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Are Venus' and Uranus' tilt of natural origin?

or

On the formation of our planetary system.

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Summary

The formation theories of our solar system have still remained filled of question marks.
Why are the orbits of Mercury and Pluto that much eccentric, and that of the other planets much less? Why are the axial tilts what they are? This we will discover in this paper. Here we will start from the primary model of a huge solar protuberance and next apply the electromagnetic and the gravitational dynamics to it. The application of these physics leads us to the description of how the planets arose, their orbits, their tilt, and their composition. Also we will comment why the Asteroids Belt and the Trojan Asteroids probably arose.

Initially, we will bring in that the complete planetary system originated from a solar eruption, and reveal that the planets have successively developed in the order : Mercurius, Venus, the Earth, and Mars on the one hand, and on the other hand Neptune, next Uranus and probably Pluto, then successively Saturnus and Jupiter. At last, the Asteroids Belt was formed, just after the formation of Mars and Jupiter. This theory is supported by the other parameters such as the comparison of the planet's density, size and chemical composition. Also the comparison of their tilt, the spacing between their orbits, and the elliptic orbit and tilt of some planets support the theory. We find evidence that Venus' and Uranus' tilt are totally natural.

Index

1. A plausible starting point: the solar eruption cloud.

Some formation theories about our solar system. – The planets emerged from a local cloud

Has our planetary system arisen from a collision between the Sun and another object? An almost-collision? Is a huge Sun eruption the origin of our solar system? A separation of a part of the sun? Do the planets come from an alignment out of an interstellar nebula? Different theories will prefer the one or the other cause, more or less founded. So far no proof has been provided which can exclude all theories with respect to another.
Actual theories in literature start from a solar nebula becoming a ring with whirls, due to a turbulent compression of the nebula into a disc cloud. These whirls are then supposed to form the planets. But nor the origin of the compression nor that of the whirls however are explained in a convincing way.

Let us choose as origin of the planets, a solar eruption, although solar eruptions generally are limited in size. The total mass of all the planets is just one fraction (0,15%) of the Sun's mass. We will see that the choice of the eruption type is not unimportant, but we provisionally start with a hot cloud.

The first question concerns the position of that cloud around the Sun. Since only a few planets arouse, rather consistently spread in the space near the Sun, the provenance could be a solar eruption cloud, which did not wander around the whole Sun, but which was only present in a limited area. There is in fact only one planet per orbit, and the orbit lie on regular distances of each other, as follows from the empiric Titius law:

$a = 0,4 + 0,3 \,.\, 2^n$ where a is the semi major axis in (AU) and the exponent n, takes values 1, 2, 3, ...

Other examples of contracting clouds showed symmetric evolutions. We have also seen in *"Lectures on: A coherent dual vector field theory for gravitation"* [2] that plane galaxy systems convert themselves into spiral systems; in *"Cassini-Huygens mission"* [4] we saw how the Saturn rings are converted into a range of mini-rings. But in these both cases the cloud has always remained symmetrical to the central mass, planet or bulge of the galaxy system. Whereas at our solar system an asymmetry must have been arisen.

A cloud nearby the Sun. – Minimum conditions

How can the solar eruption cloud have looked like? It is surprising that the planets eventually describe a circular or an elliptic orbit. And it is also unexpected that there only exists one planet per orbit region.

In order to combine all conditions which would give a chance for the formation of such a planetary system, the minimum requirements are the following:

(a) it concerned a huge local solar eruption *(b)* in which already all types of atoms were present.

The eruption (*a*) caused the ejection of matter, about 0,15 % of the Sun's total mass, at a speed below the Sun's escape velocity. The cloud with a vaporised heavier core (*b*) could escape from the Sun's attraction by means of the eruption force, while the pressure of the erupted gasses arranged a large spacing of the cloud.

While after the eruption the cloud is, in a whole, blown further away by the gas and the vapour pressure, the heavier particles will occupy a less extended area. The gasses continue expanding more easily, and will remain farther away than the other particles do.

Consequently our model forms an excellent basis for a planetary system such as ours: a small number of planets, broadly spread, with one per orbit region, describing circular prograde orbits. Of course provided that the further formation itinerary can be explained.

A certain number of phenomena must still be explained: Mercury and Pluto have got an elliptic orbit, and Venus and Uranus got a very different tilt from the other planets. Couldn't Pluto not be an adopted planet? Has the tilt of Venus and Uranus not been changed by a huge collision? Can we explain all the other macroscopic properties of each planet? These very pertinent questions have fairly good solutions, thanks to the Maxwell analogy for Gravitation.
Hereafter we see how all this is fairly compatible.

2. The electromagnetic solar eruption model.

Solar flares, post-flare loops and prominences. – *A huge prominence as model*

The description of the magnetic properties of the Sun can be found in the literature. The Sun becomes active near sunspots, and those sunspots are principally found in pairs, with a magnetic north pole and a magnetic south pole. When mass ejections occur, at very high temperature, the ionised hydrogen and the electrons follow a magnetic path which quit one sunspot pole and goes to the other pole, creating so a magnetic buckle outside the Sun's surface.

Solar flares and post-flare loops are very common events at the Sun's surface. Prominences, which reach further from the Sun's surface are common as well. All these phenomena are provoked and maintained in suspension by the magnetic fields of the Sun.

So many different eruptions can take place that in the meantime we simplify our eruption model. Let us consider an exceptionally huge prominence (eruption) that follows a magnetic field path. Positive hydrogen ions will erupt from point a while rotating screw wise along the magnetic line along point b to point c. Electrons will flow contrariwise. When we take the tangential velocity into account, the equation (2.2), see lower, is at the origin of the spiral screwing cloud along the magnetic field path,

This gives a rotation ω which changes of direction at every point of the prominence, but their direction change also with the Sun's axis-symmetric angular position.

After some time, the guiding magnetic field falls away, so that the cloud expands without changing the local directions of ω anymore.
How will this cloud evolve?

