The common cause of epicycloids and dark matter, part 1

A paper by

Dr. Norbert Südland, Aalen, 15.9.2008 (latest amendments 15.9.2008)
Dpl. Ing. Matthias Krause, Kirchzarten, 1.9.2007 (latest amendments: 15.02.2009)

Translated by Sylvia Best

Subtitle:

Visual and gravitational rotation points of masses and their mathematical calculation.

Aim

This paper examines the calculation of the correct gravitational rotational point of a mass system. It examines whether there is a connection between the epcycloids of the times before Kopernikus and today's mysterious Dark Matter.

Exact calculation of the satellite orbits of WMAP and SOHO shows that dark matter can also be calculated in the solar system. The comparability of galactic mass distribution with that in the planetary system is examined and the common factors of the two mass systems will be compared. Mathematical examination shows the reliability of the basis for the calculations. This examination will compare using the gravitational rotation point with using the visual rotation point. The significance of using the gravitational rotation point for every mass system will be mathematically proved, and we will show how to calculate it exactly.

The calculations used are not shown within the main text but are appended to this essay in order to ensure clarity. All necessary formulae and explanations needed for the calculation and description of gravitationally inter-dependent masses will be found in the appendix.

In a second paper the measurable mass amount of a galaxy will be calculated. A third paper will mathematically prove the miscalculation at the basis of the 'Pioneer Anomaly', and the 'Swing-by-Anomaly' will be investigated in the same way.
Finally, the measured and calculated values will be compared and discussed in context.

Contents

1. How Epicycloid Calculation Came About

Even thousands of years ago mankind was considering the movement of planets though the star-strewn skies. All celestial bodies circulated around the earth according to set times. This was also observed in ancient Greece at the time of Ptolemy, who developed the theory named after him. The particularity of the Ptolemaic theory was that it considered the earth to be in the centre of the universe, with all the celestial bodies circulating around it.

The movement of certain planets (for instance Jupiter), which appear to perform a 'cross-over' loop in the course of a year, was particularly significant. Such a course could not be explained with a regular movement of the earth. And so the so-called 'epicycloids' were invented. This word is based on two Greek words '*epi'* which means '*on'* and '*cyclos'* meaning '*circle'*. By imagining a smaller circle on which the planet was supposed to rotate while rotating on a larger circle around the earth, the apparent 'cross-over' could be explained. The 'cross-over', which was visible from the earth, was supposed to have come into being by the planet sometimes rotating on the smaller circle in the opposite direction to that of the larger circle. Of course, both the sun and the moon were supposed to be rotating around the earth, as shown in the following diagram. **Visually**, one can see from the earth how the sun is rotating around it within a year. Trying to calculate the mass of the sun as it is supposed to circulate around the earth, it becomes clear that a smaller mass than that of the earth's will be the result, just as the mass of the moon rotating around the earth is only one eightieth of the mass of the earth.

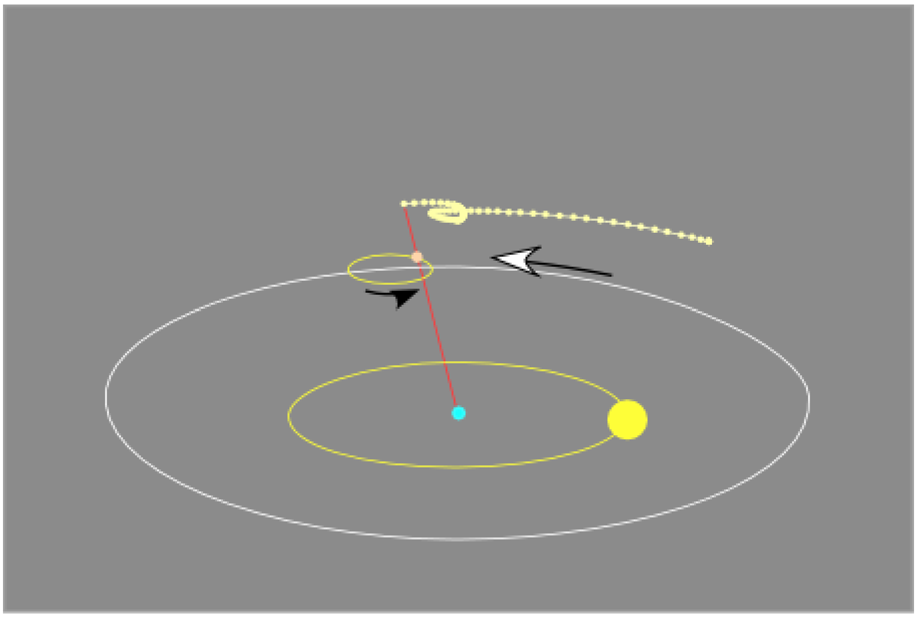


Diagram 1 *The referral point for all masses in the solar system in this diagram is depicted as the earth (blue dot). In ancient times, up to the middle ages, one believed in the Ptolemaic worldview it had the earth as its visual rotational centre.*

If it had been known at that time that in order to achieve nuclear fusion in the sun a certain minimal amount of mass was essential, one would even then have needed to invent 'dark matter'. An exotic dark matter, which reduces its gravitational force in inverse proportion to its distance from the sun. Or the other way round, one which built up its gravitational force by several thousand times, between the surface of the sun and its centre in order to produce the necessary pressure for nuclear fusion.

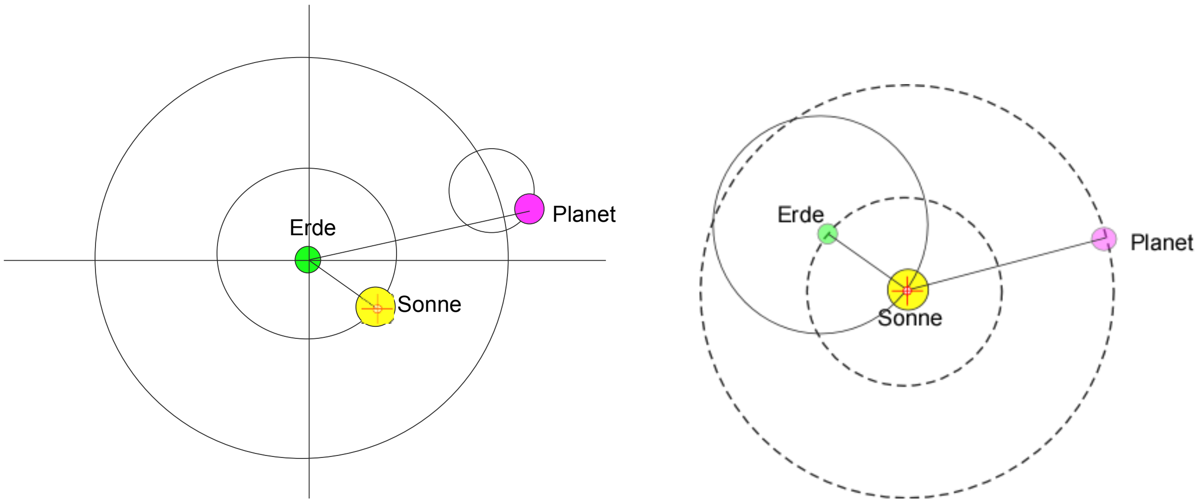


Diagram 2 *A comparison between the Ptolemaic image of the world, with the invented Epicycloids, and the Copernican image, with the sun at its centre, shows at a glance the different centres rotation.*

Fortunately, Nicholaus Copernicus recognized in the 16th century that the earth rotates around the sun, and not the sun around the earth. It all fits together as long as one starts from the correct **gravitational**, rather than the **visual**, centre of rotation. There is no need to create exotic Dark Matter for the sun, and there is also no need for Epicycloids in order to explain the apparent oppositional loop (as seen on the sky from earth) of Jupiter. When the earth rotates around the sun, it passes Jupiter on the inner orbit around the sun, and for a short time Jupiter appears to go backwards along its orbit. It is so easy to explain it all when one starts with the correct **gravitational centre of rotation**. There is no need to invent Epicycloids or exotic dark matter for the sun.

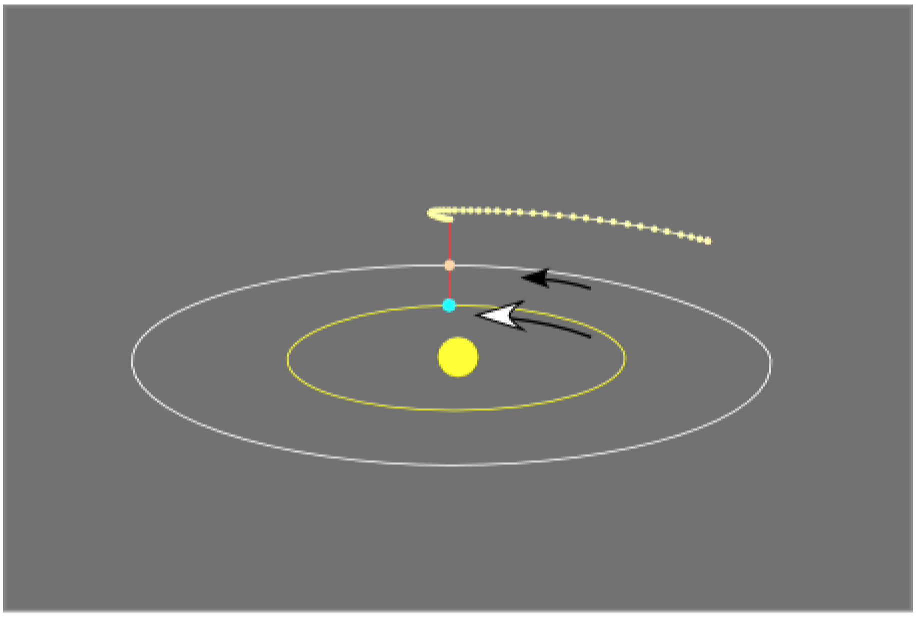


Diagram 3 *In this diagram the sun represents the reference point for all masses in the solar system (yellow dot). From the middle ages onwards the Copernican idea of the universe, with the sun as the visual centre of rotation, was generally accepted. By thus changing the reference point one was able without difficulty to explain the orbit of Jupiter with its apparent oppositional loop in the sky.*

2. Examples for calculating the gravitational centre of rotation in the multi-body system

In the classic Kepler model with its two ideal **point masses** all movements of the two point masses are exactly calculable. The gravitational centre of rotation is equivalent to the mass centre of the two ideal point masses. In reality, however, ideal point masses do not exist, but only voluminous bodies. However, when one leaves aside the two ideal point masses and turns to more than two point masses or expanded bodies or mass areas consisting of many individual masses, it is no longer so easy to determine rotational movements and masses. Where is the gravitational centre of rotation, what is its radius, how can masses which are positioned opposite each other be included in the calculation? Sir Isaac Newton showed by using a spherical homogeneous mass that the gravitational forces can be calculated integrally by using the mass centre. But can the mass be calculated by using the centre? Newton himself could not answer this question with certainty and waited nearly two decades before publishing his gravitational calculation of mass volumes.
At this moment in time the gravitation of masses presents weighty physical problems. There are small incorrections in the calculation of the planetary system which have only become obvious now that exact measurements are possible. But there are huge divergences where the masses of galaxies are concerned. Unfortunately galaxies are very distant from us and therefore we have only our own planetary system to make exact measurements, so to say on our doorstep, using satellites and calculations. Is there a sign even in our own planetary system of traces of dark matter?
The rotational movement of masses in a galaxy is not necessarily directly transferable to our own planetary system. In a galaxy we have to deal with billions of individual bodies, while in comparison our own planetary system with a few large planets appears rather manageable and calculable.

The most comparable entity to a galactic area would be a protoplanetary flat surface consisting of many millions of tiny particles. So the question arises whether comparability is possible within certain limits. This question must be investigated carefully in order to arrive at the correct result. If one could use our planetary system to simulate the gravitational connections in a galaxy it would, for instance, be easy to determine whether one might find in our planetary system that dark matter which has been calculated for the galaxies. The question, therefore, must be:

Is it possible to check and calculate galactic mass distribution in our planetary system?

Answer:

There is in our planetary system one special case of mass distribution which indeed enables a comparative calculation for a galaxy

If it is possible to make such a comparative calculation one is able to make two significant predictions and have them unequivocally determined

1. If the dark matter in the galaxies is the result of a miscalculation, this miscalculation should also become obvious when calculating our own planetary system.

---

2. If the dark matter in the galaxies is the result of a miscalculation, correct calculations should result in the same mass values as in the actually measured mass values of a galaxy or of our own planetary system.

In this essay, these two points of the prediction will be mathematically tested and proved. If these two predictions are correct, that would prove mathematically that Dark Matter is simply the result of miscalculation.
If these two predictions are not correct, so Dark Matter really exists in the Galaxies.

The statements of scientists with regard to this topic are unequivocal:
1. *In our planetary system there is definitely no dark matter, but there definitely is some in the galaxies.*
2. *In view of the high rotational speeds, the measured mass in a galaxy is by no means sufficient to keep the galaxy stable.*

Thus far the statement of the scientists.

Now let us look at the claim that in our planetary system there is an exceptional case of mass distribution which makes a comparative calculation between planetary system and galaxy possible.

There are special points in our planetary system called 'Lagrange' points (discovered and named after the French physicist J.L. Lagrange, 1736-1813). Every large planet in our solar system has five such points along or near its rotational course. If there should be a small, tiny mass at one of those points, which are also called 'libration points', this tiny mass would have the same orbital period around the large central body as the planet to which it belongs. (Please see diagram below.)

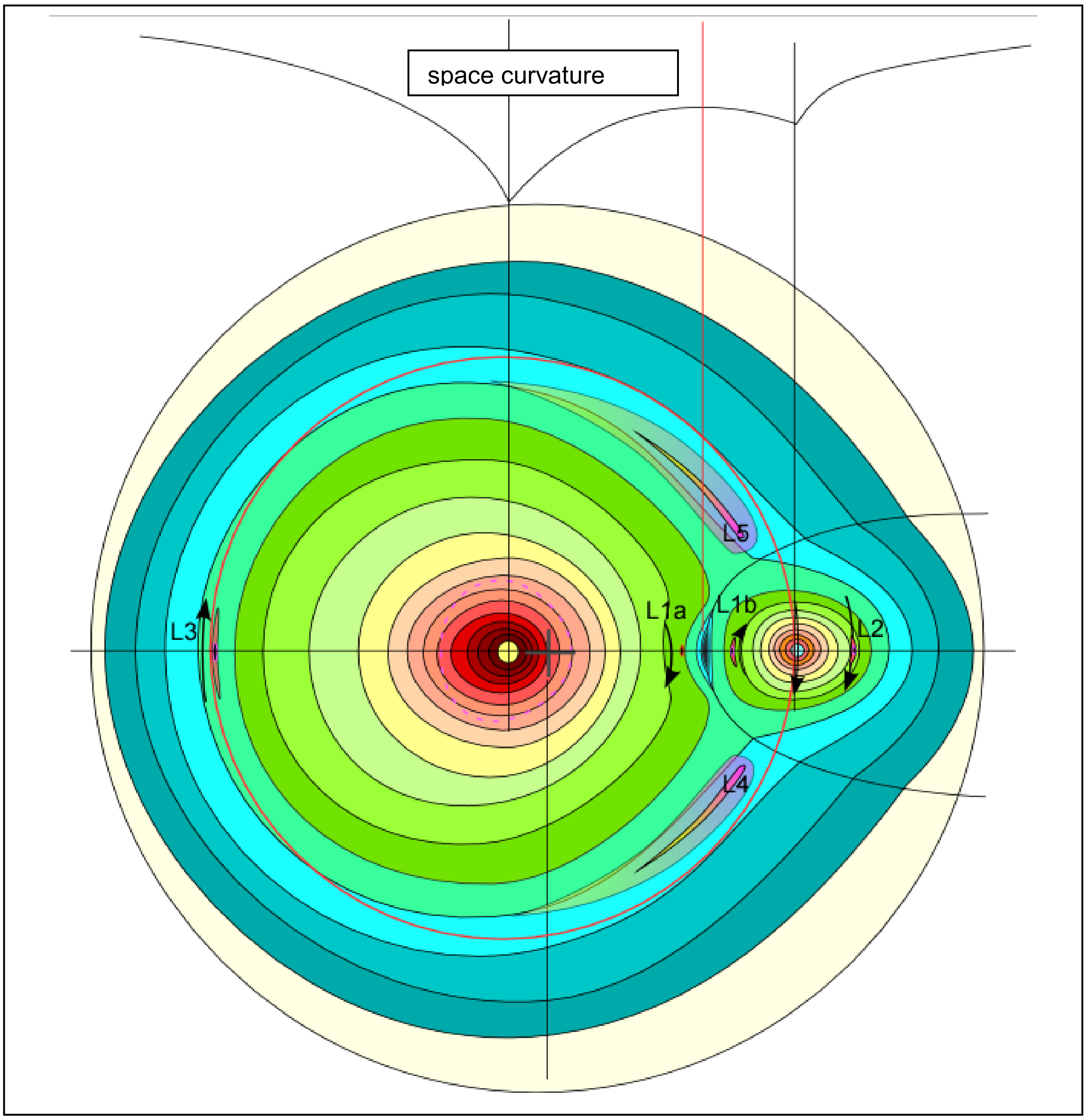


Diagram 4 *The 6 Lagrangian points on a planetary course. Areas of the same colour have equal gravitational forces.*

The tiny mass at such a libration point has in its rotation (on a librations course) around a central body, and that is special:

A small single mass during time T always faces the same constellation of the other effective gravitational masses

Thus, if, for instance, there should be a tiny mass in L1, L2 and L3 (Lagrangian Point 1, 2, 3), the three masses would always form one unalterable line.

