the small body would be broken up as soon as the radius of its orbit fell to 2.45 times the radius of the large body (J 234).	the disruption of the smaller body will occur when the radius of its orbit becomes less than two and one-half times the radius of the larger body.
[*Tidal Theory.* Actual collisions must be so exceedingly rare that we can leave them out of account (J 224).]	Collisions among the giants of space are rare indeed,
	but these gravity-tidal explosions of lesser bodies are quite common.
It is a common experience that shooting-stars are encountered in swarms,	57:6.5 Shooting stars occur in swarms
and, as we shall see, the motion of many of these swarms makes it possible to identify them as broken-up comets (J 233).	because they are the fragments of larger bodies of matter which have been disrupted by tidal gravity exerted by near-by and still larger space bodies.
Saturn's rings again admit of a natural explanation as the fragments of a former shattered moon of Saturn (J 233).	Saturn's rings are the fragments of a disrupted satellite.
In the same way a Roche's limit must surround the planet Jupiter, so that comets and other bodies may be broken up through getting inside the danger-zone marked off by this limit. Jupiter's innermost satellite is already perilously near it (J 236).	One of the moons of Jupiter is now approaching dangerously near the critical zone of tidal disruption
	and, within a few million years, will either be claimed by the planet or will undergo gravity-tidal disruption.
In the early days of the solar system, when the orbits of the planets were less nearly circular than they now are, a primaeval planet between Mars and Jupiter may well have described an orbit so elongated	The fifth planet of the solar system of long, long ago traversed an irregular orbit,
as to take it repeatedly within the danger-zone of Jupiter.	periodically making closer and closer approach to Jupiter until it entered the critical zone of gravity-tidal disruption,

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	was swiftly fragmentized,
If so, we need look no further for the origin of the asteroids (J 236-37).	and became the present-day cluster of asteroids.
	57:6.6 *4,000,000,000* years ago witnessed the organization of the Jupiter and Saturn systems much as observed today except for their moons, which continued to increase in size for several billions of years. In fact, all of the planets and satellites of the solar system are still growing as the result of continued meteoric captures.
	57:6.7 *3,500,000,000* years ago the condensation nucleuses of the other ten planets were well formed, and the cores of most of the moons were intact, though some of the smaller satellites later united to make the present-day larger moons. This age may be regarded as the era of planetary assembly.
	57:6.8 *3,000,000,000* years ago the solar system was functioning much as it does today. Its members continued to grow in size as space meteors continued to pour in upon the planets and their satellites at a prodigious rate.
	57:6.9 About this time your solar system was placed on the physical registry of Nebadon and given its name, Monmatia.
	57:6.10 *2,500,000,000* years ago the planets had grown immensely in size.

SOURCE OR PARALLEL	URANTIA PAPER 57
[In accordance with the planetesimal hypothesis, the earth began its career, separate from the sun, as a comparatively small mass. This small, original mass constituted the core of the earth-to-be. Just how large it probably was, we cannot say. Perhaps it amounted to about one-tenth of the present mass of the earth, possibly it was larger. From these beginnings it has grown to its present size by the infall of planetesimals (H.H. Newman, ed., *The Nature of the World and of Man* [1926], p. 46).]	Urantia was a well-developed sphere about one tenth its present mass and was still growing rapidly by meteoric accretion.
	57:6.11 All of this tremendous activity is a normal part of the making of an evolutionary world on the order of Urantia and constitutes the astronomic preliminaries to the setting of the stage for the beginning of the physical evolution of such worlds of space in preparation for the life adventures of time.

1. The section ("THE DEVELOPMENT OF BINARY SYSTEMS") begins:

Whatever the process of formation of binary systems may be, we experience fairly plain sailing in attempting to trace out the subsequent development of such systems. Three factors are simultaneously in operation.

Tidal Friction. The first of these three factors, which is only of brief duration, was designated "tidal friction" by Sir George Darwin, who first drew attention to it, and investigated the manner of its operation. When first a rotating mass breaks up and forms a binary system, the two components are so near that they necessarily raise tremendous tides on one another; Darwin shewed that these drive the two bodies apart, and equalise their rates of rotation in so doing. After these processes have been in operation for millions of years, the rates of rotation of the two bodies and their rate of revolution about one another must all become equal, so that each body perpetually turns the same face to its companion, and the two rotate about one another like the two masses of a dumb-bell joined by an invisible arm (J 213).

2. From https://solarsystem.nasa.gov/planets/profile.cfm?Object=Mercury&Display=OverviewLong:

"1965: Incorrectly believing for centuries that the same side of Mercury always faces the sun, astronomers find that the planet rotates three times for every two orbits."