CHAPTER 10

Additional considerations concerning the dating of the Almagest. Stellar coverings and lunar eclipses

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1. INTRODUCTION

The book by A. T. Fomenko V. V. Kalashnikov and G. V. Nosovskiy entitled ***Dating the Almagest Star Catalogue. A Statistical and Geometrical Analysis*** ([METH3]:2) covers the study of the issue of whether one could date the coverings of stars by planets described in the Almagest. The present chapter contains, among other things, additional more precise calculations that we made in this field sometime later.

The dating of the Almagest star catalogue that we came up with in the preceding chapters, basing our research on the geometrical and statistical analysis of stellar latitudes obviously contradicts the consensual dating of the Almagest's compilation (the alleged year 137 A.D.) rather drastically. This leads us to the question of whether the Almagest star catalogue can be a more recent addendum made to an authentic ancient text? Or could the contrary be true – namely, the entire text of the Almagest having been written in 600 A.D. the earliest, and finally edited during a late mediaeval epoch (from the end of the XVI century to the beginning of the XVII century)?

We already mentioned that the astronomical observations collected in the Almagest have been studies meticulously and professionally by Robert Newton, a famous American scientist specializing in celestial mechanics, navigation and astrophysics (see [614]). The result of his research can be formulated as follows briefly: those of the astronomical observation data contained in the Almagest which can be calculated with the aid of Ptolemy's theory as related in the Almagest (including the theory of solar, lunar and planetary motion as well as the precession data) are really nothing else but results of later theoretical calculations made by Ptolemy himself according to Robert Newton (or someone else acting on Ptolemy's behalf). It is therefore pointless to use these "calculated data" for independent astronomical dating purposes nowadays, since the dating of these "calculated observations" implies learning the opinion of a later author, one that lived in the XV-XVII century, in re the time when these astronomical observations took place, and nothing else.

Fortunately, there are observation data contained in the Almagest as well, and these could neither be calculated nor forged by either the theory of Ptolemy or any other astronomical theory of the Middle Ages. Among such data we can definitely count the ecliptic latitudes of 1020 stars contained in the Almagest catalogue. They present a substantial volume of information that we used for a successful dating of the Almagest, qv in the preceding chapters of the book.

The Almagest also contains certain other astronomical data that the modern commentators of the Almagest consider to be the result of "ancient" observations, namely:

I. The four "ancient" observations of stars covered by moving planets.

II. About twenty (namely, 21) "ancient" lunar eclipses mentioned in the Almagest.

Let us point out that the late mediaeval astronomers of the XVI-XVII century may well have tried to calculate the "ancient coverings of stars by planets" using Ptolemy's theory and the periods of planetary rotation around the sun. These periods were already known well in the XVI-XVII century; such knowledge suffices for the calculation of longitudinal correspondence between a star and a planet. Exact covering, or the correspondence of both coordinates, would naturally be beyond their calculation capacity. However, one isn't to exclude the possibility of such imprecise results calculated by mediaeval astronomers and presented as "ancient astronomical observations".

The same is valid for lunar eclipses, and to a greater extent at that. Lunar motion theory as developed by the astronomers of the XV-XVII century would make the approximated calculations of dates and phases of past and future lunar eclipses feasible in the XVII century. Therefore the "ancient" lunar eclipses described in the Almagest could easily have been calculated in the XVI-XVII century. The inevitable lack of precision manifest in mediaeval phase calculations could be declared a result of "errors made by the ancient observer" who would estimate the eclipse phase with the naked eye and hence approximately. Lunar eclipses are less informative this way than coverings, since the fact of covering can be observed with the naked eye, unlike the phase of the eclipse. The hoaxers of the XVI-XVII century were quite capable of including calculated lunar eclipses in the Almagest as proof of its ancient origin.