For instance, satellite WMAP is in point L2 and forms one line with the earth and the sun. (To be exact, the satellite is not at a standstill behind the earth but actually seen from the earth appears to orbit unevenly around the libration point. But that is irrelevant with regard to looking at the system in its entirety.) With regard to the sun it is always situated behind the earth and rotates around the sun on a course in the same time T as the earth. In order to get around the sun in the same time, however, this satellite must move at a slightly faster rate than the earth, as it is situated on a longer 'outer' orbit. According to Kepler's laws the satellite on an orbit around the sun outside that of the earth should move around the sun at a lower rotational speed than the earth. Since that is not the case, however, satellite WMAP is definitely not orbiting the sun on a **Keplerian orbit,** but on a so-called **libration orbit**. The gravitational forces of earth and sun are added together at a certain distance of the satellite from the earth, so that satellite WMAP orbits the sun at a higher rotational speed than the earth.

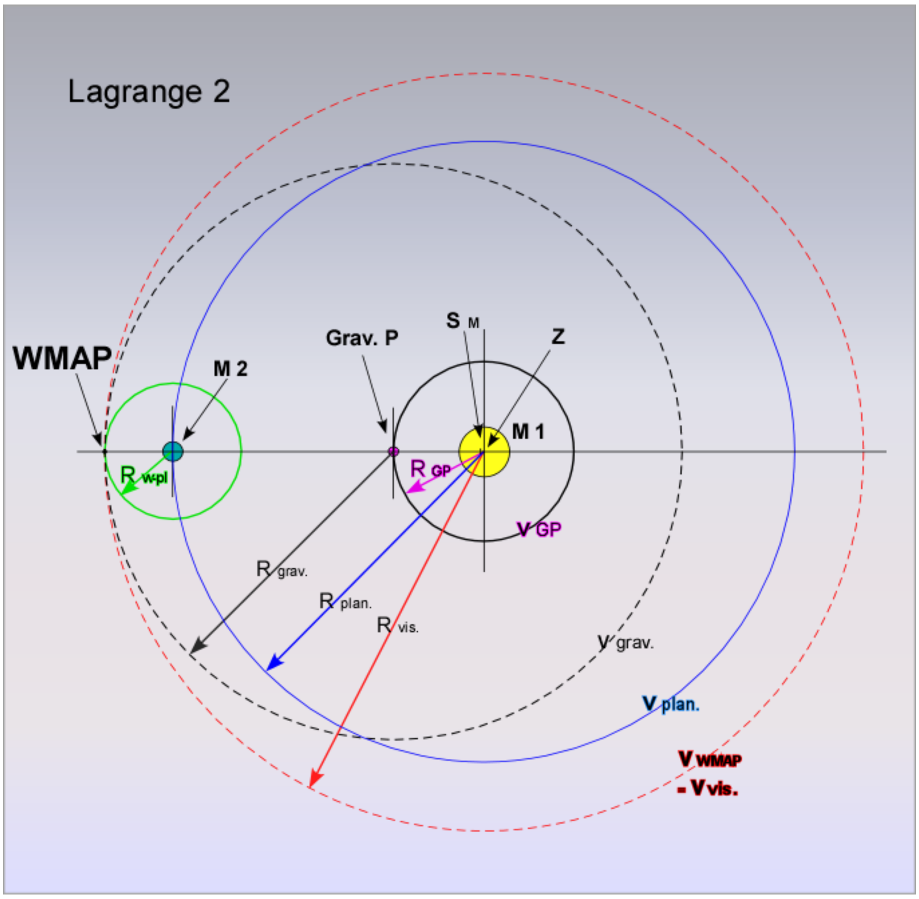


Diagram 5 *This picture shows all relevant, important and calculable parameters for the rotation of satellite WMAP around the sun (v, R, m, and the centres of rotation. All measurements are indexed with relevance to context in the narrative.)*

But what does this special case in the planetary system have to do with galaxies?

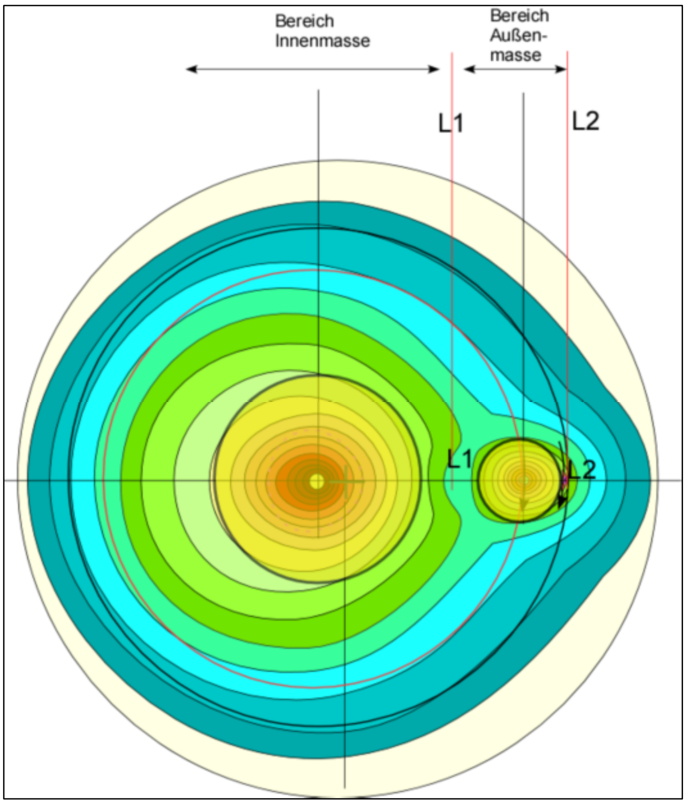
Well, the <u>first dynamic commonality</u> between the solar system + Satellite WMAP and a galaxy is that even when considering a tiny single mass (for instance of a fixed star) in a galaxy <u>throughout the time of the constellation of all other masses it remains constant.</u> It does not matter on which side of a galaxy a mass is situated, as long as it maintains the same distance to the centre. It will always have the same amounts of mass 'behind' it towards the edge, and also 'in front' of it towards the centre. Thus the galactic mass ratios are comparable to those of the Lagrange points in the planetary system. (The individual movements of the stars within the masses is irrelevant when considering a single mass within a galaxy. For comparison: For satellite WMAP in the Earth-Sun-System it is equally irrelevant whether or not there are human beings walking around on the earth – this will not change the amount of mass.)

The <u>second dynamic commonality is the non-Keplerian falling rotational speed on the outer orbit</u>. As galaxy and planetary system become comparable because of this special case in their dynamic movements, it should be possible with the help of relevant calculations to show that the results of the calculations for mass, speed and radii in **both** cases also show comparable results. If instead of the planets in our solar system one uses two or more mass-defined dust rings or parts of dust rings which rotate around the sun, a comparative calculation shows how easy it would be also in such a solar system to calculate some dark matter when using the centre. However, by calculating using the gravitational centre of rotation the masses are calculated correctly. The sample calculations below will impressively show this.

Apart from Satellite WMAP there is a second type of satellite, which however is placed between the earth and the sun. This sun-exploring satellite SOHO is in Lagrange Point 1 exactly on the line **between** earth and sun and thus is comparable to a mass inside a galaxy (positioned between central masses and edge-masses). Of course, for a correct calculation both masses, the inner mass (sun), positioned within the orbit of satellite SOHO, and also the outer mass (earth) positioned outside SOHO's orbit, must be considered. The same is then of course true for all galaxies: here also not only the inner masses but also the outside masses must be involved in order to calculate the masses correctly. (In the scientific galactic calculation, the outer masses, positioned outside an orbit, are not considered at all.)

Satellite WMAP, however, would be the same as a galactic edge mass, which in the calculation shows only masses between it and the centre.

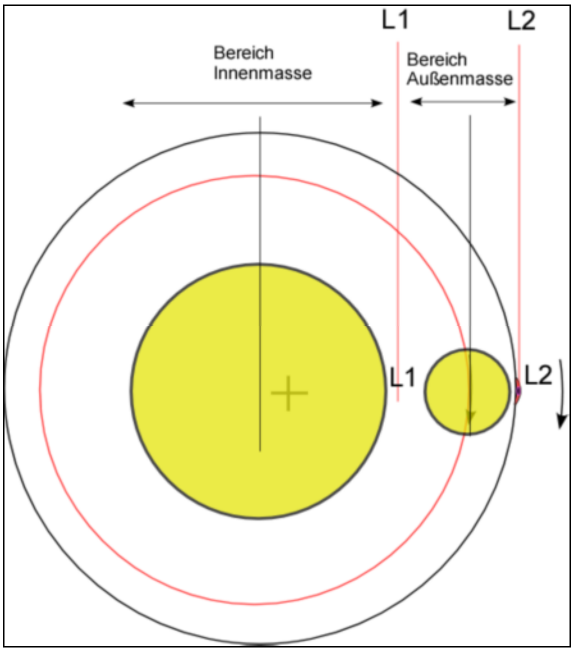
In this essay, both satellites, WMAP on L2 and SOHO on L1, are mathematically compared with galactic mass distributions and are used as examples for all masses in a galaxy.



The following figure shows with great clarity the real comparability of planet systems and galaxies. Taken from the illustrated mass system of **figure 4**, the points **L1** and **L2** remain the same during the following transformation from a planet system into a galactic mass field..

Diagram 4 A
Shows the step-by-step transformation of a planetary system into a galactic field, without changing the main corner values of Lagrange points. The two mass bodies (sun and earth) are transformed into larger areas of mass (for example, rubble clouds with the same mass of sun and earth). The fundamental traits of the mass system thus remain the same pertaining to L1 and L2. However, now there is an area of inner mass and another area of outer mass.

In the following figure the two areas of mass are increased in size and the coloured areas of equal gravitational force are no longer displayed. So far, the main criteria for the two Lagrange points have not been changed in the mass system.



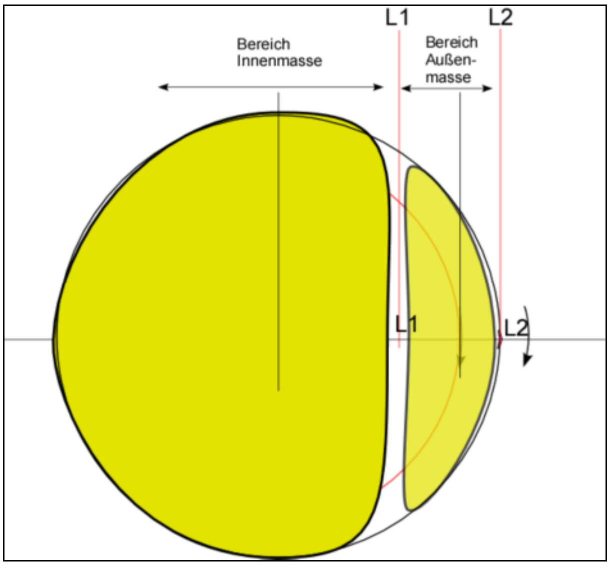


Figure 4b and c
In the end, the shape of the two mass fields does not matter and has been changed to favor a galactic mass field (see the figures above).

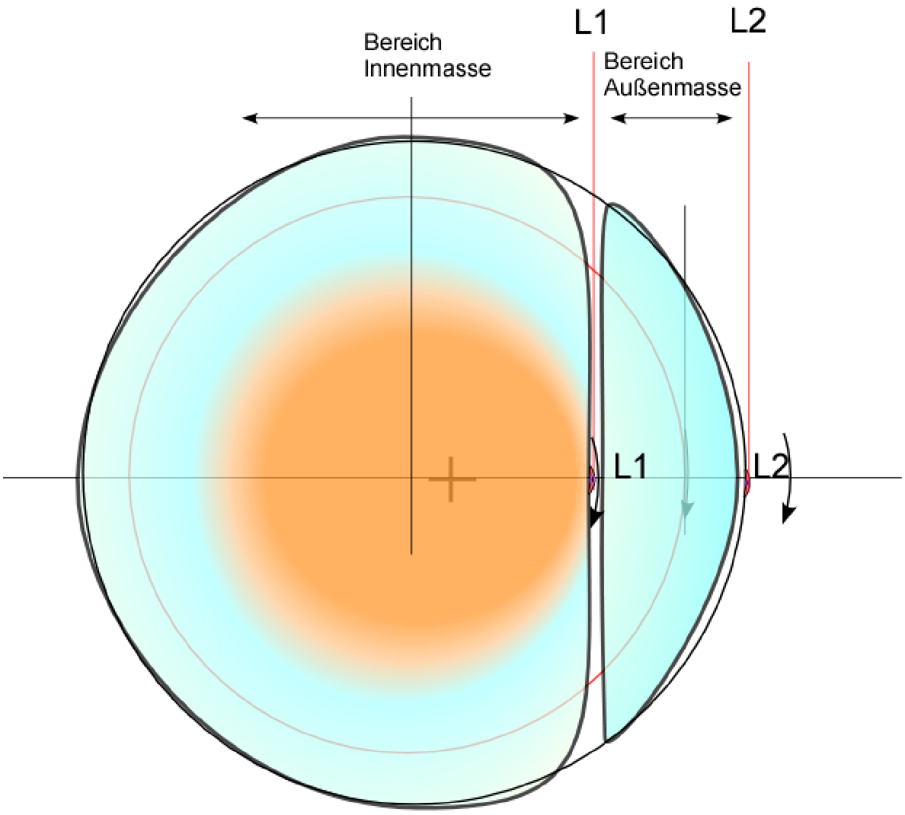


Figure 4d *shows the completed metamorphose into a galactic field. The area of inner mass represents the majority of the mass in the whole galactic system, as is the case in a planet system. The area of outer mass also remains the same during the orbital movement of a mass particle L1. Unlike in planetary systems, where the earth indeed spins and around the sun, in galactic fields the typical movement of outer masses are achieved through the loss of gravitational force on L1 and the gaining of influence on a SOHO mass in L1 during its orbit around the inner mass.*

3. Example calculations with regard to Dark Matter in the solar system

Below I will show, using the example of satellite WMAP, how the rotational speed, the orbit radius and the central mass are calculated. In the appendix, the formulae for the calculations of the values shown here can be re-calculated and verified.

The following formulae are used for the calculation

$$F = \frac{\gamma \cdot m_1 \cdot m_2}{r^2} \quad \text{(N)} \qquad (\textbf{\textit{F1}})$$

$$R_{grav.} = \frac{(F_{M1} \cdot R_1 + F_{M2} \cdot R_{M2} + ...)}{(F_{M1} + F_{M2} + ...)} \text{(m)} \qquad (\textbf{\textit{F2}})$$

$$v = \sqrt{\frac{\gamma \cdot (m_1 + m_2)}{r}} \quad \text{(m/s)} \qquad (\textbf{\textit{F3}})$$

$$T = \frac{r \cdot 2 \cdot \pi}{v \cdot 60 \cdot 60 \cdot 24} \quad \text{(days)} \qquad (\textbf{\textit{F4}})$$

$$m_2 = \frac{F \cdot r^2}{\gamma \cdot m_1} \quad \text{(kg)} \qquad (\textbf{\textit{F5}})$$

$$M = \frac{r \cdot v^2}{\gamma} \quad \text{(kg)} \qquad (\textbf{\textit{F6}})$$

$$a = \frac{\left(\frac{F}{m}\right) \cdot t^2}{2} \quad \text{(m/s}^2\text{)} \qquad (\textbf{\textit{F7}})$$

$$F_{ges.} = F_{e\text{-}w} + F_{s\text{-}w} \quad \text{(N)} \qquad (\textbf{\textit{F8}})$$

$$R_{w\text{-}s} = R_{e\text{-}s} + R_{w\text{-}e} \quad \text{(m)} \qquad (\textbf{\textit{F9}})$$

$$M_{ges.} = m_1 + m_2 = \quad \text{(kg)} \qquad (\textbf{\textit{F10}})$$

3.1 Calculating all WMAP parameters in the earth – sun model

The relationship between the three masses:

satellite,		earth		sun is
1. 10^{-24}	:	1	:	2,000,000

It is a three-body problem. Condition: the positions of the three masses do not change in relation to one another.

<u>Initial Values:</u>

1. Gaussian constant of gravitation 66.7428 * 10^{-12}
2. Mass of the sun (M_s) m2 1.98910000 .10^{30} kg
3. Mass of the earth (M_e) m1 5.9736·10^{24} kg.