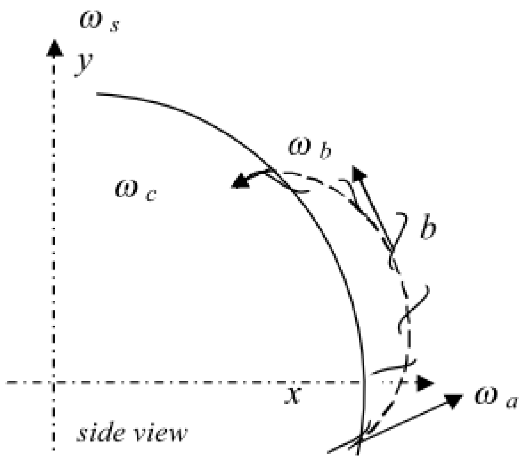

fig. 2.1 : Solar protuberance.

Dynamics of the erupted cloud. – *Electromagnetism and Gravitation*

Drawing fig.2.1 shows the eruption, projected in the vertical plane. In the horizontal plane, a similar drawing can be made, fixating the rotation vector in the horizontal plane (see fig.2.2).

The global velocity of the rotating particles is directed along the magnetic field path. The velocity vector and the rotation vector are parallel in each location. Even when the magnetic field path felt away, both velocities were maintained.

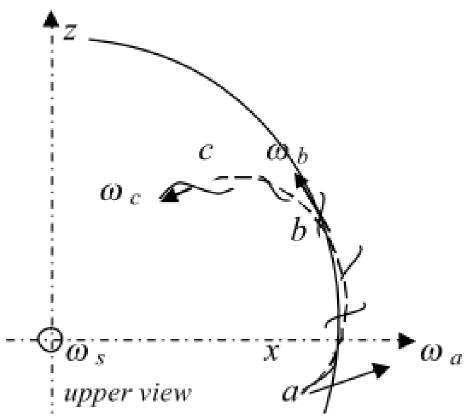

fig. 2.2 : Solar protuberance.

An important fact is that due to the law (for low velocities) :

$$v^2 = GM / r \qquad (2.1)$$

where v is the tangential velocity in relation to the Sun, a certain orbit position with radius r will be associated to every fraction of the cloud.

The radial initial velocity of point a is very probably far above the Sun's escape velocity, while its initial tangential velocity is much lower. The final orbit radius of point a will therefore be very large. When the screwing hydrogen cloud reached point c , much kinetic energy was gone (as will be demonstrated later in this chapter) and it is not sure if the velocity of point c will even reach the Sun's escape velocity, or rather fall back towards the

Sun. The remaining part, enclosing point b , will be spread away over a large space. But we should take notice : due to the cloud's shape, the radial velocity of point a relative to the Sun is much higher than that of point b . Hence, point a will not necessarily be the extreme point of the planetary system, due to their respective tangential velocities! Point a, which has a small tangential component, will stay closer to the Sun than point b. Within a few lines we will clarify this behaviour, and validate it all throughout this paper.
When the guiding magnetic field path vanished, the corresponding vectors ω maintained their angular momentum orientation.

The cloud expands not uniformly, and its shape becomes elongated. In fig. 2.3 we show the further evolution of the cloud.

The major part of the erupted cloud contained hydrogen ions and electrons that left the Sun with high speed. This creates an electric field with an attraction force. The Sun's magnetic field as well exerts a force, and both forces together can be written as an electromagnetic force $\boldsymbol{F}_{em}$:

$$\boldsymbol{F}_{em} = q\ (\ \boldsymbol{E} + \boldsymbol{v} \times \boldsymbol{B}\ ) \tag{2.2}$$

where v is the speed of charge q, the electrical field is $\boldsymbol{E}$, and the magnetic field is $\boldsymbol{B}$.

Equation (2.2) causes several effects. We know that the tangential velocity component is responsible for the screwing motion; the radial component is causing another effect: Depending of the Sun's magnetic polarity of that moment, the radial expanding cloud will undergo a prograde or retrograde swing. This means that the radial expulsion velocity will contribute to the final tangential velocity, and so, the orbit radius. Hence, it is possible that point a is not the farthest point.
The cloud will also be pressed to the neutral magnetic equator of the sun[1], this is the plane in the middle of the two poles. Indeed, only when the tangential velocity of the cloud is perpendicular to the Sun's magnetic field lines, no forces will act on it but a radial one. The most stable place is the Sun's magnetic equator.

The electrically neutral particles of the cloud will not undergo such forces. Another force however, much less important, can still play a role.
As we know from "*A coherent dual vector field theory for gravitation*" [1], not only gravitation induce forces, but each motion of objects as well is transmitted by gravitation towards other objects, resulting in a force. We call the corresponding field *gyrotation field* $\boldsymbol{\Omega}$, and the resulting gyrogravitation force F_{gg} responds to :

$$\boldsymbol{F}_{gg} = m\ (\ \boldsymbol{g} + \boldsymbol{v} \times \boldsymbol{\Omega}\ ) \tag{2.3}$$

where v is the speed of mass m, the gravitation acceleration is written as $\boldsymbol{g}$, the so-called *gyrotation field* as $\boldsymbol{\Omega}$. The gyrotation field is defined by the motion of another mass in a local gravitation reference field.

The Sun's and the galaxy's rotation is transmitted by gravitation into gyrotation forces which are responsible for two effects. The first effect of the Sun's and the galaxy's rotation is that the escape velocity of the cloud, combined with gyrotation, will provoke a prograde swing of the cloud according (2.3).
The second effect of the Sun's rotation is that the gyrotation force brings the cloud in the equator plane of the Sun, and maintains the cloud under pressure.

The order of magnitude of (2.2) versus (2.3) is very different, so is the time needed to get a noticeable effect by the latter one. We should keep in mind that even if only a small percentage or a fraction of the cloud is ionized, it might contribute to an accelerated progress of the planets' formation. After time, when the ions disappeared, the latter forces became predominant.

