
Hegel and the planets (Ceres)

An excerpt of Professor Neuser's Comment on Hegel's Habilitation

Professor Neuser (abridged translation and comment by Kai Froeb)

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No other part of Hegel's Habilitation has got so much objections as it's last 2 pages (beginning from page 31), in which Hegel gives a row of numbers for the distances of the planets.

The numbers given match roughly the gaps between the planets as they were known at that time. But Hegel's row of numbers did not left room between the 4th planet (Mars) and the 5th (Jupiter). But in the year of Hegel's dissertation, a planetoid (Ceres) was discovered in that place. Also, there was a semi-empiric row of numbers, the Bode-Titus-Row, which predicted a Planet at that place.

So from all this people are arguing that Hegel ignored or even faked the facts, in contrast to Bode, and his supporters, who got valuable data because of a strong theory.

Here we get into a number of questions: what's the foundation of the Bode-Titus-Row, when was the historical facts around the discovery of Ceres, etc.

I'm beginning with Hegel's Row of numbers for the gaps between the planets.

How to describe these gaps, has to be taken after all from our experience, it can't be derived from the Concept ("Begriff"). But to have experiences means to find a meaning in what we find in our senses. So all what we experience implies reason. So also the "facts" ("Erfahrungstatsachen") are not without reason. This is recognized by the natural scientists, according to Hegel, who try to bring the facts in accordance with a natural law. Hegel gives the example of the Bode-Titus-Row, which Astronomers see as a natural law and they try to find planets according to its predictions (this is, when we take into account that the astronomers accuse Hegel for ignoring the facts because of his theory, not without irony, as we will see later).

Hegel himself uses a different row of number, in which he sees "reason" in the sense of the number speculations of Pythagoras.

In the Timaios, Platon named a row of numbers which was made up out of 2 rows of numbers, the products of 2 and the products of 3, so: 1,2,4,8 and 1,3,9,27. Platon united that row of numbers to 1,2,3,4,9,8,27. The last number was the final one because she was part of the row and the sum of the previous ones.

In order to get an ascending line, Hegel changes 8 to 16 without explanation. Then, again without explanation, he uses a mathematical operation on that row of numbers: $y = 3 * \text{SQRT}(X^{**}[\text{power}]4)$.

[etc. Neuser shows that Hegel also made some minor errors of 0.04 in some of his calculations.

The outcome is that Hegel's numbers differed maximum 8.3% from the distances as they were known in his days. According to Prof. Neuser, other's, like G.N.Fischer (1790), had similar differences - KF]

Now which status did Hegel gave his row ? He says: *if* Timaios was right in his claim that the constructor of the world did use this row for the distances of the planets, then there would not be room for a planet between the 4th and 5th planet. If Timaios was right is left open in Hegel's text.

[KF comment:

So Hegel tries to find a way to find sense in Timaios row of numbers, squeezing and bending them until they show approximately what were the known positions of the planets in his days. So I see here only

Hegel trying to make a vague theory more according to the empirical data, not as is suggested, the other was round.

Now this only makes sense, when Ceres was not known as a planet when Hegel wrote this paper.

BTW, Hegel later wrote in the first edition of his “Encyclopaedia”, that he was not satisfied anymore with what he had written in his dissertation on the gaps between the planets.

So how was Ceres status in 1801 ?]

On 1.1.1801 G. Piazzi in Palermo first viewed this object. He only was able to follow it for 9 Degrees (i.e. about 2.5% of it's complete tour around the sun).

First he thought that he discovered a Comet, but he also discussed the possibility that it could be the Planet expected between Mars and Jupiter according to the Bode-Titus “Law”.

From the data known at that moment, the question whether the newly discovered object was a Planet or a Comet was purely a question of believe, as no enough data were present. Spectral analysis, a method used today to distinguish between comets and planets, was unknown that time.

C.F. Gauss developed during the year 1801 a new calculating method, which allowed him to figure out the orbit of this new object. He let other colleagues know from his findings informally, but only published his findings in 1808 under the name “Theoria motus corporum coelestium”.

H.W.M.Olbers observed that new object again the 7th December 1801. At least until that time the discovery of a new planet was questionable.

J.J. Lalande argues that even Gauss's calculations were not prove enough, as they were very sensible to minimal errors in the empirical data.

Prof. Neuser than discusses the Orbit eccentricity (? in German: “Bahnexzentrität”) of Ceres. He says comets have an O.E. of 0.1-0.9, planetoids of 0.08-0.9 and planets have one of 0.007-0.25. As planetoids are in between planets and comets, it is possible to confuse them with planets or comets according to their O.E. Ceres's O.E. is 0.079.

Ceres presumed orbit, as it was according to the further observations (I think he refers to Mr. Olbers here), made it likely that Ceres was a planet but no sure prove was possible until spectral analysis came up.

So e.g. the famous W. Herschel (discoverer of Uranus) wrote in November 1802 that Ceres was a comet. There was a big camp of astronomers who believed that Ceres was a Planet, but a prove was missing.

Those who believed in 1801 that the Piazzi's object was a planet didn't came up to that conclusion because of a rational discourse but because it fit into the Bode-Titus row and they believed that this row was a physical law. But up to today no one has proven the Bode-Titus row to be a law. The decision for the Bode-Titus row was theological-a priori.

Here is how the Bode-Titus row came into existence:

Both Titius and Bode's main argument, according to Prof. Neuser, is that god could not have left a gap here (Prof. Neuser quotes sentences from both to prove that).

Von Zach (a German Astronomer of Hegel's time) writes that "no other science has made so many discoveries a priori" and he does not refer to Newton but to the Titus Bode row.