4. Distance earth – sun ($R_{e\text{-}s}$) 0.1496150 10^{12} m
5. WMAP mass 1.000000 kg

We look for:
The circulation speed of WMAP around the sun
The distance of WMAP from the earth's centre (or from the sun)
Can we find dark matter in this three-body problem?

Attention, please: the exact mathematical execution of the calculation can be followed in detail in the appendix.

The result of the calculation will show the following:

Earth's circulation around the sun in days:	(***F4***)	365.25 days
Orbital velocity of the earth:	(***F3***)	29,788.15 m/s
Orbital velocity of WMAP :	(***F3/ F2/F1***)	30,086.11 m/s
WMAP circulation around the sun in days:	(***F4***)	365.25 days
Distance WMAP – earth:		1.49651* 10^{9} m
Distance WMAP – sun:		1.5111151* 10^{11} m

As a control, the masses will be calculated using the orbital velocity of WMAP, making use of the gravitational radius.

Gravitational radius of WMAP:	(***F2/F1)***	1.4666631* 10^{11} m
If one uses the gravitational radius to calculate the gravitational mass, the result using formula	(***F6***) is	1.989105974 .10^{30} kg

That is the exact equivalent of the sum of
the masses of earth and sun **addition** of the initial values 1.989105974 .10^{30} kg

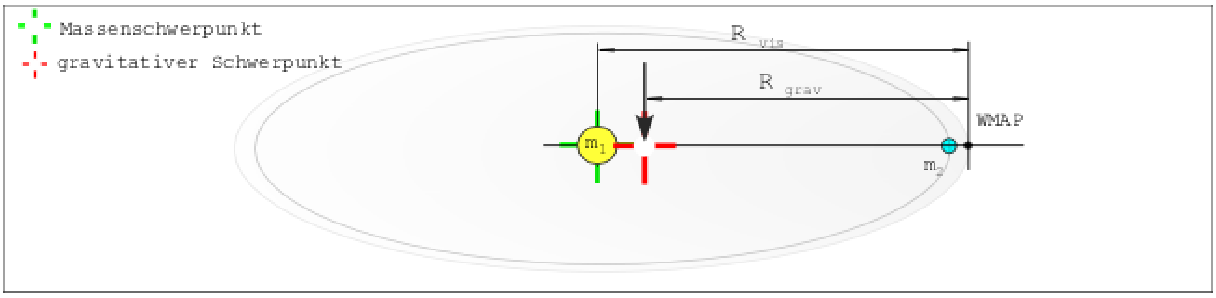


Diagram 6 *shows the relative distances of the masses in the WMAP – Earth – Sun – system to one another, as well as the important reference values*
.

Summary:
All calculated values with regard to the distance of WMAP to earth, as well as the orbital velocity around the sun are found again in the literature and they are mathematically correct; thus the correctness of the calculation using the gravitational point for WMAP is proved unequivocally (please see appendix)

Now follows the comparison with a galactic calculation: The masses of a far-away galaxy are always calculated via the visual orbital velocity of the rotating mass. Present-day science uses the static mass centre (the centre of the galaxy) as the initial point of the radius, and assumes a Keplerian orbit. If one now calculates the gravitationally effective mass (of sun and earth) on WMAP by using the visual radius (sun-centre – WMAP) and the orbital velocity using formula **(F6)** the result is
2.0493924 x 10^{30} kg.
This calculated mass value is **+ 3.031 %** above the actual mass value.
That is equivalent to an additional mass of more than 10,000 times the mass of the earth!

This proves mathematically that dark matter can also be calculated in our solar system. For the formula used above is **the basis for the calculation** of every galactic mass distribution! Using formula **(F6)** to calculate mass volume via the centre in a flat distribution of orbital velocity of the masses on the galactic area will always result in the calculation of a **linearly rising mass volume** towards the edge of the galaxy. (The additional mass is only dependent on the radius, since the orbital velocity of the masses in the galaxy remains unchanged.)

However, if one uses the same formula **(F6)** using the **gravitational centre of rotation** (with the actual gravitational orbit of WMAP, as was done above) rather than using the visual centre of rotation (with libration orbit), the factually correct mass values will be calculated.

This proves mathematically that it is impossible to calculate masses correctly in a three-body system (many-body system = solar system or galaxy) without exactly determining the gravitational centre of rotation.

In diagram 5 all relevant values are recorded schematically. It is easy to recognize that the gravitational centre of rotation for WMAP, which is so important for a correct calculation, is situated between the earth and the sun. If one subtracts the gravitational radius from $radius_{Sun–WMAP}$, the result is the distance of the gravitational centre for WMAP from the centre of the sun.

$$1.5111151 * 10^{11} \text{ m} – 1.4666631 * 10^{11} \text{ m} = 0.044452 * 10^{11} \text{ m}$$

Thus the gravitational centre of rotation (for WMAP) is situated 4.4452 million km above the centre of the sun. (That is equivalent of a distance to the sun's surface of 3.695 million km.)

Now the earth's mass is tiny in relation to that of the sun (1:2,000,000) and therefore this constellation can only in principle be compared to a galactic mass distribution. In an average galaxy the you will not find nearly 100% accumulated at the centre, but only about 25% of the masses, with the remainder being distributed with their density exponentially falling towards the edge of the galaxy. In order to improve comparability between a planetary system and a galaxy, the calculation above should be repeated using a larger 'edge-mass', for instance the planet Jupiter rather than the earth. The percentage of 'dark matter' in the planetary system being calculated via the centre should then rise considerably.

3.2 Calculating all WMAP Parameters in the Jupiter – Sun Model

The details of the individual calculations are exactly the same as in the first calculation, so this will not be shown again. Mentioned here are only the results of this calculation. Please note: The actual centre of rotation of the two large masses is positioned slightly off-centre at a distance of $2.48\ 10^{6}$ km from the centre of the sun. This will not be taken into account in the calculation, as this calculation is to consider principles. Comparability with a galaxy, which scientists always calculate via the centre, should in any case be possible. If one calculates using the actual centre of gravity of the masses of sun and Jupiter, the result will show the same proportion of Dark Matter, as if one calculated via the centre of the sun!

The mass relationship of the three masses

Satellite,		Jupiter	and	sun	is
1.10^{-24}	:	1047	:	ca. 330,000	

Base values:

1. Gravitational constant — $66.7428 * 10^{-12}$
2. Sun mass — $1.98910000.10^{30}$kg
3. Jupiter mass — $1047.56 * 5.9736.10^{24}$kg
4. Distance Jupiter – Sun — $0.780450\ 10^{12}$m
5. WMAP mass — 1.000000kg

We look for:

The orbiting speed of WMAP around the sun
The distance of WMAP from the centre of Jupiter (or of the sun)
Is it now possible to find considerably more Dark Matter in this three-body problem?

The result of the calculation then shows the following values:

Orbit of Jupiter around the sun measured in days: **(F4)** 4,344.68 days

Orbital velocity Jupiter:	(***F3***)	13,062.91 m/s
Orbital velocity WMAP :	(***F3/ F2/F1***)	14,379.82 m/s
WMAP orbit around the sun measured in days:	(***F4***)	4,344.68days
Distance WMAP – Jupiter:		$78.320 * 10^{9}$ m
Distance WMAP – sun:		$8.5877 * 10^{11}$ m
Gravitational radius of WMAP:	(***F2/F1)***	$6.4458591 * 10^{11}$ m
Result of calculating the attracting mass using the **gravitational radius**, using formula	***(F6)***	$1.9953577 \cdot 10^{30}$ kg
That is equal to the sum of the original values of the masses of Jupiter and sun	***Addition***	$1.9953577 \cdot 10^{30}$ kg

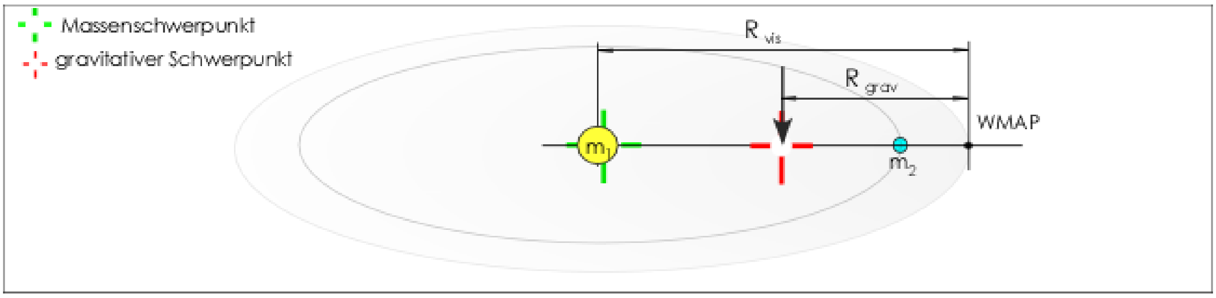


Diagram 7 *Depiction of the relative distances of the masses in the WMAP – Jupiter – Sun – system. The gravitational centre of rotation is clearly distant from the centre of gravity of the masses.*

Summary:
All calculated values are congruent, so the correctness of the mathematical calculation using the gravitational centre of rotation is proved also for the Jupiter – sun – system.
Now follows a comparison with a galactic calculation: The masses in a galaxy are calculated using the orbiting velocity of the rotating masses. In this calculation the static centre of mass (the centre of the galaxy) is used as the origin of the radius.
If one now calculates in the same way the gravitationally effective mass (of sun and Jupiter) using the visual radius (centre of the sun – WMAP) and the orbital velocity of WMAP, formula **(F6)** will yield the result $2{,}6583785 \cdot 10^{30}$ kg.
This calculated mass value is **+ 33.23 % !** higher than the actual mass value. The amount of dark matter, as expected, has risen considerably (more than ten times!)
Thus it is mathemateically proven that also in the solar system there should be a **considerable amount** of dark matter, which is definitely not the case. This clearly shows that the calculation of the mass of a mass system can **not** be done using the static mass centre (and not using the gravitational centre of mass which is not identical with the centre of the sun), in the presence of libration orbits. Libration orbits always exist in a mass system when the attracting masses do not change position (i.e. when the gravitational centre of rotation is not the same as the visual centre of rotation). Thus, using the visual centre of rotation one only calculates a fictitious mass, which is not in any way similar to the actual mass.

(The question is: when can a static mass centre be used for a calculation?
Answer: there is only one special case when such a calculation can be used: if only two mass points without any dimensions were to be calculated. All calculations using actual bodies would be incorrect, though sometimes only slightly, when the calculation is made using the centre of mass. The Pioneer Anomaly shows up exactly that mistake. A relevant calculation is executed at the end of this paper in part 3..)

At present, the scientific community uses the above formula, together with the visual centre of rotation, as the **basis for calculating** every galactic mass distribution! This would also prove that in a galaxy masses can only move along libration orbits and never along Keplerian orbits around the centre. Therefore, the galactic mass calculation which results in dark matter can only be described as a mathematical miscalculation.

The assumption made at the beginning: <u>“Because galaxy and planetary system become comparable due to this exception in their dynamic movements, relevant calculations should also show that the results in both cases are comparable.”</u>

This assumption has been proven, as even in our planetary system dark matter can be calculated in the same way as in galaxies, using orbiting velocity and the visual centre of rotation.

However, using the same formula **(F6)** but the **gravitational centre of rotation** rather than the visual centre of rotation, the correct, actually existing, mass values can be calculated without a problem. If one calculates a galaxy along the same lines, the result should be a total no-existence of dark matter. This prediction will be checked against an actual calculation (nr. 3.4). It is easy to recognize that the **gravitational centre of rotation** which is so important for a correct calculation, is situated between Jupiter and the sun. If one subtracts the gravitational radius from the radius sun – WMAP, the result will be the distance between the gravitational centre and the centre of the sun.

$$8.5877 * 10^{11}\text{ m} - 6.445859 * 10^{11}\text{ m} = 2.1175188 * 10^{11}\text{ m}$$

Thus the gravitational centre of rotation is situated 214.1841 million km above the centre of the sun, a distance roughly equivalent to the orbit of planet Mars. (Please see diagram 2)

The relative masses of Jupiter and sun are about 1 : 315 which is more similar to a galactic mass distribution than that of the earth to the sun. Even more comparable would be a mass relationship of 1:20 or even 1:10.
If one carries out a calculation using such mass relationships, it becomes obvious that the share of dark matter in the end rises to over 100%. In the following third calculation the mass of Jupiter will therefore be increased by a factor of 30, so that the sun would only be ten times as heavy as Jupiter 30.

3.3 Calculating all the WMAP Parameters in the Jupiter30 – Sun Model

In this sample calculation the mass of Jupiter will be increased by a factor of 30, with all other original values remaining the same. The details of the individual steps for the calculation are the same as in the 1. calculation, this will therefore not be shown again.
Please note: The actual mass rotation point of the two large masses lies off-centre in the sun, ca 78 10_6km away from the centre. The displacement of the rotation point is not taken into account in this calculation, as it deals with basic considerations. Comparability with a galaxy should be possible in any case. If one then uses the actual mass gravity point of sun and Jupiter 30 for the calculation, the result is the same percentage of dark matter as if one used the sun's centre for the calculation!

The relationship of the three masses is:	Satellite,		Jupiter		and sun
	1. 10^{-24}	:	31,410	:	ca. 330,000

Initial Values:

1. Gaussian Constant (of gravitation)	$66.7428 * 10^{-12}$
2. Solar mass	$1.98910000 .10^{30}$kg
3. Jupiter's mass	$30 * 1047.56 * 5.9736 \cdot 10^{24}$ kg .
4. Distance Jup – Sun	$0.780450\ 10^{12}$ m
5. WMAP Mass	1.000000 kg

0

Looking for

Gravitational speed of WMAP around the sun
Distance of WMAP from the centre of Jupiter (or from the centre of the sun)
Can more dark matter be found in this three-body problem?

The result of the calculation will then show the following values

Jupiter's rotation around the sun/200 in days:	(***F4***)	4,159.65 days
Orbital velocity Jupiter:	(***F3***)	13,644.01 m/s

Orbital velocity WMAP :	(***F3/ F2/F1***)	17,438.43 m/s
WMAP rotation around the sun in days:	(***F4***)	4,159.65 days
Distance WMAP Jupiter:		$217.045 * 10^{9}$ m
Distance WMAP sun:		$9.9749458 * 10^{11}$ m
Gravitational radius of WMAP:	(***F2/F1)***	$4.777648 * 10^{11}$ m

If one uses the **gravitational radius** to calculate the attracting mass the result using formula ***(F6)*** is $2.1768311 .10^{30}$ kg
That equals exactly the sum of the masses of Jupiter and Sun ***SUM*** of the initial values $2.1768311 .10^{30}$ kg

To sum up:
All calculated values co-incide. This proves that the mathematical calculation via the gravitational rotational point is correct also for the Jupiter30-sun-system.

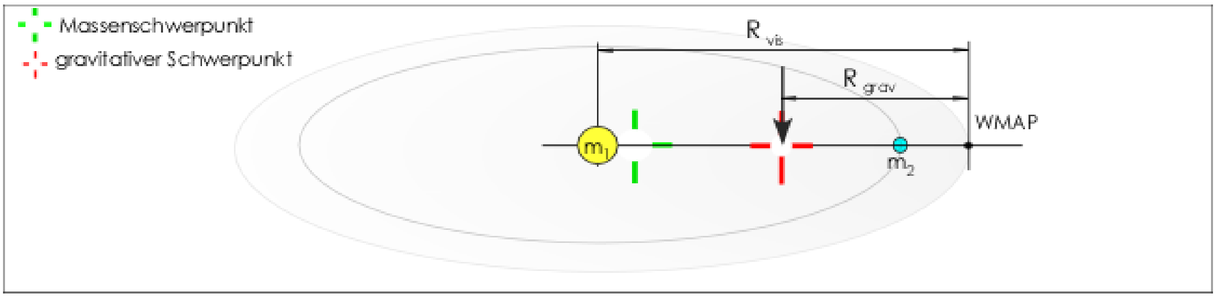


Diagram 8 *shows the relative distances of the masses in the WMAP-Jupiter30-sun-system. The mass' centre of gravity (green hair cross) has clearly moved away from the sun towards Jupiter, in comparison to the previous calculation.*

Now follows the comparison with a galactic calculation. The masses of a galaxy are calculated using the rotational speeds of the rotating masses. In that context, the static mass centre (the centre of the galaxy) is always assumed to be the starting point for the radius. If one employs the same formula to calculate the gravitationally effective mass (of the sun and of Jupiter 30) using the visual radius (centre of the sun – WMAP), formula (**F6**) will lead to a result of $4.5448665 .10^{30}$ kg.

This calculated mass value is **+108.8% !**
higher than the actual mass value. The portion of dark matter in the 'solar system' has again grown significantly, as had been assumed.

The original hypothesis: '<u>Because this exception makes the dynamic movements of galaxy and planetary system comparable, relevant calculations should also be able to show that the results in both cases are comparable</u>.'

This assumption has been confirmed, because even in our planetary system the same amount of dark matter can be calculated in the same way as in the galaxies through using the steady rotational speed and the visual mass centre.

If one uses the same formula (**F6**) but using the **gravitational rotation point** and not the visual rotational centre, this will easily result in the correct, actually existing mass values in the solar system. If one should now calculate a galaxy in the same way, the result should also not contain any dark matter. The following calculation should prove the correctness of this prediction.