In order to understand well the evolution from fig. 2.1 and fig. 2.2 towards fig. 2.3 and fig. 2.4 below, we must not forget that the angular momentum of each fraction of the cloud will remain the same from the moment that the magnetic guiding path of the cloud vanished. So, if we consider the eruption as many superposed screwing rings, the angular momentum of each ring remains the same, but the rings will slide the one over the other in order to get a broaden set of rings.

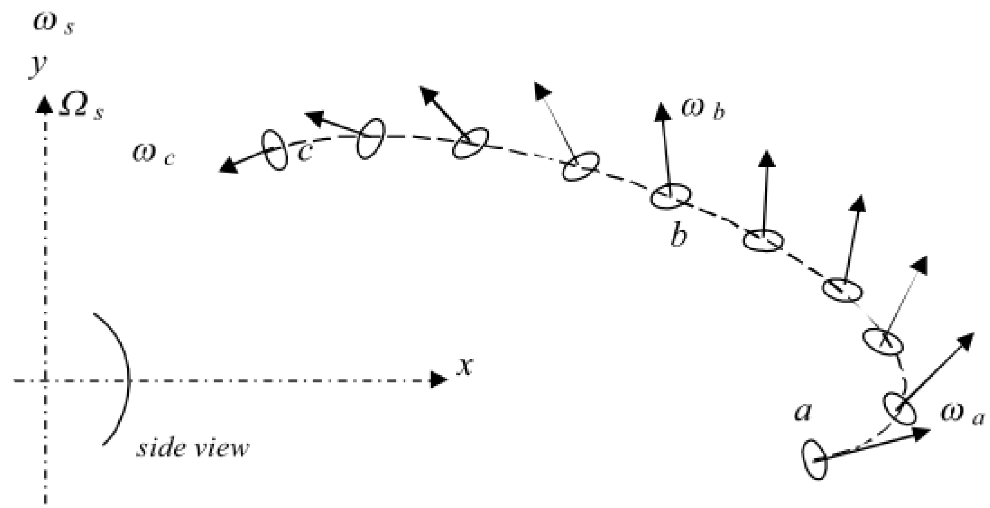

fig. 2.3 : The spiral split up into several rings.

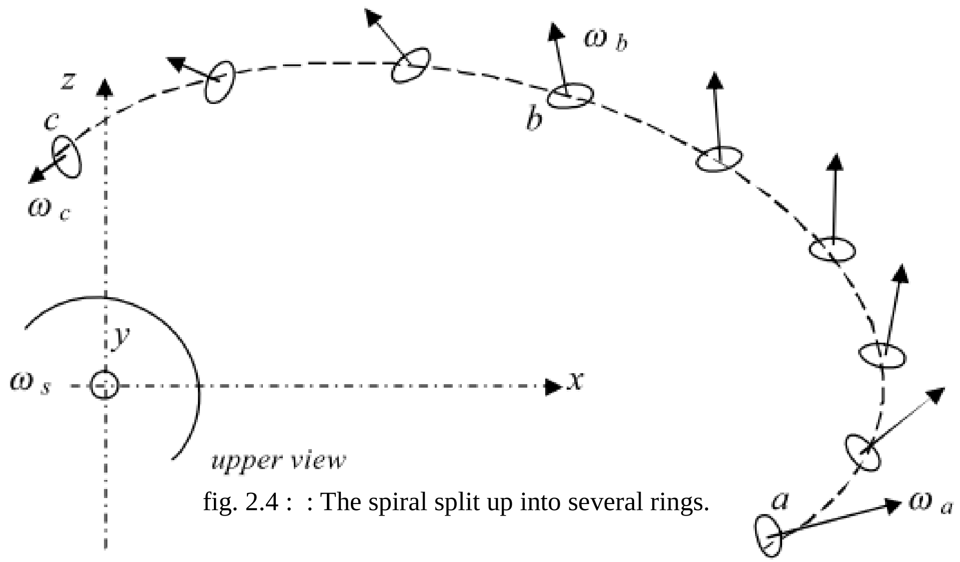

fig. 2.4 : : The spiral split up into several rings.

It is clear that every rotating ring will influence the rings close by, because the particles' velocities in the common border operate against each other. These particles can contribute in three kinds of effect: *(a)* due to collisions, push away the rotation centres of the several screwing rings; *(b)* group every set of two rings into a common ring with a larger diameter; *(c)* by annihilation of opposed speeds, create turbulent regions without rotation.

The general example shown in the drawings illustrate that a large region at both sides of point b has got a relatively constant tilt.

An important consequence of (2.2) is also that the screwing motion of the cloud will create an opposed induced field $\boldsymbol{B}$ that slows down the velocity, more and more while it moves on from point a to the points b and c. At last, the extremity of the cloud is only screwing very vaguely. In addition, the globally scale-enlarging cloud acquired principally a tangential velocity in relation to the Sun. Point c got the Mercury orbit speed of about 50 km/s. In next chapter, we will see that this apparently means the half of the initial speed of point a. In chapter 7 we will understand better the link between both velocities.

Does our model match the planets' parameters ? – The model fits most of the planet's data

In table 2.1 are shown the major parameters of our planetary system. The comparison of the masses shows that the planets are in a logic order except for Mars and Pluto. In chapter 4 we will find reasonable explanations to this. Moreover, Neptune and Uranus should be inversed to match a logic order. Let us remind this for later.
The densities do not follow a very clear logic, because this depends from several parameters: the composition of the matter (kind and state: solid, vapour, or gas), the internal pressure of it, and the velocity-dependent external pressure caused by the Sun and the galaxy, which we find out of (2.2) and (2.3). Hence, the density patters do not result in immediate conclusions concerning the model.

The axial tilt of the planets is given in the last line of the table. Very typical are the tilts of the Earth, Mars, Saturn and Neptune. These tilts increase steadily from 23.5° to 28.3°. On the other hand, the tilt of Jupiter is 3.1°.