Another remarkable fact deserves to be mentioned herein. As we shall discuss in more details below, the Almagest doesn't contain any "ancient" solar eclipses. Why would that be? Solar eclipses are a great deal more remarkable than the lunar, after all. One would assume them to be primary candidates for inclusion in the Almagest. We consider the answer to be quite simple. The Almagest in its present form appears to have undergone a great deal of falsification in the XVI-XVII century aimed at making the book seem more ancient. Thus, the Almagest contains a substantial amount of mediaeval theoretical reverse calculations. Solar eclipse theory is more complex than lunar eclipse theory, and calculations of solar eclipses would be a formidable task for the astronomers of the late XVI – early XVII century. This is the apparent reason why they were cautious enough to refrain from including reports of the "ancient" solar eclipse into the "ancient" Almagest – they must have been aware of the fact that later generations of astronomers wouldn't find it too hard to reveal the hoax.

Below we shall consider the issue of dating the planetary coverings of the stars by their descriptions found in the Almagest in more detail. It turns out that this problem has no exact astronomical solution – the only solutions we find are of an approximated nature. The best one we arrived at is mediaeval and concurs well with the dating of the Almagest star catalogue as related above. However, we must reiterate that they cannot serve the end of dating the Almagest independently due to their being approximate. Still one cannot ignore the fact that both approximated mediaeval solutions correspond well to our primary result – the mediaeval dating of the Almagest star catalogue and the comparatively recent XVI-XVII century epoch of its final edition.

We shall consider the possibility of dating the Almagest by the descriptions of lunar eclipses at the end of the present chapter, in section 8.

2. DATING THE PLANETARY COVERINGS OF THE STARS. CALCULATIONS THAT INVOLVE AVERAGE ELEMENTS

It is known well that the Almagest only describes four planetary coverings of the stars (see [614], for instance).

Ptolemy's text runs as follows:

1) Chapter X.4: "Among the ancient observations we have chosen one, described by Timocharis in the following manner: in the 13th year of Philadelphus, on the 17th-18th of the Egyptian Messor, in the 12th hour, Venus completely covered the star located on the opposite of Vindemiatrix" ([1355], page 319).

Ptolemy (in C. Tagliaferro's translation) proceeds to tell us that "the observation had been conducted in the year 406 after Nabonassar" ([1355], page 319). However, the translation of I. N. Veselovskiy tells us that "the year of the observation was 476 after Nabonassar" ([704], page 322). This circumstance was pointed out to us by M. E. Polyakov. C. Tagliaferro might be erring here, since Ptolemy proceeds to cite a calculation demonstrating that 408 years passed between this covering and the year 884 since Nabonassar ([1355], page319). The covering therefore took place in the year 476 since Nabonassar, which we shall be referring to as the primary version hereinafter. On the other hand, it is also possible that C. Tagliaferro was using other versions of the Almagest naming 406 after Nabonassar explicitly. This could result from discrepancies inherent in different copies of the Almagest, so we should formally consider this version as well, which we shall be referring to as "the misprint version".

2) Chapter X.9: "We have considered one of the old observations, which makes it clear that in the 13th year of Dionysius, on the 25th of Aigon, Mars covered the northernmost star on Scorpio's forehead in the morning" ([1355]), page 342.

Ptolemy (in C. Tagliaferro's translation) tells us that "the observations date to the 42nd year after the death of Alexander [or the year 476 since Nabonassar]" ([1355], page 342). The translation made by I. N. Veselovskiy, on the other hand, states that "the time of this observation corresponds to the year 52 after the death of Alexander, or 476 after Nabonassar" ([704], pages 336-337). Either C. Tagliaferro made yet another misprint, or Ptolemy's chronology conceals distortions of some sort. This wouldn't be all that surprising since Ptolemy uses several eras and keeps converting datings from one into another, which could naturally generate errors. At any rate, both translations ([1355] and [704]) cite the same year for the covering of a star by Mars – namely, 476.

3) Chapter XI.3: "We have once again considered a very accurate old observation telling us that in the 45th year of Dionysius, on the 10th of Parthenon, Jupiter covered the Northern Asse" ([1355], page 361).