It is easy to recognize that the **gravitational rotation point**, which is so important for correct calculations, is situated between Jupiter30 and the sun. If one subtracts the gravitational radius from $radius_{sun–WMAP}$, the result is the distance between the gravitational centre and the centre of the sun.
$10.006900 * 10^{11}$ m - $4,777648 * 10^{11}$ m = $5.229252 * 10^{11}$ m

Thus the gravitational rotation point is 522.9252 million km above the centre of the sun, a distance roughly equivalent to that of the small planets rotating around the sun.

Now the relationship of the masses of the Sun and Jupiter30 is about 10:1, which is much more similar to a galactic mass distribution than any of the other mass relationships so far considered. But the only real comparison would be a collection of more than two masses in a multi-body model.
However, the masses in the planetary system do not move with a constantly equal [*torque*] rotation and therefore the distances of the masses from one another are always changing. But if one looks at two [*particle rings*] circulating the sun, similar to the rings in the Saturn system, the amounts of mass in that 'planetary system' remain equally unchanged as in a galactic mass [*group*]. Such a 'planetary snapshot' is then quite comparable with a galactic mass distribution which also does not change its basic dimensions over time. Thus here, as before, a 'snapshot' is entirely sufficient. If one carries out such a planetary multi-body calculation, it should be possible to calculate the masses accurately. **This multi-body model bridges the gap between the planetary system and the galaxy <u>and thus the direct comparability of the two mass-systems has been shown.</u>**

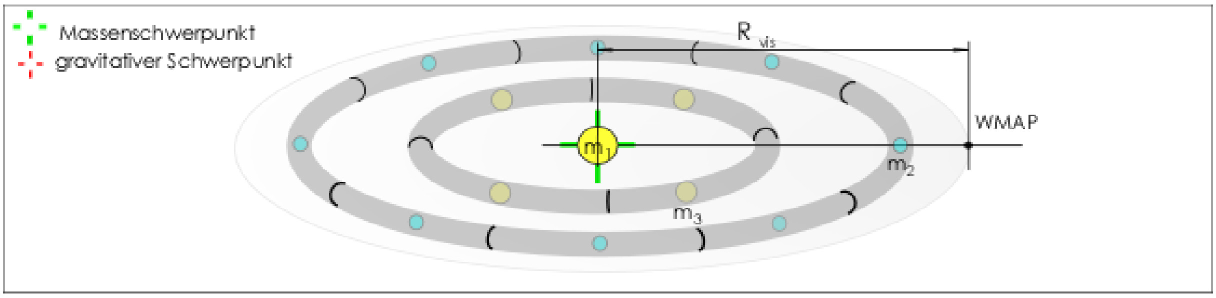
3.4 Calculating all WMAP Parameters in the Multi-Body Model

This calculations is described in detail in the appendix

In this sample calculation the mass of the sun at the centre in relation to Jupiter is reduced to factor 131, 4 further masses (4 segments of the dust-ring) or on an inner 'fixed' orbit, the segments each have the mass of 31 Jupiter-masses, and on the edge orbit 8 masses (8 segments of an outer dust ring), each with an individual mass of 8.25 Jupiter-masses.

The relationship between the four different masses is then

satellite,		segment (planet) outer		segment (planet) inner		and sun
$1.\ 10^{-20}$	:	8.25	:	31	:	137



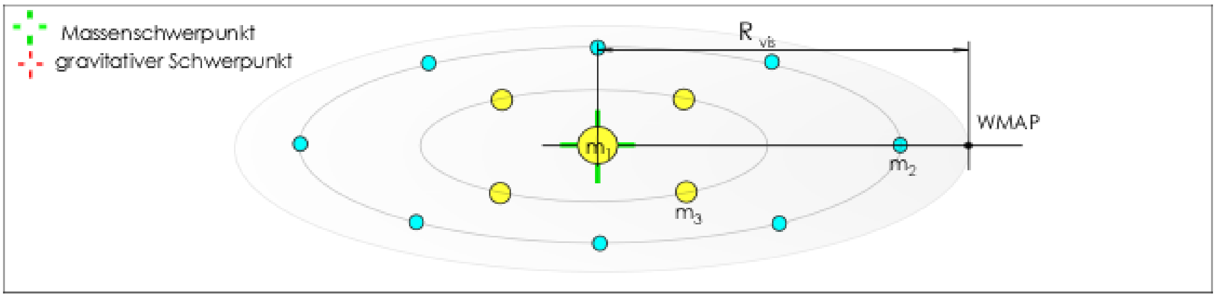


***Diagram 9a+9b** Image of a 'galactic' mass formation (consisting of 'dust rings' in Diagram 9a) in the planetary system which is to be 'pooled' (diagram 9b) in order to depict the relative distances of the masses in the WMAP-many-body-system. In this minimal model there is a central mass, here called 'sun', then follow the 4 inner masses (pooling of the four ring-segments), here coloured yellow, and 8 outer masses (pooling of the eight ring-segments) which are depicted against a blue background. Thus the inner and outer masses are not fixed bodies but the poolings of each dust-ring segment around the central body.*

The masses are pooled on an axis (WMAP – centre and further). To simplify matters, the pooling is depicted as only five mass-points on the axis WMAP – centre. The diagram depiction below shows with the help of inserted arrows which masses are pooled in which point.

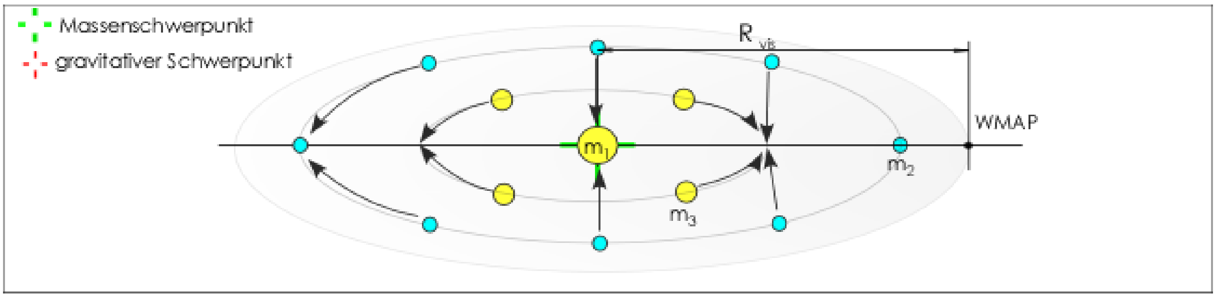


***Diagram 10** The pooling of the masses (forces) in five mass points on the axis WMAP – centre.*
These pooled masses have new names in the mathematical appendix: $M_{2++}+M_a+M_{2m++}+M_{2mh}+M_{3ah}$.
In this context the indices describe the position *s = sol*
a = outside
m = middle
h = behind
+ = added mass
In diagram 12 (below) the same points are also simply numbered through:
$m_{1+}+m_2+m_{3+}+m_{4+}+m_{5+}$

Before the masses can be pooled on the axis WMAP – centre, the masses must be re-calculated as forces and their mass-equivalents, affecting satellite WMAP. (This was also done in the previous calculations.)
All forces of masses which are situated outside the WMAP – centre axis must be reduced according to the parallelogram of forces. (This reduction of forces is new to the considerations.) Attention: it is the blue arrows which are relevant, not the striated ones. The red arrows indicate that part of the forces which cancel each other out

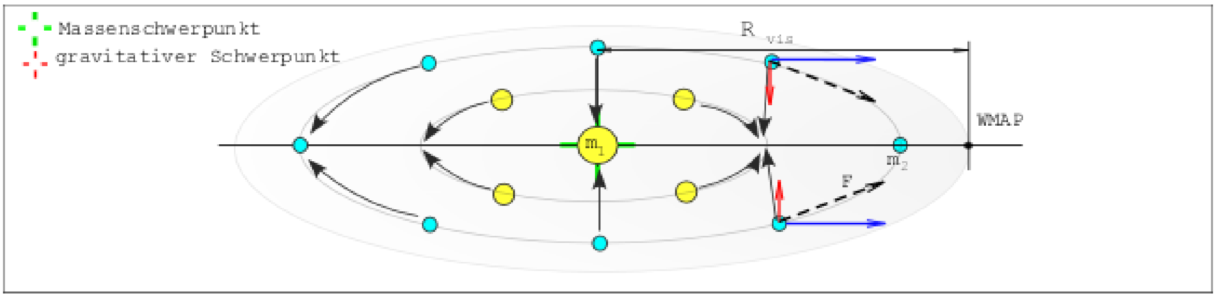


***Diagram 11** Force reductions according to the parallelogram of forces for the masses (forces) **not** situated on the WMAP – centre axis.*

If the masses (forces) on the axis WMAP – centre are pooled, one must first calculate the speed with which mass m2 is orbiting the centre. The rotational speed of m2 is not much greater than it would be if it only orbited m1. Therefore the orbital period of WMAP is now shorter than before, and the speed also increases. This type of pooling of a galactic mass distribution to a planetary scenario makes it possible to calculate the orbit of the WMAP satellite, and thereby the orbit of a galactic boundary mass.

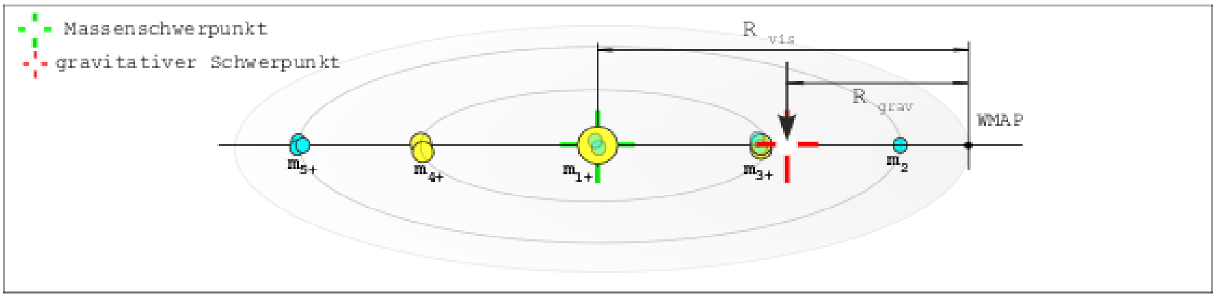


***Diagram 12** Depiction of the relative distances of the pooled masses (forces) in the WMAP multi-body system*

<u>Original Values:</u>
1.Gravitational Constant $66.7428 * 10^{-12}$

2.Sun-mass m1 131*1047.56 * 5/9736·10^{24} kg .
3.Outer mass m2/m5 8,25*1047.56 * 5.9736·10^{24} kg .
4. Inner mass m3/m4 31*1047.56 * 5.9736·10^{24} kg .
5.Distance outer mass – sun 0.780450 10^{12} m
6.Distance Inner mass – sun 0.390000 10^{12} m
7. WMAP Masse 1.000000 kg

We look for

Rotational speed of WMAP around the sun
Distance of WMAP from the centre of the outer mass (or of the sun)
How much dark matter is to be found in this multi-body problem?

The result of the calculation will then show the following values:

Outer mass orbit around the sun m1 in days: (***F4***) 4601.023 days
Orbital velocity outer mass: (***F3***) 12,335.13627 m/s
Orbital velocity WMAP : (***F3/ F2/F1***) 14,970.9894 m/s
WMAP orbit around the sun in days: (***F4***) 4,601.023 days
Distance WMAP outer mass : 166.771630* 10^{9} m
Distance WMAP sun: 9.4722163* 10^{11} m
Gravitational radius of WMAP: (***F2/F1*** ***)*** 5.29824430* 10^{11} m
If one uses the **gravitational radius** to calculate the attracting mass, using formula ***(F6***) the result is 1.7792156* 10^{30} kg
That equals exactly the sum of the mass equivalent of all masses reduced by the fraction of the parallelogram of forces 1.7792156* 10^{30} kg

The addition of all the masses results in the ***Addition*** *of the original values* 2.0462693* 10^{30} kg

To sum up:
All calculated values coincide, thus proving that calculation via the gravitational rotation point is correct also in the multi-body system.
Now follows the comparison with a galactic calculation: The masses in a galaxy are calculated using the orbital speed of the rotating masses. In this calculation the base point for the radius is always taken to be the static mass centre (the centre of the galaxy).
If one now calculates in the same way the gravitationally effective force using the visual radius (centre of the sun – WMAP), formula **(F6)** will lead to the result 3.1808866 .10^{30} kg

This calculated mass value is **+ 55,45 % !**
higher than the real mass value. The proportion of dark matter, as assumed before, has again been confirmed for the galactic planetary many-body mass model. (This calculated mass valued is **78.8% !** higher than that of the mass equivalent.

The assumption made at the beginning: “Because this special case means that the dynamic movements of galaxy and planetary system become comparable, relevant calculations should also show that the results in both cases are comparable.” This assumption has been confirmed because even in a planetary multi-body system dark matter can be calculated, in the same way as in the galaxies via the rotational speed and the visual mass centre.

But if one uses the same formula **(F6)** for the calculation, using the **gravitational**, rather than the visual, **centre of rotation**, the true, actually existing mass equivalents (which must not be confused with the real mass values) can easily be calculated in the planetary or multi-body system. Using the same pattern to calculate a galaxy, there will be no more dark matter. This prediction also has been mathematically proven and confirmed through the example above.

The diagram below shows a galactic mass distribution with the gravitational radius and the pooling of all masses on the extended axis $\mathbf{m}_{\mathrm{WMAP}}$ **Zentrum**.

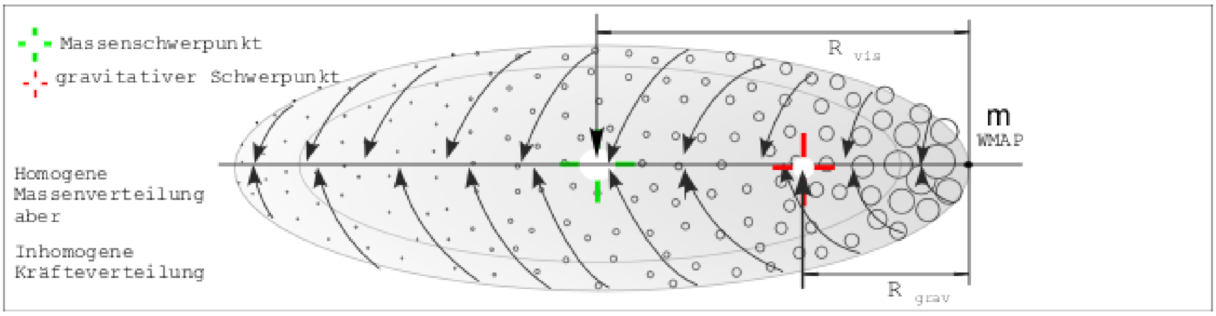


***Diagram 13** Depiction of a galactic mass surface with the pooled masses (forces) as in the WMAP-many-body-system. Both mass systems (Diagram 12 and diagram 13) are directly comparable, the difference between the two, based on the small number of mass points in diagram 12, is lower than 20%.*

It is easy to recognize that the **gravitational centre of rotation** which is so important for the correct calculation is situated between the marginal mass and the visual centre. When the gravitational radius is subtracted from radius$_{Cent-WMAP}$, the result will be the distance of the gravitational centre to the centre of the sun

$9.4722163 * 10^{11}$ m – $5.2982443 * 10^{11}$ m = $4.1739720 * 10^{11}$ m

That means that the gravitational centre of rotation is situated 417.39720 million km above the centre of the sun, which is in the area of the small planets orbiting the sun..

The multi-body example used above shows clearly that it is possible to calculate the masses on a galactic surface. It could be shown by all examples in our planetary system that calculating the masses by using the centre will always lead to a result which is far too high. It was also shown and proved that the number of masses under consideration, whether three, 30 or 300, is ultimately immaterial. It has also been shown that the gravitational centre of rotation does not co-incide with the centre of gravity. It is easy to calculate the galactic surface using a modern PC. A free sample calculation can be downloaded by using the link www.kosmoskrau.de "Rechenwerkzeuge" ("calculation tools")..

.

Now follows a calculation for satellite SOHO, which orbits the sun between earth and sun on the first Lagrangian Point.

3.5 Calculating all SOHO Parameters in the Earth – Sun Model

The mass relationship between the three masses

Earth		Satellite		Sun	amounts to
1	:	1.1^{-24}	:	2,000,000	

This is a three-body problem
Condition: The relative position of the three masses to one another does not change.

Original Values:

1.Gravitational Constant	$66.7428 * 10^{-12}$
2.Sun – mass (M s) m2	$1.98910000 .10^{30}$ kg
3.Earth – mass (M e) m1	$5.9736 \cdot 10^{24}$ kg.
4.Distance Earth – Sun (R_{e-s})	$0.1496150\ 10^{12}$ m
5. SOHO Mass	1.000000 kg

Looking for
The rotational speed of SOHO around the sun
The distance of SOHO from the centre of the earth (or of the sun)

Can dark matter be found in this three-body problem?