Comparing these results with our model in fig. 2.3 , we see that the model shows a kind of protuberance which is not totally correct.

		SUN	MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
Mass	(10^{24}kg)	1989000	0,33	4,87	5,97	0,642	1899	568	86,8	102	0,0125
Diameter	(10^3 m)	1390000	4879	12104	12756	6794	142984	120536	51118	49528	2390
Density	(kg/m^3)		5427	5243	5515	3933	1326	687	1270	1638	1750
Rotation Period	(hours)		1407,6	-5832,5	23,9	24,6	9,9	10,7	-17,2	16,1	-153,3
Distance from Sun	(10^9 m)		57,9	108,2	149,6	227,9	778,6	1433,5	2872,5	4495,1	5870
Orbital Period	(days)		88	224,7	365,2	687	4331	10747	30589	59800	90588
Orbital Inclination	(degrees)		7	3,4	0	1,9	1,3	2,5	0,8	1,8	17,2
Orbital Eccentricity	Eccentricity		0.205	0.007	0.017	0.094	0.049	0.057	0.046	0.011	0.244
Axial Tilt	(degrees)		0,01	177,4	23,5	25,2	3,1	26,7	97,8	28,3	122,5

table 2.1[8]

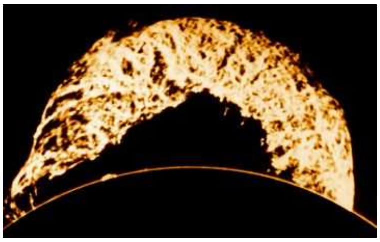

fig. 2.5[9]

fig. 2.6[10]

The planets Earth until Neptune, with the exception of Jupiter and Uranus, have tilts which vary very slightly. The protuberance that initially we thought alike fig. 2.5 seems to resemble much more fig. 2.6 : the points *a* and *c* in fig. 2.3 got a totally different tilt as the rest of the cloud. This would explain the slightly changing tilt of the planets Earth until Neptune. But we need to explain the tilt of Jupiter. We will attempt to solve this in chapter 6 when we analyse the consequences of the electromagnetic protuberance-model more in detail, especially the central part of the cloud.

The rotation period also represent an important parameter in order to compare the planetary system with the model. For the planets Earth, Mars, Saturn and Neptune, the rotation period is short. Jupiter has even the shortest rotation period. Very probably, our model has got the requested properties. The spin of point *a* is the highest, and decreases towards point *c* because of the energy losses between in both points. However, the tilt of the cloud fractions near point *a* , which constituted the proto planets Mercury and Venus, vary very rapidly from the one to the other angle. When fractions group towards a planet, the combination of different tilts will partly be transformed into thermal energy.
On the other hand, the tilt in Jupiter's region (point *b*) is quite the same, allowing Jupiter to rotate faster than the other planets.

The axial tilt of Mercury and that of Venus are not what we would expect with the model. However, their rotation period is that slow, that the theoretical prediction of the tilt is difficult anyway. Although the model shows a certain tilt (in fig. 2.3 it is 120°, but we know that the remaining rotation in point *c* is low and turbulent anyway), depending of the eruption shape and orientation, Mercury has an axial tilt of about 0° and Venus of nearly 180°.

Considering Mercury's small mass and the extremely long periods of both planets, the global angular momentum of these two planets is negligible.

The tilt of Uranus is similarly 90°, because point a didn't reach the extremity of the planetary system. More likely, Uranus was predestined to reach the edge of our planetary system, according to our reflections about fig. 2.3.

Also table 2.2 gives support to this model. It is known that the solar activity depart from sunspots, or near sunspots. Sunspots are colder than the surrounding surface of the Sun. They contain lots of iron and many other low- and non-volatile atoms such as metals and rocky material. Very probably, reasonable amounts of sunspot matter have been blown out during this huge eruption.

Element (wt%)	Atomic Mass	Mercury	Venus	Earth	Mars
Fe	26	*64,47*	*31,17*	*32,07*	*9,50*
O (bound)	8	*14,44*	*30,90*	*30,12*	*45,00*
Si	14	*7,05*	*15,82*	*15,12*	*25,00*
Mg	12	*6,50*	*14,54*	*13,90*	*17,00*
S	16	*0,24*	*1,62*	*2,92*	
Ni	28	*3,66*	*1,77*	*1,82*	
Ca	20	*1,18*	*1,61*	*1,54*	*1,50*
Al	13	*1,08*	*1,48*	*1,41*	
Total (wt%)		*98,62*	*98,91*	*98,90*	*98,00*
Total mass (10^{24}kg)		*0,33*	*4,87*	*5,97*	*0,642*

table 2.2 a. [11] [12]

Element (wt%)	Atomic Mass	Jupiter	Saturn	Uranus	Neptune	Pluto
H	1	*90,00*	*93,00*	*59,00*	*74,00*	
He	2	*10,00*	*3,00*	*10,00*	*22,00*	
Rocky core	(estimate) 25		*3,00*	*30,00*	*3,00*	*70,00*
Water	10					*30,00*
Total (wt%)		*100,00*	*99,00*	*99,00*	*99,00*	*100,00*
Total mass (10^{24}kg)		*1899*	*568*	*86,8*	*102*	*0,0125*

table 2.2 b. [13]

The sunspot at point a blew out rocky material such as we find in Uranus, Pluto, Neptune and Jupiter.
Very probably, point c has ejected some sunspot content which contained much iron, such as we find decreasingly in Mercury, Venus, the Earth and Mars. Did it happen following to an implosion in c of incoming matter coming from a ? Though, it seems clear that the group of planets Mercury, Venus, the Earth and Mars are very unlike the group Jupiter, Saturn, Uranus, Neptune, although the group Earth, Mars, Saturn, and Neptune has an almost identical tilt. This confirms a different origin of both groups, but a common eruption event.
Did the two flows join, resulting in a turbulent non-rotating zone near Venus ? Probably they did. That would help explaining the Mercury's and Venus' tilt and slow rotation period, and the more "normal" tilt and rotation period of the Earth and Mars. The implosion model in point c also helps explaining the properties jump between Mars and Jupiter, while maintaining the Titius law.
The model also explains why Neptune's composition is more Saturn-like than Uranus-like. The normal order of the planets' matter content requires again an inversion of Uranus and Neptune.
The case of Pluto will be discussed later, because of its particularly strange properties and its insignificant size.