Because of its "metaphysical" character, W.Herschel, J.B.J.Delambrer and J.Lalande did object to the Titus Bode Row (TBR). (Even today astronomers are split in objectors like H.Alfvén and G.Arrhenius and at least partial supporters like C.F.von Weizsäcker).

A confirmation of that row came in 1781, when Herschel discovered Uranus (whose distance matches well with the TBR). The discovery of Ceres continued that success.

Today things don't look that bright anymore: with today 2500 known asteroids, which surround the sun in a field of 1 astronomic unit (149 600 000 km) width, it is problematic to let them correspond to a single distance in the TBR.

Neptune doesn't match the TBR (or it has an error of 29%), for Pluto we get an error of 95,5% [KF: Pluto's distance from the sun varies a lot, he is sometimes, like now in 1999/2000, nearer to the sun than Neptune, so the actual percentage may be even worse].

Today's astronomers are convinced that there are plenty objects in the size of asteroids in all kind of orbits in our stellar system.

In his lectures on the philosophy of nature, Hegel wrote (this is also a very free translation):

"One [KF: Hegel] wants to have a law for the distances between the planets, but this has not been found yet. The Astronomers despise in total ("im Ganzen") such a law and don't want to be involved with it, but it is a necessary question".

Prof. Neuser than discusses how modern sciences tries to explain the gaps between the planets (my summary, as I understood it: there basically exist two theories, but both can only explain some facts, not all, may be one can combine both for better results).

Now let me refer his last comments on that topic (page 58-60):

When one reviews all facts around Hegel's row of numbers for the gaps between the planets, one can say that the accusations against Hegel are without reason. The only fitting, but very clear critique comes from Hegel himself: "I'm not satisfied anymore about what I wrote in a former dissertation on that topic" (Encyclopaedia, 1st edition).

Hegel's row of numbers has been given without any philosophical arguments. That's because according to Hegel's own diction she should be found from experience. After the new discoveries in our solar system, we have to say that from an empirical point of view, the row is completely false.

This is different when we look at the other parts of his habilitation: Hegel continued to develop his philosophical program in Jena and finally in Heidelberg, where he published it for the first time 1817. finally we can say that the question of the inner logic of the concepts ("Begriffe") of natural science is still up to date. Modern natural science has not only to look for the mathematical prove of it's empirical facts, but also has to look after it's system of Concepts ("Begriffsgefüge"), which allows that mathematical treatment of the empirical data.

[..]

Now, Hegel's Dissertation was written in a hasty style and in it the empirical facts are much more constitutive than in his later work of philosophy of nature.

In the text, in which Hegel presents his row of numbers for the gaps between the planets, we don't find a reason why he adds this row to his dissertation.

This row is not justified from within Hegel's overall concept ("Gesamtkonzept"), even when Hegel refers to Plato's *Timaios* and seems to share F.v.Baader's philosophical judgement of its "arithmetic row".

The row given is neither a philosophical speculation in the sense of Hegel's writings, nor does it make mathematical sense.

Maybe that Hegel only tells us this row of numbers because of its accidental coincidence with the gaps between the planets as they were observed, to caricature the search for planets of the astronomers according to a row of numbers without physical explanation.

A hint for this interpretation is that Hegel discusses this problem of ratio between empirical facts and natural law exactly before he comes to his row. Another hint for this interpretation is that between 1790 and 1800 the astronomical literature ("Berliner astronomisches Jahrbuch") was full of different tries to get the gaps between the planets or between their moons into a mathematical row of numbers.

In a similar way, Hegel argues in polemic way against Newton's apple, who is said to be as important as Eve's or Trojan apple, in order to show his relation to Newton in an ironic way.

This attitude of Hegel against an experimental method, which would generalize empirical data without a proper systematic background ("begrifflicher Rahmen") also shows up when Hegel coincides Comets and Years of good wine:

"I've made Mr. Bode sigh, when I said to him, the experience shows us now that on the sight of comets we get good wine years, as in the years of 1811 and 1819, and this double experience is as good, or even better, than the one on the return of the comets. [..]", as Michelet tells us a remark from Hegel in one of his 'Lectures on the Philosophy of Nature'.

OTOH, against Hegel showing such an ironical distance, we have the fact that Hegel preferred his whole lifetime the "Potenzreihe" (row of potencies?) against the arithmetical row.

Whatever made Hegel claim this row of numbers, at least he doesn't apodictically say only seven planets could exist in our solar system. The supposition that Hegel denied the Asteroid to be discovered because of philosophical speculations can't be proven from the Latin text.

However, we have to wonder about the reception history of Hegel's dissertation: both Hegel's critique of Newton and his own concept could have given material for a more objective critique than we find in the secondary literature.

OTOH, there is not the slightest reason, to get upset against Hegel's row of planets. But here the secondary literature is full of upset scolding.

The above is taken from:

Hegel, G.W.F.: 'Dissertatio Philosophica de Orbitis Planetarum'

/'Philosophische Erörterung über die Planetenbahnen' (Schriften z. Naturphilos., 00002) translated, introduced and commented by Prof.Dr. Wolfgang Neuser, VCH at Akademie Verlag Berlin., 1986, ISBN 3-527-17547-4, Price 64,- DM

Professor Wolfgang Neuser is a highly reputed Professor at the University of Kaiserslautern. He is not only a very good knower of Hegel, but also a reputed natural scientist (he wrote books for the German version of the Scientific American) and also a known researcher in the history of science (in Hegel's time).

The book consists of the Latin text together with a German translation, Schelling's notes, and a very detailed (73 pages) discussion of the complete text, including many historical notes, on Hegel's development in these days, the situation of the astronomic science these days and the reception history of Hegel's dissertation in Germany.

From this discussion, I translated above most of pages 50-57. I've tried to be close to the German text, but it's a summary in my own words, so misunderstandings are my fault (KF=Kai Froeb)