Attention please: The exact mathematical execution of this calculation is described in detail in the appendix..

The result of the calculation will then show the following values:

Orbit of Earth around the sun in days:	(***F4***)	365.25 days
Orbital velocity of Earth:	(***F3***)	29,788.15 m/s
Orbital velocity of SOHO :	(***F3/ F2/F1***)	29,492.12541 m/s
SOHO orbit around the sun in days:	(***F4***)	365.25 days
Distance SOHO Earth:		$1.486820 * 10^{9}$ m
Distance SOHO Sun:		$1.4812818 * 10^{11}$ m

As a control measure the masses will be calculated from the rotational speed of SOHO, for this we need the gravitational radius.

Gravitational radius of SOHO: (***F2/F1)*** $1.52633618421 * 10^{11}$m

Using the gravitational radius to calculate the gravitational mass applying formula ***(F6)*** the result will be $1.989105974 .10^{30}$ kg

That exactly equals the sum of the masses of Earth and Sun **Addition** of the initial values $1.989105974 .10^{30}$ kg

---

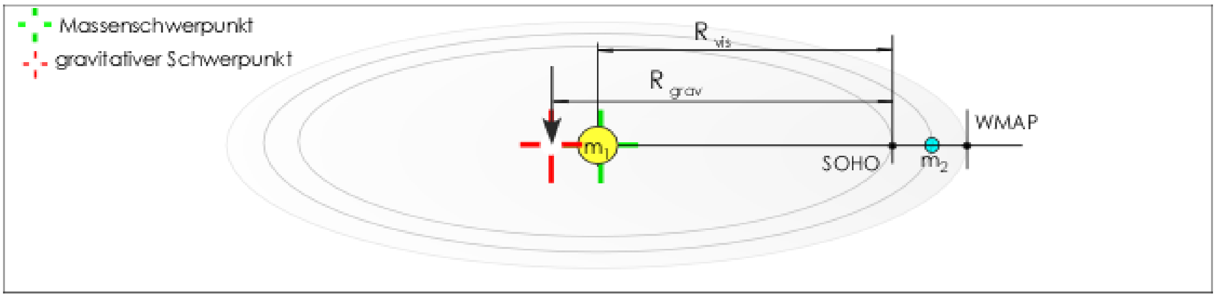


Diagram 14 *Depiction of the relative distances of masses in the Earth-SOHO-Sun-System towards one another. The gravitational centre of rotation for satellite SOHO is behind the sun as seen from Earth!*

Summary:
All calculated values about the distance SOHO to Earth, as well as the rotational speed, are found again in the literature and co-incide mathematically; this unequivocally proves the correctness of calculations using the gravitational centre of rotation of SOHO (please see appendix)

Now follows a comparison with a galactic calculation. The masses in a distant galaxy are basically calculated through the visual rotational speed of of the rotational masses. In present scientific literature the basis for the radius for this calculation is always assumed to be the static mass centre (the centre of the galaxy), and the rotating masses are assumed to follow Keplerian orbits.

If one now uses the same way to calculate the mass (of Sun and Earth) which gravitationally affects SOHO, using the visual radius (Sun-centre – SOHO) and the rotational speed formula **(F6)** will lead to the following result $1.9303916 .10^{30}$ kg
This calculated mass value is **-2.952%**

lower than the real mass value. That would be equal to nearly 10,000 times (exactly 9,828.98 times) the mass of the Earth.
In the previous calculations for satellite WMAP, which is considered as a **peripheral mass in a galaxy**, Dark Matter could be calculated. Satellite SOHO now is considered as a mass **within a galactic surface**. This example of satellite SOHO shows here that in a scientific galactic calculation the inner masses are calculated as being too small (diminished).
If one now sets inner and outer masses on a galactic surface in relation to one another, the difference to the supposedly ‘real’ calculated mass at the periphery of a galaxy appears even more extreme.

This now proves mathematically that both in the solar system and in a galaxy one can only use the mass centre to calculate a **fictitional mass**.
For the formula mentioned just now is the **basis for the calculation** of every galactic mass distribution! Using formula (F6) and the centre and a flat distribution of rotational speed of the masses on a galactic surface will always lead to the result of a **linearly rising amount of mass** towards the edge of a galaxy (or a linearly diminishing amount of mass towards the centre). This gain in mass is solely dependent on the radius as the rotational speed of masses in a galaxy remains nearly constant, whether they are in the centre or on the periphery.
If one uses the same formula **(F6)** using the **gravitational centre of rotation** (with the actual gravitational orbit of SOHO, as seen above) and not using the visual centre of rotation (with libration course), the correct actually existing mass values of the gravitational bodies can be calculated.

This proves mathematically that it is impossible to calculate correctly the masses in a three-body system (multi-body system = solar system or galaxy) without exactly assessing the gravitational centre of rotation.

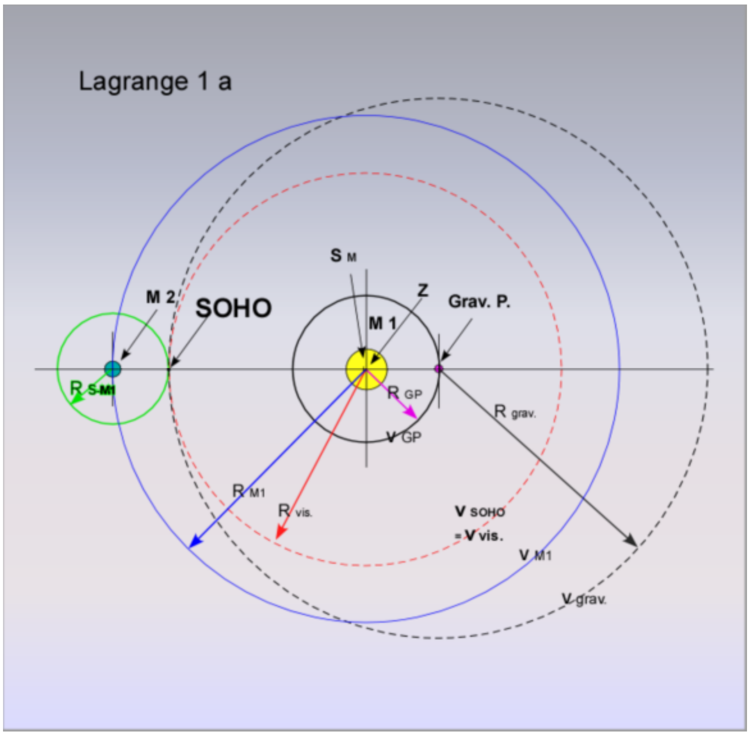


Diagram 15
The schematic diagram depiction of all relevant parameters for Satellite SOHO in Lagrangian Point 1. The centre of gravity is behind the Sun and not between Earth and Sun! It is important to point out here that Satellite SOHO is gravitationally attracted by the Sun, that force being diminished by the gravitational force of Earth. If the Satellite moves nearer to Earth, there will come a point at which the Sun's and the Earth's gravitational forces will cancel each other out. By moving the Satellite even nearer to Earth, it will be possible to keep it on a kind of 'solar synchronous' orbit exactly between Earth and Sun. However, at that point the disturbance caused by [? to] the moon will be too great. From a mathematical point of view, therefore, there would be a second Lagrangian Point 1 (please see the end of this paper, and also diagrams 4 and 18).

In diagram 15 all relevant variables have been entered schematically. It it easy to recognize that the gravitational centre of rotation for SOHO, which is so important for the correct calculation, is **not!** situated between Earth and Sun. When one subtracts the gravitational radius from radius$_{sun–SOHO}$ the resulting negative value is the distance of the gravitational centre of SOHO from the centre of the sun

$1.48128180 * 10^{11}$m – $1.52633618421 * 10^{11}$m = $0.04505438421 * 10^{11}$ m

Thus the gravitational centre of rotation (for SOHO) is 4.5054 million km behind the centre of the sun. (That is about 3.744 million km above the surface of the sun.)

So far our calculations for both satellites have shown that using the centre of rotation in the middle of a galaxy to calculate masses on its edge, as depicted by satellite WMAP, will lead to results which are above the real mass value. Calculating masses near the centre of a galaxy using the same centre of rotation, as depicted by satellite SOHO, will lead to a result which is below the actual mass value. If one inserts these two results calculated using that 'middle' centre of rotation into a diagram which also shows the actual mass values, we can see how those two mass values shift in relation to each other, dependent on the distance from the considered mass.

Of course, in comparison with the sun, earth is only tiny (1:2,000,000) and therefore this constellation only approaches comparability with a galactic mass distribution. In an average galaxy, only about 25% of the masses (rather than nearly 100%) are accumulated near the centre. All other masses are distributed, depending on their density decreasing exponentially towards the edge of the galaxy. In order to achieve a better comparability between a planetary system and a galaxy, the planetary calculation should be repeated using a greater 'edge mass', for instance Jupiter rather than Earth. The proportion of 'negative' matter in the planetary system calculated via the centre should then clearly be higher in the case of SOHO. Calculations using a lower sun-mass or a greater edge-mass leads to expected results.

The results of the mass-calculation are put together in the following diagram.

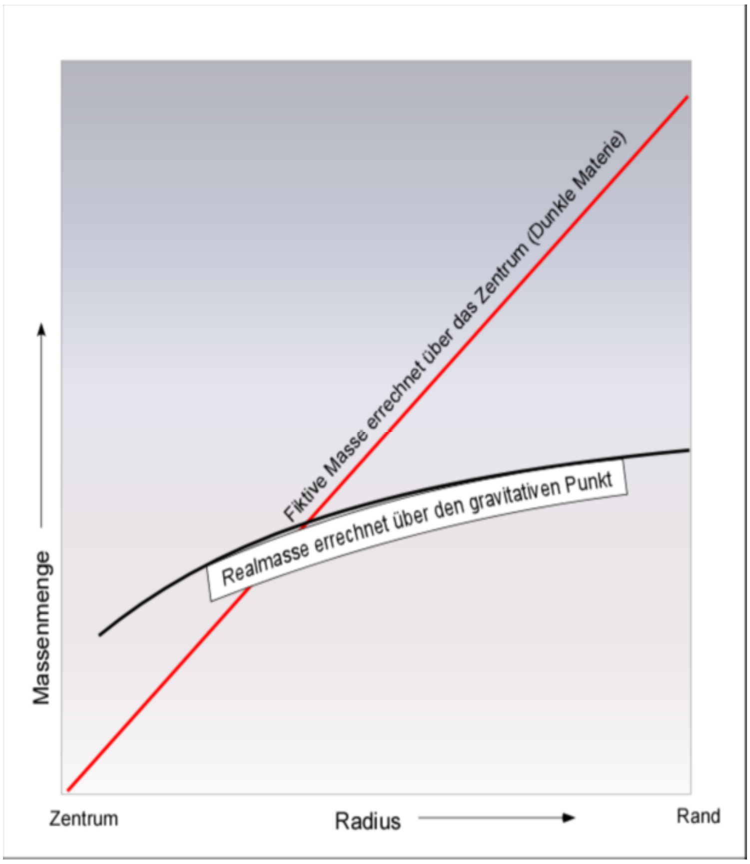


Diagram 16 Schematic depiction of a sum of masses
*The red mass-line (please see footnotes) shows the typical, incorrect, fictive, sum of masses in a galaxy, calculated using the **centre of the galaxy**. (The same is true for the planetary system.) Calculations using the rotational speed of an edge-mass result in mass values which are twice the real mass values calculated via the gravitational centre of rotation (dark matter). The sample calculations using satellite WMAP prove this mathematically. Using the rotational speed of a mass near the centre will result in a smaller mass value than the real one calculated via the gravitational centre of rotation. This also is mathematically proven in the sample calculations for satellite SOHO. The black mass-line shows the mass calculated using each **gravitational centre of rotation**. These are the same as the real mass values. The basis for both(!) types of calculation is formula (**F6**).*

See please footprints **[1] [2] [3] [4] [5]**

In the papers mentioned in the footnotes, and not only in those papers, the formula above is always the basis for a cumulative mass calculated via the centre of the mass. The result of this formula is always a linear rise of masses towards the edge. Even when this formula is not actually mentioned in a paper, the result of this formula as a linear rise of mass value always appears.
Neither in the solar system nor in a galaxy is the gravitational centre of rotation situated in the centre of the masses. This we have proven mathematically by the example of satellites WMAP and SOHO. If one inserts the course of the gravitational centre of rotation in relation to the distance from the centre of the considered mass, the result is a curve from which one can estimate the gravitational radius for a galactic surface. The red-striated graph in diagram 17 below shows the passage of the gravitational centre of rotation on a mass surface. The further the considered individual mass is from the centre of the mass surface, the nearer the gravitational centre of rotation is to the 'central' centre of rotation,

---

[1] Masso , Eduard 1995; S2 und 3 http://www.arxiv.org /astro-ph/pdf9601/9601145.pdf
[2] Das Zentrum der Galaxis S.41 Suw Spezial 2/2004
[3] Sterne und Weltraum 3/2005 S.92 Rechenbeispiel zur Dunklen Materie
[4] Burkert, Andreas (10/2006) Auf der Suche nach dunkler Materie in Ellipt. Galaxien, Sterne und Weltraum S. 23
[5] van Albada et al (1985), ApJ 295, 313

without the two ever actually coinciding. The reason for this can be mathematically proven through the example of the two Pioneer probes.

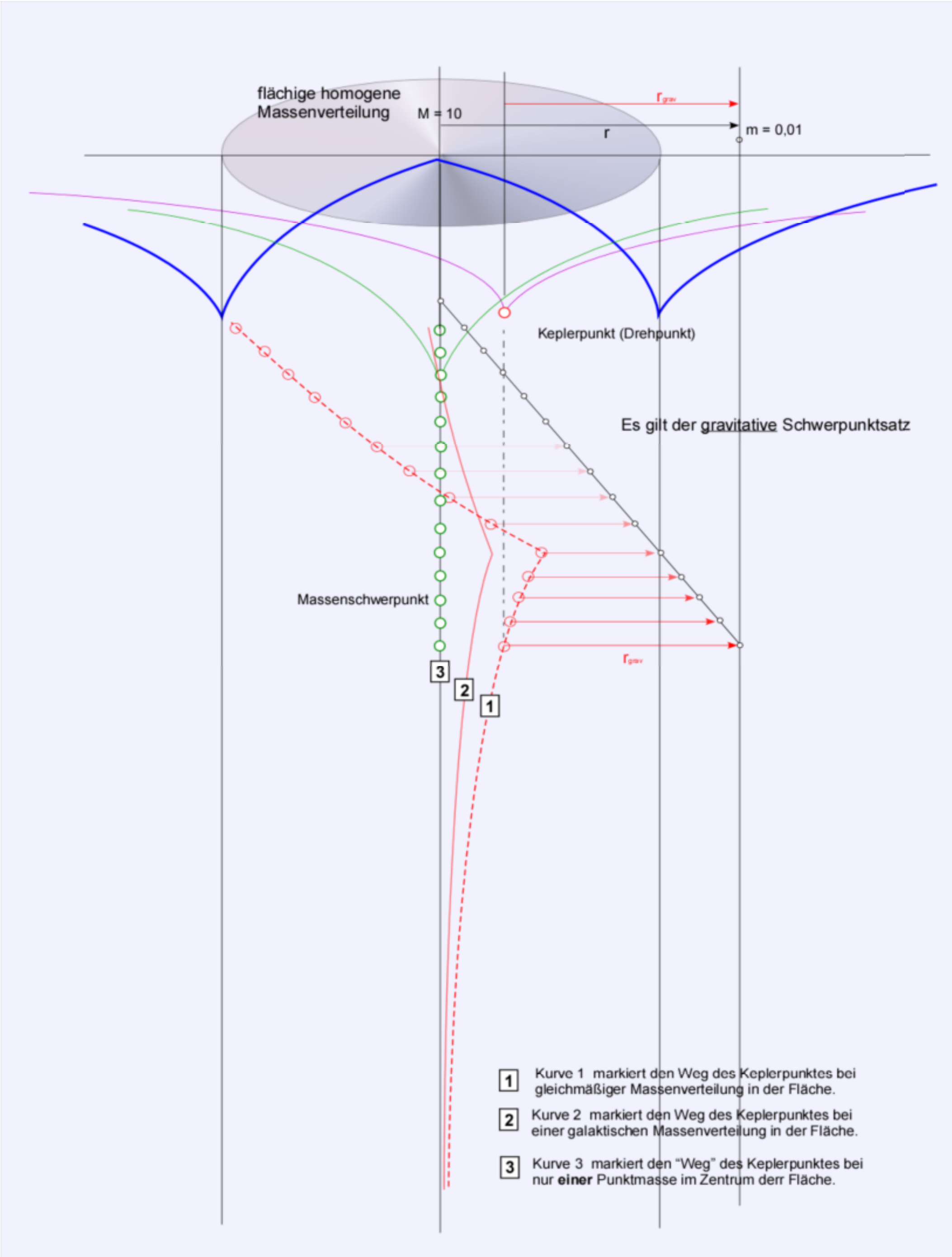


Diagram 17 *This shows the course of the gravitational centre of rotation (red striated graph) taking into account the distance of the considered mass from the visual centre of rotation. The gravitational centre of rotation never reaches the static mass centre, even at the greatest distance of the considered mass, though it approaches it asymptotically.*