Finally, the model is supported by the many spin-orbit and orbit-orbit resonances in our planetary system. These resonances suggest indeed a link between the corresponding objects[15]. The large moons got a 1:1 spin-orbit resonance, indicating that they came out the respective proto-planets in formation, due to some gravitational eccentricity in the proto-planets followed by a splitting process. Pluto and Neptune have a 3:2 spin-orbit resonances, confirming our model concerning a link between both planets.

3. The temperature and the initial velocity of the huge solar eruption.

Forces acting on the cloud – Gas law, gravitation and kinematics

Immediately after the eruption, the cloud took place in a zone, nearby the Sun. We consider the cloud in the equator plane for the moment, although the ejection probably occurred at another latitude. Fig. 3.1 shows a very general situation.

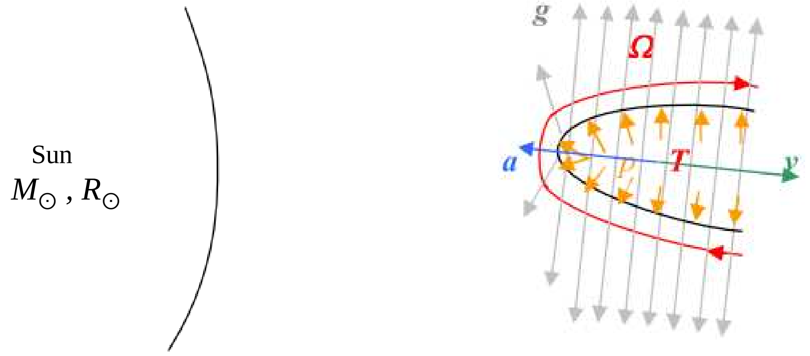

fig. 3.1

The influences on the cloud are:

a. The initial velocity v_0, which must have been below the escape velocity of the cloud.
Hence, $v_0 < (GM_\odot/R_\odot)^{-1/2}$.

b. The pressure p of the gasses and the vapour, which is responsible for the further expansion of the cloud, in all directions. As a matter of fact, the initial velocity is generated by this internal pressure.

c. Thirdly, we have got the temperature, which is related to the pressure as well.

d. The electromagnetic force from the Sun, as seen in chapter 2.

e. The gyrogravitation force, due to the Sun's attraction and rotation, and due to its orbit speed in the Milky Way.

f. Finally, the ejected mass, which is causing a gravitational contraction.

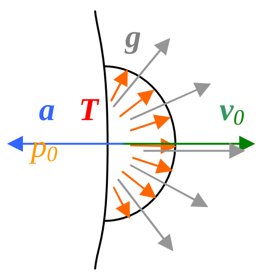

fig. 3.2

The explosion area is shown in fig. 3.2.

The equation of the kinetic and the thermodynamic energies results in [14]:

$$^1/_2\ m_a \langle v^2\rangle = {}^3/_2\, k\, T \qquad (3.1)$$

This equation is valid for the average velocity $\langle v\rangle$ and the mass m_a of one gas atom or molecule.
T is the temperature of the eruption which is close to the one of the Sun.
k is a physical constant. The Sun's temperature is known, and the total expulsed mass can be estimated.

For one mole of gas, equation (3.1) becomes $^1/_2\ m_m \langle v^2\rangle = {}^3/_2\, N_A\, k\, T$ where

N_A = Avogadro's number $= 6 \times 10^{23}\ mole^{-1}$. This is the number of gas atoms in one mole.

So, $\langle v^2\rangle = 3\, N_A\, k\, T/\, m_m$

And the gasses' velocity is $\langle v\rangle = (3\, N_A\, k\, T_\odot/\, m_m)^{-1/2}$. (3.2)

k = Boltzmann constant $= 1.38 \times 10^{-23}\ J/K$

G = universal gravitation constant $= 6.67 \times 10^{-11} N\ m^2\ kg^{-2}$

$M_\odot = 2 \times 10^{30}\ kg$: is the Sun's mass.

$R_\odot = 0.7 \times 10^{9}\ m$: is the Sun's radius.

$T_\odot$ is the Sun's temperature at the location of the eruption. It is clear that the eruption of a planetary system must be a very exceptional event. The core, with a radius of $^1/_4\ R_\odot$ has a generally accepted temperature of $1.5 \times 10^{7} K$. Also the corona, outside the Sun's surface has about the same temperature. As a first approximation of the exceptional eruption temperature we shall assume that it stayed below $1.5 \times 10^{7} K$.

m_m equals the mass of one mole of gas particles, which can be hydrogen isotopes, deuterium and helium. Therefore we check the composition of our planetary system in tab. 2.2 a. and b.

Only the four large outer planets have got much hydrogen (91%) and helium (9%). When the eruption took place, the hydrogen was ionised before becoming bi-atomic molecules.

Hence, the average mass m_m is $0.91\ g + 4 \times 0{,}09\ g = 1.27\ g/mole$.

The average velocity $\langle v_h \rangle$ at which the gas particles move inside a gas bubble of the Sun can be found out of equation (3.2) :

$$\langle v_h \rangle = 5.4 \times 10^{5}\ m/s\ ,$$

and the directions at which these hydrogen gas molecules move are random, because of the many collisions in the gas. A freed molecule however reaches such speeds.