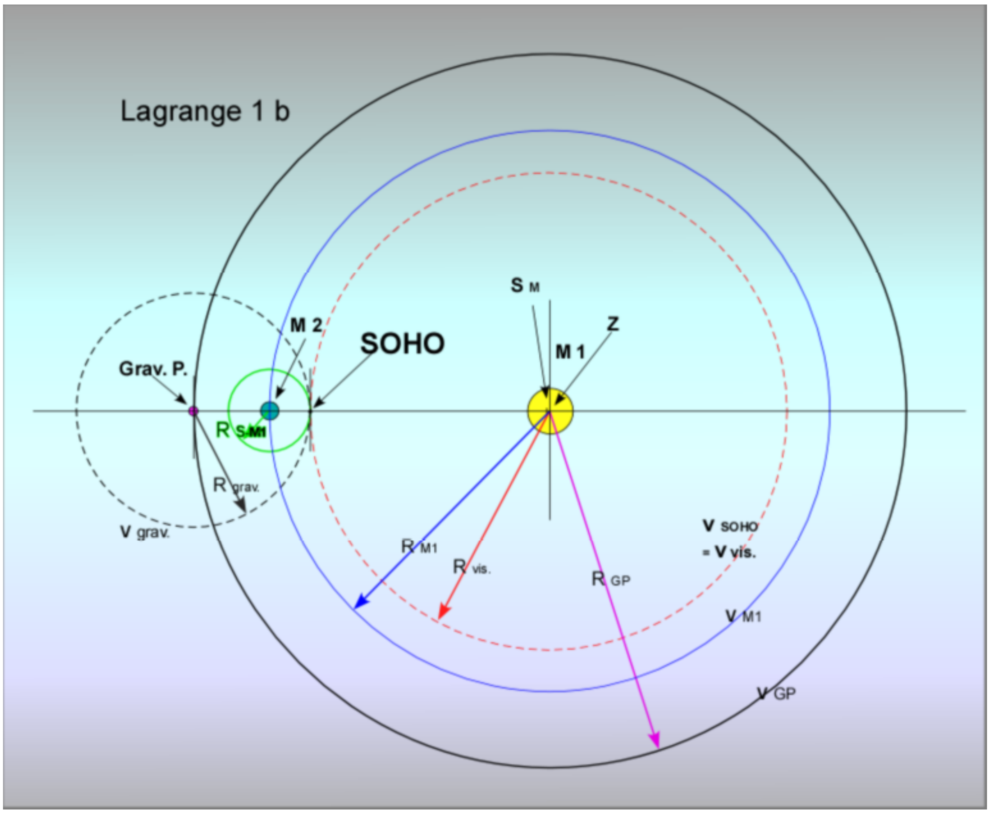


Diagram 18 *In this Lagrangian Point satellite SOHO is gravitationally bound to Earth. It orbits on a course in the opposite direction to the rotation of the Earth around the Sun. (Attention: This calculation is only possible without the Earth-Moon.) The satellite is 203,730.7km distant from the centre of Earth and orbits Earth in exactly one year. That means it remains between Earth and Sun during its entire orbit.*

Summary Part 1

All these mathematical calculations and considerations have shown that the visual centre of rotation of the static mass centre of a mass system are unsuitable, indeed wrong, for correct calculations. Thus epicycles and dark matter have indeed one common cause:

The wrong visual centre of rotation

The correct centre of rotation of every mass system is the gravitational centre of rotation which is calculated using the centre of mass forces.
We have been able to prove that in a galactic mass distribution exclusively, and also in our planetary system, there exist libration orbits. These libration orbits are no Keplerian orbits. Confusing the two orbits leads to the calculation of dark matter in the planetary system just as in a galaxy.

Looking forward

What has been proved here mathematically with regard to dark matter can logically also be applied in the same way to dark energy. In this area also basing calculations on a visual mass centre (in this case the ‘big bang’) is the cause for the mis-interpretation of the gravitational realities.
Thus both dark energy and dark matter are clearly the result of faulty thinking. There is, and this also is mathematically provable, a decrease of masses towards the edge of the universe. There is no dark energy, but there is normal gravitation of masses which in a relativistically constructed universe attracts the masses towards the edge.

4. Appendix I for detailed calculations

Summary of applied formulae

$$F = \frac{\gamma \cdot m_1 \cdot m_2}{r^2} \qquad (F1)$$

$$R_{grav.} = \frac{\left(F_{e-w} \cdot R_e + F_{s-w} \cdot R_s + \ldots.. \right)}{\left(F_{e-w} + F_{s-w} + \ldots..\right)} = \qquad (F2)$$

$$v = \sqrt{\frac{\gamma \cdot (m_1 + m_2)}{r}} \qquad (F3)$$

$$T = \frac{r \cdot 2 \cdot \pi}{v \cdot 60 \cdot 60 \cdot 24} \qquad (F4)$$

$$m_2 = \frac{F \cdot r^2}{\gamma \cdot m_1} \qquad (F5)$$

$$M = \frac{r \cdot v^2}{\gamma} \qquad (F6)$$

$$a = \frac{\left(\frac{F}{m}\right) \cdot t^2}{2} \qquad (F7)$$

$$F_{ges.} = F_{e\text{-}w} + F_{s\text{-}w} \qquad (F8)$$

$$R_{w\text{-}s} = R_{e\text{-}s} + R_{w\text{-}e} \qquad (F9)$$

$$M_{ges.} = m_1 + m_2 = \qquad (F10)$$

3.1 How to calculate all WMAP parameters in the Earth – Sun model

The mass relationship between the three masses

Satellite		Earth		Sun	is
1. 10^{-24}	:	1	:	2.000.000.	

Original Values:

1.Gravitational Constant y	$66.7428 * 10^{-12}$
2.Sun-mass m_1	$1.98910000 \,.10^{30}$ kg
3.Earth-mass m_2	$5.9736 \cdot 10^{24}$ kg.
4.Distance Earth – Sun $R_{e\text{-}s}$	$0.1496150\ 10^{12}$ m
5. WMAP Mass	1.000000 kg
6. Distance WMAP – Earth ($R_{w\text{-}e}$)	(to be used as a variable)

For the calculation it is essential to pool all formulae in an EXCELL Calculation
Only then will it be possible to vary the value for the distance of satellite WMAP to Earth **($R_{w\text{-}e}$)** until the satellite's orbiting time around the Sun equals that of the Earth for the same orbit.

***<u>The result of the calculation then shows the following values</u>*:**

The Earth's orbit speed v_e , calculated using ***(F3)*** is

$$v_e = \sqrt{\frac{\gamma \cdot (m1 + m2)}{R_{e-s}}}$$

$$v_e = \sqrt{\frac{66.7428 \cdot 10^{-12} \cdot \left(1.9891 \cdot 10^{30} + 5.9736 \cdot 10^{24}\right)}{0.149615 \cdot 10^{12}}} = 29788.15 \text{ m/s} \quad (\textbf{\textit{F3}})$$

The Earth's orbit T_e around the Sun (in days) is calculated using the initial values: (***F4***)

$$T = \frac{R_{e-s} \cdot 2 \cdot \pi}{v_e \cdot 60 \cdot 60 \cdot 24} = \frac{0.149615 \cdot 10^{12} \cdot 2 \cdot \pi}{29788.15 \cdot 60 \cdot 60 \cdot 24} = 365.2455$$

Orbit speed 365.25 days

Calculation of the two individual forces affecting WMAP:

Gravitational force Earth–WMAP

$$F_{e-w} = \frac{\gamma \cdot 1 \cdot m_2}{R_{w-e}{}^2}$$

$$F_{e-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 5.9736 \cdot 10^{24}}{1{,}496{,}510{,}000^2} = 0.17802513 \text{ N} \quad (\textbf{\textit{F1}})$$

Gravitational force Sun–WMAP

$$F_{s-w} = \frac{\gamma \cdot 1 \cdot m_1}{(R_{w-e} + R_{e-s})^2}$$

$$F_{s-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 1.989100 \cdot 10^{30}}{(1.496510 \cdot 10^{9} + 1.49615 \cdot 10^{11})^2} = 5.813878 \text{ N} \quad (\textbf{\textit{F1}})$$

The sum of the forces affecting WMAP then equals ***(F8)***

$F_{ges.} = F_{e-w} + F_{s-w} =$ 5.99190360 N

The gravitational rather than the visual radius is essential for the correct calculation
R_{grav} is then calculated using formula **(F2)**

$$R_{grav.} = \frac{\left(F_{e-w} \cdot R_{w-e} + F_{s-w} \cdot R_{w-s} + ... \right)}{\left(F_{e-w} + F_{s-w} + ...\right)} = \quad (\textbf{\textit{F2}}) \text{ with } (\textbf{\textit{F8}})$$

$$R_{grav.} = \frac{(8.7854395 \cdot 10^{11} + 2.6641639 \cdot 10^{8}}{(5.99190360} = 146.66631 \cdot 10^{9} \text{ m}$$

The gravitational radius of WMAP is: (***F2/F1)*** 1.4666631* 10^{11} m

The orbit speed $v_{grav.}$ of WMAP on the gravitational orbit is: (***F3***) 30,086.11 m/s

$$v_{grav} = \sqrt{\frac{\gamma \cdot (m_1 + m_2)}{R_{grav.}}}$$

$$v_{grav.} = \sqrt{\frac{6.674280 \cdot 10^{-11}(1.98910 \cdot 10^{30} + 5.9736000 \cdot 10^{24})}{146.66631 \cdot 10^{11}}} = 30{,}086.10689 \text{ m/s}$$

This orbiting speed of WMAP is expectedly slightly greater than the orbiting speed of Earth around the Sun. The length of the gravitational orbit of WMAP is calculated using the circumference formula

U grav. = R grav. *2*π = 9.2150440* 10^{11} m

The orbiting time of the gravitational orbit of WMAP is then

$T_{grav.} = U_{grav.} / v_{grav.}$ = 30,628,902 sek.

This results in an orbiting time for WMAP $T_{grav.}$ in days

$T_{grav.}$ = 30,628,902 / (60*60*24) = 354.50117 days

Satellite WMAP needs for the gravitational orbit around the gracitational centre of rotation on the Keplerian orbit 354.50117 days.
The visual orbit of satellite WMAP however has the Sun in its centre. This orbit around the sun is slightly longer than the gravitational orbit (please see Diagram 1). If one calculates the orbiting time of the satellite on the visual orbit with speed $v_{grav.}$ the result is the orbiting time on the Libration Course around the Sun.

Radius R_{w-s} is composed from the radius of the Earth's orbit R_{e-s} and the distance of WMAP to the centre of Earth. The distance of Earth to the Sun is known (**R_{e-s}**), the distance of satellite WMAP to Earth (**R_{w-e}**) is unknown and needs to be calculated. That can be done by assuming a value and inserting that value into the formulaic body. Nowadays this can be done easily using any PC and an EXCELL table. This value of the radius R_{w-s} is an important part of other formulae, for instance to calculate the orbiting time.

Formula (***F9***)indicates the sum of the two values $R_{w-s} = R_{e-s} + R_{w-e}$

Value **R_{w-e}** will be continuously changed uneil the orbit speed **T_{lib}** of satellite WMAP takes the sam number of days as Earth takes to orbit around the Sun

The following formula for the orbit speed $T_{lib.}$ **=** **$T_{vis.}$** of satellite WMAP around the Sun on the visual libration course, the orbiting speed can be calculated in days.

Orbit of WMAP around the Sun in days:$T_{lib.}$ (***F4***) takes 365.25 days

$$T_{lib.} = \frac{R_{w-s} \cdot 2 \cdot \pi}{v_{grav.} \cdot 60 \cdot 60 \cdot 24} = \frac{1.5111151 \cdot 10^{11} \cdot 2 \cdot 3.1415}{30{,}086.10689 \cdot 3600 \cdot 24} = 365.25$$

The distance of WMAP to the Sun R_{w-s} is: 1.5111151 * 10^{11} m

As mentioned above, this value is calculated by adding the distance Earth – Sun ($R_{e\text{-}s}$) to the distance Earth – WMAP ($R_{w\text{-}e}$).

$R_{w\text{-}s} = R_{e\text{-}s} + R_{w\text{-}e}$ ***(F9)***

Value $\mathbf{R_{w\text{-}e}}$ is calculated iteratively by insertion into the formulaic structure.
Distance WMAP Earth $\mathbf{R_{w\text{-}e}}$: 1.49651* 10^9 m
This valued is iteratively calculated.

To check whether this calculation is correct using the **gravitational radius** to calculate the attracting mass from the rotational speed, formula (**F6**) will lead to the following result

$$M_{ges.} = \frac{R_{grav.} \cdot v_{grav.}^{\ 2}}{\gamma} = \frac{146.66631 \cdot 10^9 \cdot 30{,}086.10689^2}{6.74280 \cdot 10^{11}} = 1.989105974 \cdot 10^{30} \text{ kg}$$

This calculate mass value equals exactly the sum of the masses of Earth and Sun

Sum of the initial values with ***(F10)***

$$M_{ges.} = m_1 + m_2 = 1.9891*10^{30} + 5.9736*10^{24} =$$

$$1.989105974 \cdot 10^{30} \text{ kg}$$

However, if one uses the radius with which WMAP orbits around the Sun, i.e. the visual radius or the **centre-related radius**, to calculate the entire attracting mass
where $R_{ges.} = R_{vis.} = R_{w\text{-}s}$

$R_{w\text{-}s} = R_{e\text{-}s} + R_{w\text{-}e}$ ***(F9)***

using formula ***(F6)***, the result will be

$$M_{ges.} = \frac{R_{ges.} \cdot v_{grav.}^{\ 2}}{\gamma} = \frac{151.11151 \cdot 10^9 \cdot 30{,}086.10689^2}{6.74280 \cdot 10^{11}} = \mathbf{2.0493924 \cdot 10^{30} \text{ kg}}$$

This **entire mass value calculated via the visual centre of rotation** is considerably higher than the sum of the masses of Earth and Sun

$M_{ges.}$*(sum)*	$= 1.989105974 \cdot 10^{30}$ kg
$M_{ges.}$*(centre-related)*	$=$ **$2.0493924 \cdot 10^{30}$ kg**
The difference is	$= +0.060286426 \cdot 10^{30}$ kg

That is +3.03% or 10,092 earth-masses more than the actual amount of mass!

Remarks with regard to the calculation:
The gravitational orbit of Satellite WMAP T_{grav} is shorter than the visual orbit T_{vis}. The two values are the result of the calculation

$T_{grav.}$	=	354.50117 days
$T_{lib.}$	=	365.25 days
The difference is		10.74883 days

If one calculates the orbiting time of the gravitational centre of rotation around the central body, the Sun, the result is exactly the difference in orbiting time between $T_{grav.}$ and $T_{vis.}$.
The radius of the gravitational centre of rotation to the centre of the sun is calculated as follows.
If one subtracts the gravitational radius from the radius$_{Sun\text{–}WMAP}$, the result is the distance of the gravitational centre of rotation to the centre of the sun.

$$1.5111151 * 10^{11}\ m - 1.4666631 * 10^{11}\ m = 0.044452 * 10^{11}\ m$$

The orbital velocity $v_{grav.}$ WMAP on the gravitational orbit is 30,086.11 m/s
From the two previously mentioned values is calculated the orbital distance of the gravitational centre of rotation around the visual centre of

The orbital velocity $v_{grav.}$ WMAP on the gravitational orbit is 30,086.11 m/s
From the two previously mentioned values is calculated the orbital distance of the gravitational centre of rotation around the visual centre of

$$U_{grav\ point} = R_{grav.\ point} * 2 * \pi = 0.279291916 * 10^{11}\ m$$

The duration of the orbit of the gravitational centre of rotation around the visual centre is

$$T_{grav.\ point} = U_{grav.\ point} / v_{grav.} = 928{,}308.5\ sek.$$

From this one can calculate the orbital period for the gravitational centre of rotation $T_{grav.point}$ in days
$T_{grav.}$ = 928,308.5 / (60*60*24) = 10.7443 days

The difference of the two orbital periods of WMAP and T_{lib} and T_{grav} is 10.7488 days

The two values are nearly identical. From this one may deduce a direct connection between the gravitational centre of rotation and the gravitational orbit of WMAP.

---

1. Calculating all the WMAP Parameters in the Multi-Body Model

The relation between the four masses therefore is

Satellite,		Planet (outer)		Planet (inner)	and	Sun
$1.\ 10^{-20}$	:	8.25	:	31	;	137

Initial Values:

1.Gravitational Constant	$66.7428 * 10^{-12}$
2.1x Sun Mass m1	$131 * 1047.56 * 5.9736 \cdot 10^{24}$ kg .
3.8x Outer Mass m2	$8.25 * 1047.56 * 5.9736 \cdot 10^{24}$ kg .
4.4x Inner Mass m3	$31 * 1047.56 * 5.9736 \cdot 10^{24}$ kg .
5.Distance Outer Mass – Sun R s-a	$0.780450\ 10^{12}$ m
6.Distance Inner Mass – Sun R 2m++	$0.390000\ 10^{12}$ m
7. WMAP Mass	1.000000 kg

Aim of the calculation:

Finding the orbital speed of WMAP around the sun.