Indeed, the gravitational escape velocity $v_g = -(GM_\odot/R_\odot)^{-1/2}$ will counteract this speed. The kinetics of a gas planet P, consisting of its orbital speed and its rotation speed, should comply with the explosion speed, reduced with the speed due to the solar gravity.

$$v_P + \omega_P R_P = (3\ N_A\ k\ T_\odot/\ m_m)^{-1/2} - (GM_\odot/R_\odot)^{-1/2} + (GM_\odot/R_P)^{-1/2} \qquad (3.3)$$

Herein, the second term on the right hand is the solar gravitational escape velocity and the third term is the gravitational escape velocity at Jupiter's orbit.

The rotation velocity of Jupiter is 9.9 hours.
Using table 2.1, the equatorial velocity at Jupiter's surface is :

$$\omega_P R_P = \pi\ 1.4 \times 10^{8}\ m\ /\ (9.9 \times 3600\ s) = 1.26 \times 10^{4}\ m/s$$

and $$v_P = 1.3 \times 10^{4}\ m\ /\ s$$

With this equations, the eruption temperature can be estimated out of (3.3). For Jupiter, the corresponding solar eruption temperature must have been around $10^{7} K$.

Does this fits the creation of our planetary system ? – A sunspot erupted with the hot cloud

A pregnant question is to know how big the gas bubble should have been in order to eject a mass as large as the sum of all our planets, asteroids, and gasses of our planetary system.

To answer that question, we need to consider that the surface temperature of the Sun is only $T_{s\odot} = 5.8 \times 10^{3} K$. If an eruption took place, colder surface matter will be ejected by erupting hot gasses laying below that surface.

And as we know from tab. 2.2. , the inner planets contain lots of heavier metals such as iron, just as probably sunspots do. And sunspots are definitely considered as predictors of solar activity.

Thus, we should consider an enormous internal gas bubble blowing away a sunspot out of the Sun's gravitation area. We can estimate the sunspot mass m_{sp} as the sum of the inner planets and the cores of the outer planets, which equals $1.2 \times 10^{25}\ kg$ and constitutes only $0.5\ \%$ of the total mass of the planets; indeed, the gas bubble is then the mass of hydrogen and helium m_h in our planetary system, which is $2.6 \times 10^{27}\ kg$.

In fact, we have no confirmation of the real eruption temperature. It is however obvious that if we set $T_\odot \approx 10^7 K$ in (3.3), the kinetics for the largest gas planet is not in contradiction with the inner solar temperature, just below the Sun's surface.

What we have found out until now is:

A solar eruption left the Sun's surface at an initial speed of $4.5 \times 10^5\ m/s$, when assuming an initial cloud temperature of around $10^7 K$. During the eruption, huge masses of hydrogen and helium ions snatched other colder matter of a sunspot, which was then expelled as well.

In the next chapter we are analysing how the planets split-off from the cloud.

4. How the first planets got separated – a possible storyboard.

We shall understand in the present chapter, but also the following ones, that the logical separation order of the planets is the formation of the inner and the outer planets at first. There are three physical phenomena which are responsible for the separation of the planets off the cloud.

The orbit drift. – Tangential velocity defines the orbit

In chapter 2, we have seen that the Sun's magnetic field will cause a prograde or retrograde swing (I guess it was prograde, but even retrograde would lead to almost the same final situation) of the ionised part of the cloud. The same force transformed a part of the radial velocity into a tangential force. The cloud has been driven towards the Sun's magnetic equator by the same force.
In my work "*A coherent double vector field theory for gravitation"* [1] of 2003 we saw that the gyrotation forces of the Sun cause a swing as well, although much weaker, and bring the cloud in the equatorial area too (even originally retrograde orbits).

The cloud is widely spread, as shown in fig. 2.3 and 2.4, and its fractions cover a wide range of orbit velocities.
Each movement will have consequences on the law of energy conservation between gravitation and centrifugal forces, which is, for small speeds, expressed by:

$$v^2 = GM / r \qquad (4.1)$$

All these effects make the cloud becoming spirally shaped. This effect alone will however not split-off the planets.

The axial tilt. – Repellent turbulences help separation

Earlier we saw that the fractions of the cloud near points a and c are dissimilar because of their tilt. These different tilts cause a turbulent region between in the cloud's fractions, where many collisions occur. Due to the high temperature of the gasses, the turbulent zones are more repellent, what makes the split-off easier.
In our opinion, neither this effect seems sufficient to obtain the split-off. But a third force was added to the other two.

The gyrotation pressure. – *Edges separated faster*

In my work *"Cassini-Huygens Mission, New evidence for the Dual Field Theory for Gravitation"* [4] I have shown that the tiny Saturn rings did split-off one by one from a larger ring, because of the gyrotation force which is caused by the orbit velocity of the rings.
Very rapidly, the ring's edge laying the most inwards near Saturn separated, forming so a tiny ring. The most outer laying edge of the same main ring detached as well. One by one, the separations resulted in new edges for the main ring. And again the extreme edges formed new tiny rings. Bit by bit, the main ring was transformed into tiny rings, from the outer edges towards the centre of the main ring.

In our planetary system, the split-off happened analogically: first were separated Mercury and Neptune, shortly later Uranus. We believe this because (4.1) is responsible for a slower proto-Neptune, so that point a, thus proto-Uranus approached the remaining cloud, while proto-Neptune got away from it.
These separations reduced the extent of the remaining cloud. But what about Pluto?

The separation of Mercury, Pluto, Uranus and Neptune. – *First steps in defining the separation order*

Can we assume that Mercury and Pluto must have separate from the cloud when the rest of the cloud still remained intact? As a matter of fact, how certain are we that Pluto is no adopted planet? We can answer the latter question. The level of certitude follows of the density analysis of the planet. This is virtually the same as the one of Neptune, the last planet but one. In tab.2.1 some important parameters of all planets are reproduced, showing this.