Distance R_{w-a} of WMAP from the centre of the outer mass (or of the sun).

How much dark matter can be calculated via the centre in this multi-body problem?

Clustering of the individual masses on the axis (straight) WMAP – centre in the simplifiered process.
The exact distances of the individual masses to WMAP are not taken into account here (non-trigonometric). The masses are roughly clustered, which is acceptable and sensible in vire of the low number of individual masses. Only a mass model with more than 350 mass points would lead to a mistake of less than 1%. The mass model considered here has 13 individual masses which might result in an estimated fault of +/– 2%.
Usually the forces exerted by the individual masses are clustered, but to simplify matters here the masses are clustered directly, reduced by that part of the parallelogram of forces representing those forces which cancel each other out.

<u>The result of the calculation then shows the following values:</u>

The sum of all masses results in the ***sum*** of the initial values 2.0462693* 10^{30} kg

It is essential for the correct calculation that all the following formulae are put together in an EXCELL calculation. Only that enables thee value for the distance of satellite WMAP to the outer mass (R_{w-a}) to be changed continuously until the orbiting time of the satellite around the sun is equivalent to that of the outer mass around the sun,

<u>The result of the calculation will then show the following values:</u>

The outer mass orbit T_a around the sun in days is calculated from the initial values (**F4**)

$$T = \frac{R_{a-s} \cdot 2 \cdot \pi}{v_a \cdot 60 \cdot 60 \cdot 24} = \frac{0.78045 \cdot 10^{12} \cdot 2 \cdot \pi}{12{,}335.13627 \cdot 60 \cdot 60 \cdot 24} = 4{,}601.023$$

Orbiting time 4,601.023 days

The orbital velocity v_a of the outer mass is calculated using formula (**F3**) and is

$$v_a = \sqrt{\frac{\gamma \cdot (m1 + m2 + ...)}{R_{a-s}}} = \sqrt{\frac{\gamma \cdot (M_s + M_a + M_m + M_{mh} + M_{ah})}{R_{a-s}}}$$

To make things easier, the masses here are only added up and not, as it should be, put together via the forces and mass equivalents.

M_a = 5.9736 *10^{24} * 1047.56 * 8.25 = 0.5162606*10^{29} kg
Is the outer mass M a, behind which WMAP is situated

M_{2m++} = 5.9736 *10^{24} * 1047.56 * (31*2*0.714+8.25*2*0.3) = 3.0799170*10^{29} kg

The two outer masses are added to the two inner masses which are still placed in front of the sun (M_{2m++}).
All masses are reduced by the parallelogram of forces (0.714, 0.3).
This pools all the masses which are nearer than the sun. Only the masses situation behind the sun are missing.

M_{2mh} = 5.9736 *10^{24} * 1047.56 * (31*2*0.9) = 3.4917991*10^{29} kg
The two inner masses which are behind the sun, are added together (M_{2mh}). Both masses are reduced by the proportion of the forces parallelogram (0.9)

M_{3ah} = 5.9736 *10^{24} * 1047.56 * (8.25+2*8.25*0.85) = 1.3939037*10^{29} kg
The three outer masses which are behind the sun are added up (M_{3ah}). Two of those masses are reduced by the proportion of the forces parallelogram (0.85).

The entire mass value is then
$M_{ges} = M_{s++} + M_a + M_{2m++} + M_{2mh} + M_{3ah}$ = 1.7792156 10^{30}

The result (reduced by the forces parallelogram) can then be inserted into formula (***F3***). The result of that will be the rotational speed of the outer mass around the central sun at time t_0

$$v_a = \sqrt{\frac{66.7428 \cdot 10^{-12} \cdot (1.7792156 \cdot 10^{30})}{0.78045 \cdot 10^{12}}} = 12{,}335.13627 \text{ m/s} \quad (\textbf{\textit{F3}})$$

Calculating the five individual forces according to (***F1***) which influence WMAP:

Attractive force outer mass–WMAP

$$F_{a-w} = \frac{\gamma \cdot 1 \cdot M_a}{R_{w-a}{}^2}$$

$$F_{a-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 5.1626061 \cdot 10^{28}}{166{,}771{,}630{,}000^2} = 1.2388795 \cdot 10^{-4} \ \text{N}$$

Attractive force M $_{2m++}$ -$_{WMAP}$

$$F_{2m++-w} = \frac{\gamma \cdot 1 \cdot M_{2m++}}{(R_{w-a} + R_{a-s} - R_{2m++})^2}$$

$$F_{2m++-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 3.0799170 \cdot 10^{29}}{(0.166{,}771{,}63 \cdot 10^{12} + 0.780{,}45 \cdot 10^{12} - 0.39 \cdot 10^{12})^2} = 0.66204 \cdot 10^{-4} \ \text{N}$$

Attractive force sun++ – WMAP

$$F_{s-w} = \frac{\gamma \cdot 1 \cdot M_{S++}}{(R_{w-a} + R_{a-s})^2}$$

$$F_{s-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 9.3102752 \cdot 10^{29}}{(0.16677163 \cdot 10^{12} + 0.780450 \cdot 10^{12})^2} = 0.69257 \cdot 10^{-4} \ \text{N}$$

Attractive force M $_{2mh}$ – WMAP (mass is situated behind the sun, behind the centre)

$$F_{2mh-w} = \frac{\gamma \cdot 1 \cdot M_{2mh}}{(R_{w-a} + R_{a-s} + R_{2m++})^2}$$

$$F_{2mh-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 3.4917991 \cdot 10^{29}}{(0.166{,}771{,}63 \cdot 10^{12} + 0.780{,}45 \cdot 10^{12} + 0.39 \cdot 10^{12})^2} = 0.130331 \cdot 10^{-4} \ \text{N}$$

Attractive force M $_{3ah}$ –WMAP (mass is situated behind the sun, behind the centre)

$$F_{3ah-w} = \frac{\gamma \cdot 1 \cdot M_{3ah}}{(R_{w-a} + R_{a-s} + R_{a-s})^2}$$

$$F_{2ah-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1 \cdot 1.3939037 \cdot 10^{29}}{(0.166{,}771{,}63 \cdot 10^{12} + 0.780{,}45 \cdot 10^{12} + 0.78045 \cdot 10^{12})^2} = 3.116842 \cdot 10^{-6} \ \text{N}$$

The total force effective on WMAP then equals *(**F8**)*

$$F_{ges.} = F_{s++} + F_a + F_{2m++} + F_{2mh} + F_{3ah} = 2.75499\ 10^{-4}\text{N}$$

R_{grav} is calculated using formula **(F2)**

$$R_{grav.} = \frac{\left(F_{a-w} \cdot R_{w-a} + F_{s++-w} \cdot R_{w-s} + \ldots.. \right)}{F_{ges.}} = \qquad (\ \textbf{\textit{F2}}\ ) \text{ mit } (\ \textbf{\textit{F8}}\ )$$

The products of force and distance in (**F2**) for the five mass points above the fraction bar are calculated as follows

$$F_{a-w} * R_{w-a} = 1.2388795*10^{-4} * 0.16677163 *10^{12} = \qquad 2.0660995 * 10^{7}$$

$$F_{s++} * (R_{w-a} + R_{s-a}) = 0.692557*10^{-4} * 0.94722163 *10^{12} = \quad 6.560174 * 10^{7}$$

$$F_{2m++} * (R_{w-a} + R_{s-a} - R_{2m++}) =$$
$$0.66204498*10^{-4} * (0.780450 *10^{12} + 0.16677163 *10^{12} - 0.3900 *10^{12}) =$$
$$3.689058 * 10^{7}$$

$$F_{2mh} * (R_{w-a} + R_{s-a} + R_{2m++}) =$$
$$0.130331*10^{-4} * (0.780450 *10^{12} + 0.16677163 *10^{12} + 0.3900 *10^{12}) =$$
$$1.7428109 * 10^{7}$$

$$F_{3ah} * (R_{w-a} + R_{s-a} + R_{s-a}) =$$
$$0.03116842*10^{-4} * (0.780450 *10^{12} + 0.16677163 *10^{12} + 0.780450 *10^{12}) =$$
$$0.53848794 * 10^{7}$$

Adding the five points together will result in the sum (*N m*)
$14.596630 * 10^{7}$

This result will be inserted into $R_{grav.}$

$$R_{grav.} = \frac{14.596630 \cdot 10^{7}}{0.000275499} = 529.824430526 \cdot 10^{9} \text{ m}$$

The gravitational radius of WMAP is: (***F2/F1***) $0.529824430526 * 10^{12}$ m

---

The orbital velocity $v_{grav.}$ of WMAP on the gravitational orbit is: (***F3***) 14,970.98944 m/s

$$v_{grav} = \sqrt{\frac{\gamma \cdot (M_{ges.})}{R_{grav.}}}$$

$$v_{grav}. = \sqrt{\frac{6.674280 \cdot 10^{-11}(1.7792156 \cdot 10^{30})}{529.8244305 \cdot 10^{9}}} = 14{,}970.98944 \quad \text{m/s}$$

As expected, this rotation speed is a little higher than that of the orbital velocity of the outer mass M_a around the sun.
The length of the gravitational orbit of WMAP is calculated using the formula for calculating the circumference

U grav. = R grav. *2*π = 3.3288869* 10^{12} m

The orbital period of the gravitational orbit of WMAP is then

$T_{grav.}$ = $U_{grav.}$/ $v_{grav.}$= 222,355,838 sek.

The result is the orbital period for WMAP $T_{grav.}$ in days

T_{grav}. = 222,355,838 / (60*60*24) = 2,573.5629 days

For a gravitational orbit around the gravitational centre of rotation on the Keplerian orbit, satellite WMAP needs 2,573.5629 days.

However, the visual orbit of satellite WMAP has the sun at its centre. This orbit around the sun is slightly longer than the gravitational orbit (please see diagram 1). If one calculates the orbital period of the satellite on the visual orbit at speed v grav., the result will be the orbital period on a libration course around the sun.

Radius R_{w-s} is the result of adding the radius of the orbit of the outer mass R_{a-s} to the distance of WMAP to the centre of the outer mass. The distance of the outer mass to the sun is known (**R_{a-s}**), the distance of satellite WMAP to the outer mass **(R_{w-a}**) is unknown and must be calculated. This is done by assuming a value and inserting it into the formulae. Nowadays this can easily by done by using an EXCELL table on any ordinary PC.

This value of the radius $R_{w-s} = R_{a-s} + R_{w-a}$ is essential in other formulae, for instance to calculate the orbital period.

Formula *(F9)*indicates the sum of the two values $R_{w-s} = R_{a-s} + R_{w-a}$

Value **R_{w-a}** needs to be continuously changed until the orbital period **T_{lib}** of satellite WMAP takes the same amount of days as that of the outer mass around the sun.

The following formula for the orbital period T_{lib}. = **T_{vis}.** of satellite WMAP around the sun on the visual libration course the orbital period can be calculated.

The orbit of WMAP around the sun takes: $T_{lib.}$ (***F4***) = 4,601.023 days

$$T_{lib}. = \frac{R_{w-s} \cdot 2 \cdot \pi}{v_{grav}. \cdot 60 \cdot 60 \cdot 24} = \frac{9.4722163 \cdot 10^{11} \cdot 2 \cdot 3.1415}{14{,}970.98944 \cdot 3600 \cdot 24} = 4{,}601.023$$

The distance of WMAP to the sun R_{w-s} is: 9.4722163* 10^{11} m

This values is calculated by adding the distance outer mass – sun (R_{a-s}) to the distance of the outer mass – WMAP (R_{w-a}), as mentioned above.

$R_{w-s} = R_{a-s} + R_{w-a}$ ***(F9)***

Value **R_{w-a}** is calculated iteratively by insertion into the formulaic system.
Distance WMAP to outer mass **R_{w-a}** 166.771630* 10^{9} m

This value is calculated iteratively.

To check that the formula is correct it is possible to calculate the attracting mass through the rotational speed using the **gravitational radius**, Formula (**F6**) will render the following result

$$M_{ges.} = \frac{R_{grav.} \cdot v_{grav.}{}^2}{\gamma} = \frac{529.824430526 \cdot 10^9 \cdot 14{,}970.98944^2}{6.74280 \cdot 10^{11}} = 1.7792156 * 10^{30} \text{ kg}$$

This calculated mass value equals exactly the sum of the five pooled mass points
Sum of the initial values using ***(F10)***

$$M_{ges} = M_{s++} + M_a + M_{2m++} + M_{2mh} + M_{3ah} = 1.7792156\ 10^{30}$$

$$1.7792156\ .10^{30} \text{ kg}$$

But if one uses the radius of satellite WMAP's orbit around the sun, i.e. the visual or **centre-related radius**, to calculate the total attracting mass, so that $R_{ges.} = R_{vis.} = R_{w\text{-}s}$

$$R_{w\text{-}s} = R_{a\text{-}s} + R_{w\text{-}a} \qquad \textit{(F9)}$$

Formula (**F6**) will render the result

$$M_{ges.} = \frac{R_{ges.} \cdot v_{grav.}{}^2}{\gamma} = \frac{947.22163 \cdot 10^9 \cdot 14{,}970.98944^2}{6.74280 \cdot 10^{11}} = \mathbf{3.1808866\ .10^{30}\ kg}$$

This **total mass value calculated via the centre of rotation** is considerably higher than the mass value of the five pooled individual masses.

$M_{ges.}$(sum)	$= 1.7792156\ .10^{30}$ kg
$M_{ges.}$(centre related)	$= \mathbf{3.1808866.10^{30}}$ **kg**
The difference is	$= +1.7878029\ .10^{30}$ kg

That is +78.78% more mass than the actual gravitational mass!

Attention: the gravitational mass is not the same as the real mass

3.5 How to Calculate All SOHO Parameters in the Earth – Sun Model

The mass relationship of the three masses	Earth		Satellite		Sun	is
	1	:	$1.\ 10^{-24}$	:	2,000,000	

Original Values:
1.Gravitational constant _ 66.7428* 10^{-12}
2.Sun-mass m_1 1.98910000 $.10^{30}$ kg
3.Earth-mass m_2 $5.9736 \cdot 10^{24}$ kg.
4.Distance Earth – Sun $R_{e\text{-}s}$ 0.1496150 10^{12} m
5. SOHO mass 1,000.000 kg
6. Distance SOHO – Earth ($R_{sat\text{-}e}$) (variable insertion)

For the calculation it is essential that all following formulae are put together in an EXCELL calculation. Only that makes if possible to keep varying the distance between satellite SOHO and earth **(R_{sat-e})** orbiting period of the satellite around the sun equals that of the earth around the sun

<u>The result of the calculation then shows the following values:</u>

The rotational velocity v_e of earth, calculated using (***F3***) is:

$$v_e = \sqrt{\frac{\gamma \cdot (m1 + m2)}{R_{e-s}}}$$

$$v_e = \sqrt{\frac{66.7428 \cdot 10^{-12} \cdot (1.9891 \cdot 10^{30} + 5.9736 \cdot 10^{24})}{0.149615 \cdot 10^{12}}} = 29788.15 \text{ m/s} \quad (\textbf{\textit{F3}})$$

The rotation of the earth around the sun T_e in days will be calculated from the original values:(***F4***)

$$T = \frac{R_{e-s} \cdot 2 \cdot \pi}{v_e \cdot 60 \cdot 60 \cdot 24} = \frac{0.149615 \cdot 10^{12} \cdot 2 \cdot \pi}{29788.15 \cdot 60 \cdot 60 \cdot 24} = 365.2455$$

Orbital period 365.25 days

Calculating the two individual forces influencing SOHO :

Gravitational force Earth – SOHO

$$F_{e-sat} = \frac{\gamma \cdot 1000 \cdot m_2}{R_{sat-e}{}^2}$$

$$F_{e-sat} = \frac{66.7428 \cdot 10^{-12} \cdot 1000 \cdot 5.9736 \cdot 10^{24}}{1{,}486{,}820{,}000^2} = 0.18035317 \text{ N} \qquad (\textbf{\textit{F1}})$$

Gravitational force Sun-SOHO

$$F_{s-sat} = \frac{\gamma \cdot 1000 \cdot m_1}{(R_{sat-e} + R_{e-s})^2}$$

$$F_{s-w} = \frac{66.7428 \cdot 10^{-12} \cdot 1000 \cdot 1.989100 \cdot 10^{30}}{(1.48682 \cdot 10^9 + 1.49615 \cdot 10^{11})^2} = 6.050422 \text{ N} \qquad (\textbf{\textit{F1}})$$

The forces must be subtracted from each other as in relations to SOHO the sun and earth are situated opposite one another. The total force influencing SOHO then equals ***(F8)***

$$F_{ges.} = F_{s-sat} - F_{e-sat} = \quad 5.870069 \text{ N}$$

For the correct calculation the gravitational radius is essential, rather than the visual radius. R_{grav} is then calculated using formula **(F2)**

$$R_{grav.} = \frac{(F_{s-sat} \cdot R_{s-sat} - F_{e-sat} \cdot R_{e-sat} - \ldots\ldots)}{(F_{s-sat} - F_{e-sat} - \ldots\ldots)} = \qquad (\textbf{\textit{F2}}) \text{ with } (\textbf{\textit{F8}})$$

$$R_{grav.} = \frac{8.96238 \cdot 10^{11} - 2.6815270 \cdot 10^{8}}{5.870069} = 152.633618421 03 \cdot 10^{9} \text{ m}$$

The gravitational radius of SOHO is: (***F2/F1)*** $1.52633618421 \cdot 10^{11}$ m

The orbital speed $v_{grav.}$ of SOHO on the gravitational orbit is: (***F3***) 29,492.12541 m/s

$$v_{grav} = \sqrt{\frac{\gamma \cdot (m_1 + m_2)}{R_{grav.}}}$$

$$v_{grav.} = \sqrt{\frac{6.674280 \cdot 10^{-11}(1.98910 \cdot 10^{30} + 5.9736000 \cdot 10^{24})}{152.633618421 \cdot 10^{11}}} = 29{,}492.12541 \text{ m/s}$$

This orbital speed of SOHO is expectedly slightly lower than the orbital speed of the earth around the sun.

The length of the gravitational orbit of SOHO is calculated with the formula for calculating circumference

U grav. = R grav. *2*π = $9.5899702 \cdot 10^{11}$ m

SOHO's orbiting speed on the gravitational course is then

$T_{grav.} = U_{grav.} / v_{grav.} =$ 32,517,054 sek.

That means that SOHO has a rotational speed $T_{grav.}$ in days

$T_{grav.}$ = 30,628,902 / (60*60*24) = 376.35479 days

Satellite SOHO needs for a gravitational rotation around the gravitational centre of rotation on the Keplerian orbit 376.35479 days.

But the visual course of satellite SOHO has the sun at its centre. This orbit around the sun is slightly shorter than the gravitational orbit. (Please see diagram 15) If one calculates the orbital period of the satellite on the visual orbit at speed $v_{grav.}$ the result is the orbital period on a libration course around the sun.

The radius R_{sar-s} is the difference between the radius on the earth's orbital course R_{e-s} minus SOHO's distance to the centre of the earth. The distance between Earth and Sun is known (R_{e-s}), the distance of Satellite SOHO to the earth (**R_{sat-e}**) is unknown and needs to be calculated. This is done by assuming a value and inserting it into the set of formulae. Nowadays this can easily be done using an EXCEL calculation table on any PC. The value of the radius R_{sat-s} is essential in other formulae, for instance to calculate the orbital period.

The formula (***F9.1***) shows the difference between the two values $R_{sat-s} = R_{e-s} - R_{sat-e}$

Value **R_{sat-e}** is to bechanged until the orbital period **T_{lib}** of satellite SOHO is the same in days as that of earth's around the sun. Only when this has been done all other parameters can be exactly calculated.

Using the following formula for the orbital period $T_{lib.}$ **= $T_{vis.}$** of satellite SOHO around the sun on the visual libration course the orbital period (in days) can be calculated.

Days WMAP takes to orbit the sun: $T_{lib.}$ (***F4***) is 365.25 days

$$T_{lib.} = \frac{R_{sat-s} \cdot 2 \cdot \pi}{v_{grav.} \cdot 60 \cdot 60 \cdot 24} = \frac{1.481281800 \cdot 10^{11} \cdot 2 \cdot 3.1415}{29{,}492.12541 \cdot 3600 \cdot 24} = 365.25$$

The distance between SOHO and the sun R_{sat-s} is: 1.481281800* 10^{11} m

As mentioned above, this value is calculated by subtracting the distance Earth – SOHO (R_{sat-e}) from the distance Earth – Sun (R_{e-s}).

$$R_{sat-s} = R_{e-s} - R_{sat-e} \qquad \textit{(F9.1)}$$

Value **R_{sat-e}** can be calculated iteratively by inserting into the set of formulae.

Distance SOHO – Earth **R_{sat-e}**: 1.486820* 10^{9} m

This value is calculated iteratively (by trying out variations)

In order to check for correctness, the attracting mass can be calculated from the rotational speed using the **gravitational radius**. Formula ***(F6)*** will yield the following result

$$M_{ges.} = \frac{R_{grav.} \cdot v_{grav.}^{2}}{\gamma} = \frac{152.633618421 \cdot 10^{9} \cdot 29{,}492.12541^{2}}{6.74280 \cdot 10^{11}} = 1.989105974 .10^{30} \text{ kg}$$

This calculated mass value is exactly equal to the sum of the masses of Earth and Sun
Adding the initial values using ***(F10)***

$$M_{ges.} = m_1 + m_2 = 1.9891*10^{30} + 5.9736*10^{24} = \quad 1.989105974 .10^{30} \text{ kg}$$

But if one uses the radius of satellite SOHO rotating around the sun, i.e. the visual or **centre-related radius**, to calculate the attracting total mass

, where $R_{ges.} = R_{vis.} = R_{sat-s}$

$$R_{sat-s} = R_{e-s} - R_{sat-e} \qquad \textit{(F9.1)}$$

Formula ***(F6)*** will yield the result

$$M_{ges.} = \frac{R_{ges.} \cdot v_{grav.}^{2}}{\gamma} = \frac{148.1281800 \cdot 10^{9} \cdot 29{,}492.12541^{2}}{6.74280 \cdot 10^{11}} = \mathbf{1.9303916 .10^{30} \text{ kg}}$$

This **total mass value calculated using the visual centre of rotation** is considerably lower than the mass values of Earth and Sun

$M_{ges.}$*(Addition)* $= 1.989105974 .10^{30}$ kg
$M_{ges.}$*(centre-related)* $=$ **$1.9303916.10^{30}$ kg**

The difference is $= +0.058714421 .10^{30}$ kg

That is -2.952% or 9,828.984 Earth-masses fewer, than the actually existing mass!

Annotation to the calculation:
The gravitational orbit of satellite SOHO $T_{grav.}$ is longer than the visual orbit $T_{vis.}$. The two values are the result of the calculation.

	$T_{grav.}$ =	376.35	days
	$T_{lib.}$ =	365.25	days
The difference is		11.10	days

If one calculates the ‘orbital period’ of the gravitational centre of rotation with $v_{grav.}$ around the central body, the Sun, the result will be exactly the ‘difference in orbital period’ of $T_{grav.}$ and $T_{vis.}$.

Attention please: This calculation is only a mathematical consideration and does not yield real actual values. The true orbital period of the gravitational centre is the same, as is that of satellite SOHO around the Sun.

The radius of the gravitational centre of rotation to the centre of the sun is calculated as follows

If one subtracts the gravitational radius from Radius $_{Sun-Soho}$, the result is the distance of the gravitational centre of rotation from the centre of the sun.

$$1.481281800 \cdot 10^{11}\ m\ -\ 1.52633618421 \cdot 10^{11}\ m\ =\ 0.04505438421 \cdot 10^{11}\ m$$

The orbital speed of $v_{grav.}$ from SOHO on the gravitational orbit is: 29,492.1254 m/s

From the two previous values it is possible to calculate an ‘orbital period’ of the gravitational centre of rotation around the visual centre of

$$U_{grav.\ Punkt} = R_{grav.\ Punkt} \cdot 2 \cdot \pi = 0.28307669599 \cdot 10^{11}\ m$$

One ‘orbit’ of the rotational centre around the visual centre takes

$$T_{grav.Point} = U_{grav.\ Point} / v_{grav.} = 959{,}838.23\ \text{sek.}$$

Therefore the ‘orbital period’ of the gravitational centre of rotation $T_{grav.\ Point}$ takes (measured in days)

$T_{grav.}$ = 959,838.23 / (60*60*24) =	11.10 days
The difference of the two orbital periods of SOHO on T_{lib} und T_{grav} is	11.10 days

Both values are nearly identical. Therefore one may conclude that there is a direct connection between the gravitational centre of rotation and the gravitational orbit of SOHO.

((((((Seite 45)))))

5. Appendix II the theoretical derivation of the gravitational centre of rotation according to Dr. N. Südland

With Dr. Norbert Südland’s kind permission this theoretical treatise may be published here. It applies to the entire treatise which follows:

Krause-002.nb

Questioner: 16.12.2006 Dipl.-Ing. Matthias Krause
Reply: 8. 9.2008 – 15. 9.2008 Dr. Norbert Südland
Final Calculation: 15. 9.2008 Dr. Norbert Südland

■ 2.1. Question

Is there a possibility of motivating or improving on the empirical derivation / calculation shown in point of sort *([Krau2007], chapter 3, page [24])*

$$\vec{R} == \frac{\sum_{k=1}^{n} \left|\vec{F}_k\right| \vec{r}_k}{\sum_{k=1}^{n} \left|\vec{F}_k\right|} \tag{2.1}$$

in strictly theoretical ways?

■ 2.2. Answer

. 2.2.1. Definition Centre of Gravity

. 2.2.1.1. According to Szabó

The centre of gravity is calculated as follows ([Sza1956], § 9., pp. 62-68):

$$\vec{R} == \frac{\sum_{k=1}^{n} m_k \vec{r}_k}{\sum_{k=1}^{n} m_k} \tag{2.2}$$

with: m_k Mass of the ***k***-th body
$\vec{r}_k$ Centre of gravity of the ***k***-th body
$\vec{R}$ Cumulative centre of gravity

The integral representation of this formula is not necessary for the problem treated here.

2.2.1.2. Expected value according to Bronstein

A generalization of the centre of gravity is found in the *expected value* of a (normalized) distribution. ([BrS1987], paragraph 5.1.3., page 665):

$$\vec{R} == \frac{\sum_{k=1}^{n} f_k \vec{r}_k}{\sum_{k=1}^{n} f_k} \tag{2.3}$$

with: f_k Weighting factor function of the ***k***-th body
r_k Generalized centre of gravity of the ***k***-th body
R Result Point

■ 2.2.1.3. Commonality of all generalized centres of gravity

When in the centre-of-mass formula (2.3) the vector is moved to . $\vec{h}_k + \vec{h}$ by displacing the origin of coordinates, the result is:
:

$$\vec{R} == \frac{\sum_{k=1}^{n} f_k \vec{h}_k}{\sum_{k=1}^{n} f_k} + \vec{h} \tag{2.4}$$

When the coordinate system containing $\vec{R} == \vec{h}$. is considered it becomes obvious that in this generalized centre of gravity (the *expected value*), the lever principle of the weighting function f_k leads to an equilibrium in rotation moment.

Especially where the forces f_k (not just the weight-forces) are concerned, this means that there is a point of symmetry in the system where the sum of the sum of the levers to the left of the symmetry-point create the same *rotational moment* as the sum of the levers to the right of the symmetry-point – only in the opposite direction. This is true independent of the number of space dimensions or the direction of the coordinate-axes.

▪ 2.2.2. Resulting gravitational force

▪ 2.2.2.1. . Usual calculation

The resulting gravitational force of (**n – 1**) bodies onto an **n**-th body is vectorially calculated according to the following formula:

$$\vec{G} == -\gamma\, m_n \sum_{k=1}^{n-1} \frac{m_k}{|\vec{r}_k - \vec{r}_n|^2} \frac{(\vec{r}_k - \vec{r}_n)}{|\vec{r}_k - \vec{r}_n|} == -\gamma\, m_n \sum_{k=1}^{n-1} \frac{m_k}{|\vec{r}_k - \vec{r}_n|^3} (\vec{r}_k - \vec{r}_n) \tag{2.5}$$

with:

with:	G .	resulting gravitational force
	γ	gravitational constant
	m_n	mass of the body on which the resultant of gravitational forces is determined (calculated)
	m_k	mass of one of the remaining (n – 1) bodies
	$\vec{r}_n$	position vector of the body one which the resultant of forces is determined (calculated)
	$\vec{r}_k$	position vector of one of the +n _ 1/ remaining bodies

The negative sign indicates an *attracting* force.
The integrating denominator is raised to the third power as the result of the the need that the amount of each individual force must be in inverse proportion to the square of the distance, and the overall vectorial result must be a force.

▪ 2.2.2.2. Calculation according to Krause

The idea of the chartered engineer Matthias Krause is that a point must be found which points in the direction of the vectorial sum but is calculated analogously to the expected value of a distribution. The result is a (small) correction of Krause's formula:

$$\vec{R} == \frac{\sum_{k=1}^{n} |\vec{F}_k| \frac{\vec{r}_k}{|\vec{r}_k|}}{\sum_{k=1}^{n} \frac{|\vec{F}_k|}{|\vec{r}_k|}} == \frac{-\gamma\, m_n \sum_{k=1}^{n-1} \frac{m_k}{|\vec{r}_k-\vec{r}_n|^3} (\vec{r}_k - \vec{r}_n)}{-\gamma\, m_n \sum_{k=1}^{n-1} \frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}} \tag{2.6}$$

The numerators in formulae (2.5) and (2.6) are now identical, so that $\vec{R}$. and $\vec{G}$. pointing in the same direction. it takes on the function of a *distance-substitute* by which the (n – 1) bodies appear to be distant from the n-th body.
In order to achieve the same resulting gravitational force when using that *distance-substitute*, a 'mass-substitute' must be defined according to the following formula which suitably shows the *n*-body problem as a *two-body problem.*

$$\vec{G} == -\frac{\gamma m_n M}{R^2}\frac{\vec{R}}{R} == -\frac{\gamma m_n M}{R^3}\vec{R} \tag{2.7}$$

$$M == \frac{\sqrt{\vec{G}.\vec{G}}}{-\gamma m_n}\left(\vec{R}.\vec{R}\right) == \frac{-\gamma m_n}{-\gamma m_n}\sqrt{\left(\sum_{k=1}^{n-1}\frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}\left(\vec{r}_k-\vec{r}_n\right)\right).\left(\sum_{k=1}^{n-1}\frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}\left(\vec{r}_k-\vec{r}_n\right)\right)} * \frac{\left(\sum_{k=1}^{n-1}\frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}\left(\vec{r}_k-\vec{r}_n\right)\right).\left(\sum_{k=1}^{n-1}\frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}\left(\vec{r}_k-\vec{r}_n\right)\right)}{\left(\sum_{k=1}^{n-1}\frac{m_k}{|\vec{r}_k-\vec{r}_n|^3}\right)^2} \tag{2.8}$$

The depiction here describes a *vectorial dot product* (in American notation).
Using *substitute-distance* and *substitute-mass every n*-body-problem of gravitation can correctly be transferred to a similar two-body-problem.
It is extremely likely that without the idea of Matthias Krause these formulae could not be accounted for. Even using an approximation (2.1) the results are good enough and enable the use of alternatives in the numerical solution to multi-body-problems.

2.2.2.3. Taking account of Südland's law of gravitation

Südland's gravitation formula [Süd2004], formula (3.34\0, p. 23-24
:

$$F[\vec{r},\vec{v}] == -\gamma\frac{m M}{r^2}\left(1+\frac{\vec{v}.\vec{r}}{c r}\right)\frac{\vec{r}}{r} \tag{2.9}$$

and, in consideration of *relativist effects* will not add any great changes in the algorithm of Matthias Krause but only even more complicated formulae than the formulae (2.6) and (2.8), when also the *relative speeds* of the participating bodies play a role. In this context ***C*** is a still unknown speed of field expansion for the gravitational force. Also the two-body-problem of Südland's gravitation formula is still for the most part analytically resolvable.

[Süd2007].

2.2.2. ▪ 2.2.3. Conclusion

The approach described by Matthias Krause is impressive and only needs very minor corrections. Thereby the old *n*-body-problem of gravitation and all non-linear central forces is now theoretically solved and can on every occasion be transferred on to a two-body-problem.

▪ 2.3. Protocol

The *Mathematica* version is:

{$Version, $ReleaseNumber, $LicenseID}

{Microsoft Windows 3.0 (October 6, 1996), 0, L4526_3546}

Time takenfor calculation:

TimeUsed[ ]"s"

0.38 s

Literatur Bibliography

[BrS1987]
Bronstein I. N., Semendjajew K. A. *Taschenbuch der Mathematik*, Gemeinschaftsausgabe Verlag Nauka, Moskau und BSB B. G. Teubner Verlagsgesellschaft Leipzig, 23. Auflage, (1987)

[Krau2007]
Krause M. *Die rätselhafte Dunkle Materie auf dem Prüfstand*, CID (Cosmologic Independent Department), Kirchzarten, (2007)

[Süd2004]
Südland N. *Physik für Wirtschaftsingeniere*, Vorlesung an der Hochschule Aalen, WS 2004/2005, (2004)
http://www.Norbert-Suedland.de/Deutsch/Physik/WS2004-05/Differentialgleichung.nb.zip

[Süd2007]
Südland N. *Eine Variante des Gravitationsgesetzes – Bastelstube für neue Formeln*, Vortrag an der Aalener Sternwarte am 11. 9.2007, AAAA e.V., Aalen, (2007)

[Sza1956]
Szabó I. *Einführung in die Technische Mechanik*, Springer-Verlag, 2. verbesserte und erweiterte Auflage, (1956)