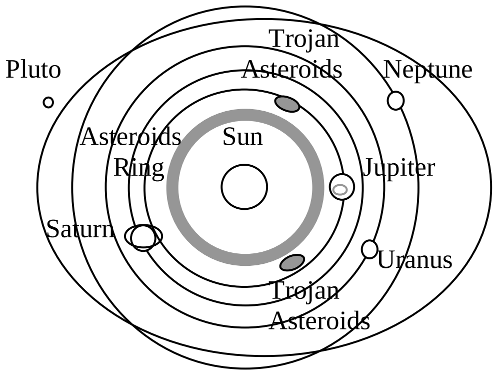

fig.5.5

Nevertheless still the next uncertainty exists. Is Pluto the first separated planet on that side? The mass of Pluto is only one fraction of that of Neptune. Moreover all planets beyond Mars are large, with a low density, what shows that the cloud at that place indeed experienced a small gravitation and a small gyrotation force.
The separation of Neptune from the cloud as the first planets at that side, before Pluto, is however much more logical. The extremity of the cloud was very extended by the presence of gasses, what justifies the separation of a large planet. It seems more obvious that Pluto arose only accidentally, in the neighbourhood of Neptune and Uranus, because there could have been a small limb between Neptune or Uranus and the rest of the cloud. The axial tilt of Pluto, its composition and its rotation period, which has a 3 to 2 orbit resonance with Neptune, even suggests that Pluto arouse out of the region near proto-Neptune.

Pluto has a nearly symmetric elliptic orbit with the circular orbit of Neptune, and both orbits join twice per revolution, in the neighbourhood of the small axis of Pluto's ellipse. In the next chapter we will try to find the reason for it more in detail.

Let us safeguard this conclusion for the time being. Out of tab. 2.1. follows also that the size, the spread-out of the orbits, the densities and the tilts correspond quite well with our model of fig. 2.3, corrected with fig. 2.6.

5. The reason of the elliptic orbit of Mercury and Pluto – a possible storyboard.

The gravitation force of the cloud – Mercury and Pluto got a gravitational oscillation

Earlier, we saw that the split off of Mercury and Neptune apparently took place at first, probably together with Pluto, and next Uranus, whereas the rest of the cloud remained still a whole, even if it became a widely extended spiral cloud.

In fig.5.1.a the solar system is presented after the formation of the first four planets.
Naturally, it follows from the law (4.1) that those planets which no longer revolute in phase with the cloud, will finally reach their dedicated orbit.

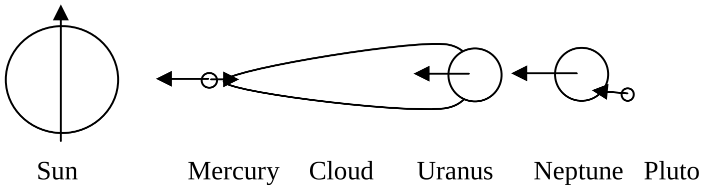

fig.5.1.a

In fig.5.1.b we have drawn the cloud in front of the Sun, under a certain angle.

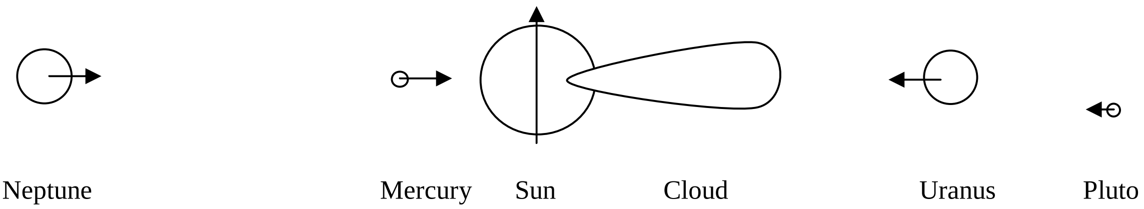

fig.5.1.b

Based on this figure, we find that the gravitation forces that are experienced by Pluto, Uranus, and Mercury became quite different: Pluto experiences a smaller force because the other planets are now further away. Mercury now experiences a larger force because the cloud stands farther away. Both planets have got an eccentric revolution orbit because their original gravitation forces vanished as soon as the split off changed their orbit frequency. The planets were therefore swung to a higher (for Pluto) or lower orbit (for Mercury), where they obtained respectively a smaller or larger speed. This exchange of potential and kinetic energy becomes an oscillating motion, what means an elliptic orbit. Without doubt, the small mass of both planets were at the origin of such strong effect.

The eccentricity of Neptune's orbit – Neptune was the lonely planet

And Neptune? Its orbit appears to not be eccentric!
Could the spiral shaping of the cloud be the cause of this? Probably it is. Neptune position was influenced by the expanding and the spirally spreading-out of the cloud, presented as fig.5.2 (upper sight). The gravitation force of the cloud did not change the circular orbit, because due to (4.1), Neptune slowed down and went tangentially away from the cloud, whereas Uranus could stay closer to the remaining cloud. It is not impossible that Pluto was also swung away by Neptune's gravitation effect, what enlarged the main axis of the elliptic orbit.

The other planets have also got characteristics which follow from this model. In the next chapter we see which ones and how this happened.

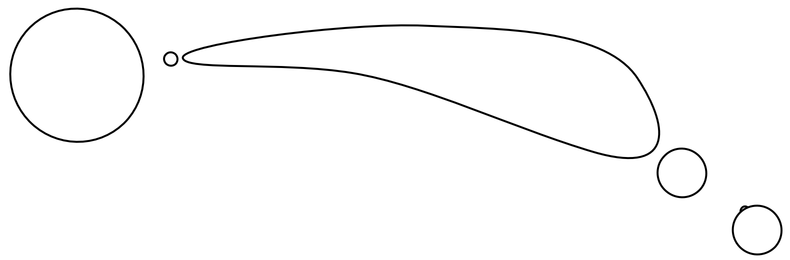

fig.5.2

6. The shaping of the other planets and objects. – a possible storyboard.

Venus, the Earth, and Mars on the one hand, Neptune, Uranus, and Saturn on the other hand.

In the same way as the first planets have split themselves off, also Venus, the Earth and Mars successively split off. The cloud became each time less extended, but at the same time the spiral shape of the cloud became larger. It seems perhaps strange that Mars is a lot smaller than the Earth and Venus. But on the other hand, it is not at all certain that the cloud was nicely homogeneous. It is indeed conceivable that it consisted of parts with different composition, with regard to the shape and with regard to the type of particles: the totally different properties of gasses and solid particles grouped the solids closer to the Sun, and the gasses further away.

The same was valid for Uranus and Saturn, which also successively split them off. Two planets which are much larger, revolve on much larger distance, and have got a low density, as expected.

The residual planet, Jupiter, and the remaining objects such as the Asteroids Belt and the Trojan Asteroids have not yet been discussed. They form a separate part of our solar system, they confirm our model once again, and allow us still to improve the description of the solar eruption cloud.

Jupiter, the Asteroids Belt and the Trojan Asteroids. The shaping and the elliptic orbit of Mars.

Jupiter has been created totally unlike the other planets. This planet is the last one which arose, the largest, and stood in the middle of the system. It is also the one that today resembles the most the original cloud. This planet has been separated from nothing else, and has remained what it was at the origin: a cloud of gasses.
A remarkable similitude between the model and the planets' data, which we analysed also in chapter 2, lays in the fact that Jupiter has a global magnetic field of 0.1 Tesla (10^3 Gauss), as much as the magnetic field of a sunspot. This suggests that Jupiter is magnetically similar to the sunspot area of which it has erupted.

But not only Jupiter however did remain at last. On the same orbit as Jupiter and on equal distance of it we have a group of Asteroids. They are respectively called the Western and the Eastern Trojan Asteroids, and are situated at 60° to the right and the left of Jupiter, in the so-called Lagrange points.

And between Mars and Jupiter is situated the widely spread Asteroids Belt.
The reader will already have realized that this Asteroids Belt arose from the spiral cloud, after that all planets were formed, and when the spacing of the residual parts of the cloud had no chance any more to get regrouped, because the residual spiral cloud finally became an eccentric ring. The reason for the somewhat more elliptic shape of Mars' orbit has to do with the eccentric spiral shape which the "Asteroids cloud" then already had (when forming an almost closed ring) strongly influenced by the attraction force of Jupiter. This deformed Mars' orbit the elliptic way as well, the more by its quite small mass. Jupiter keeps this eccentricity of the Asteroids Belt ongoing. Mars is smaller than the Earth, against all expectations. This can only be explained by the spread-out of the proto-Asteroids Cloud before Mars' final formation, resulting in a much smaller cross-section of the cloud at Mars' orbit level.

The Trojan Asteroids are something strange. But also there, we can assume that the cloud, close the eventual orbit of Jupiter was already spirally stretched, so that the astringency of that portion of the spiral could not entirely take place: the centre part of that circular section of the cloud contracted towards Jupiter, but on both sides in the same orbit the gravitation forces did not reach sufficiently far and so there stay behind two groups of Asteroids, symmetrically positioned relative to Jupiter.

Finally, the above thoughts about Jupiter bring us to a solution for Jupiter's tilt. The spiral cloud where Jupiter and the Trojan Asteroids were made out measured at least one third of the orbit circumference. But as well, that part of the cloud filled several orbit widths, with their own velocities and orbit periods. The tilt is about 26°, but the several fractions of this cloud got different orientations of this same tilt after many orbital periods. It is perfectly possible that the grouping of those different orientations of this tilt resulted in the average tilt of 3°.

7. Additional validation of the model.

The orbit velocity of Mercury – *The orbit velocity fits the model*

The kinetics the planet P, which was applied for Jupiter above, can also be applied for a core-planet, for instance Mercury. The speed, consisting of its orbital speed and its rotation speed, should comply with the explosion speed, reduced with the speed due to the solar gravity.

$$v_P + \omega_P R_P = (3 N_A k T_\odot / m_m)^{-1/2} - (GM_\odot / R_\odot)^{-1/2} + (GM_\odot / R_P)^{-1/2} \qquad (3.3)$$

The rotation velocity of Mercury is negligible.
Using table 2.1, the average orbital speed is :

$$v_P = 4.8 \times 10^4 \ m/s$$

With this equation, the eruption temperature can be estimated out of (3.3). For Mercury, the corresponding solar eruption temperature is just below $10^7 K$. It is not a surprise that the temperature for the proto- gas planets and these from the proto-core-planets correspond. Even the slight difference between both temperatures is not extraordinary. The solar spot probably was a little colder since it is closer to the Sun's surface and its mass is much smaller than that of the surroundings.

8. Conclusion: the formation of our planetary system.

The assumption of a huge solar protuberance, adopted at the beginning of this work appears to give, by using classic physics and the Maxwell analogy for Gravitation, a first glance of the complete description for the creation of our planetary system, and the eccentric orbit of Mercury, Mars and Pluto.
The planets were created from one eruption, but consisted of two successive eruption shocks: a first eruption shock of mainly hydrogen at one side of the protuberance (proto-Uranus (!), -Neptune, -Saturn, -Jupiter), followed by an implosion-eruption shock due to the first shock wave at the other side of the protuberance (proto-Mercury, -Venus, -Earth, -Mars).
One by one, the planets have been separated from the cloud rather quickly, starting with the outer planets Neptune and probably Pluto, followed by Uranus, Saturn and Jupiter with the Trojan Asteroids on the one hand. The planets Uranus and Neptune got inverted during their formation. Pluto arose probably from a small limb out of Neptune.
On the other hand we had first Mercury, followed by Venus, the Earth, Mars –together with the proto-Asteroids cloud– , and the Asteroids Ring. The Asteroids remained at last as coagulated scraps in the spiral, and in the end a central Asteroids Ring.
Many parameters have been checked with the model. The planets' axial tilts comply with the model, including these of Uranus and Venus. Their composition, size, mass, orbit, and rotation period comply as well. The orbit velocity of Mercury complies as well. We did not find any significant parameter contradicting the model.

9. References and interesting lecture.

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