Furthermore, according to both translations (Tagliaferro's and Veselovskiy's), "this time corresponds to the 83rd year since the death of Alexander" ([1355], page 361; also [704], pages 349-350). There is no discrepancy between the two different translations of the Almagest in this case.

4) Chapter XI.7: "We have considered yet another accurate observation of old, according to which Saturn was located two units below the southern shoulder of Virgo on 5 Xanticus of the Chaldaean year 82" ([1355], page 379).

Later on, both translations (Tagliaferro's and Veselovskiy's) inform us that "the time in question corresponds to the year 519 after Nabonassar" ([1355], page 379; also [704], page 362). There is no discrepancy between the two different translations of the Almagest in this case, either.

According to the known traditional identifications of Ptolemaic stars as their modern counterparts (qv in [614] and [1339]), the coverings in question may be the following ones:

1. Venus covered η Vir around 12.
2. Mars covered β Sco in the morning.
3. Jupiter covered δ Can at dawn.
4. Saturn was observed "two units" lower than γ Vir in the evening.

We have verified these identifications, and they proved correct. The book by A. T. Fomenko, V. V. Kalashnikov and G. V. Nosovskiy ([METH3]:2) uses the middle element values of planetary orbits from G. N. Duboshin's reference book ([262]) for calculations; their latitudinal precision roughly equals 1'. Since we are considering the issue of calculation precision, let us clarify what exactly it is that we mean by saying "a planet covered a star".

It is common knowledge that human eye can distinguish between two points located at the angle distance of 1'. For the people with a particularly keen eyesight this distance may equal 30". The matter is that the characteristic size of retinal cones in the centre of the eye-ground corresponds to 24". Thus, the covering of a star by a planet, or their mutual superimposition, actually means that the angle distance between them roughly equals 1' as seen from the Earth.

Modern theory allows to calculate past positions of Venus and Mars with the latitudinal precision of 1' on the historical time interval that interests us. The precision of calculating the latitudes of moving Mars and Venus equals circa 3'. This suffices, since it is the latitudinal value that defines the fact of a star covered by a planet. A planet's longitude alters rather rapidly as compared to its latitude. Locally, the longitude can be regarded as proportional to time. Thus, the error of several arc minutes in the estimation of the longitude only leads to a very minor error in the estimation of the moment when a planet covered a star. Therefore in case of Venus and Mars the coverings described by Ptolemy can be calculated with sufficient precision once we use modern theory as a basis.

The motion theory of Jupiter and Saturn is more complex and somewhat less precise than the one used for Venus and Mars. V. K. Abalakin is right enough to point out that "insofar as the external planets are concerned (Jupiter, Saturn, Uranus, Neptune and Pluto) … the middle orbital elements [of these planets] can in no way be used for the solution of the stability problem and remain applicable for intervals of several million years … [they are] only of utility for the period of several centuries before and after the present epoch" ([1], page 302).

However, in case of the Almagest we are in no need of ultra-precise formulae. The reason is that, according to the Almagest, the observation of Saturn is of secondary importance, since Saturn did not cover the star, but rather was observed at the distance of "two units" from it; as for the actual Ptolemaic definition of a "unit", the issue remains unclear. Therefore calculating the positions of Saturn with the precision of 1' is of no use to us.

As for Jupiter, Ptolemy might claim it to have "covered a star"; however, modern theoretic calculations demonstrate that Jupiter didn't approach the δ of Cancer closer than 15' anywhere on the historical interval; therefore, we have to search for moments where the distance between Jupiter and the star in question equalled 15'-20'. Extreme precision of formulae isn't needed for this purpose; the level guaranteed by the modern theory is quite sufficient.

Let us now address the issue of just how these four coverings are dated by Ptolemy (see table 10.1). The primary era used by Ptolemy is the era of Nabonassar ([1355]). He is most prone to using it for re-calculating the datings of ancient observations. He also uses other chronological eras. Let us cite the table of datings containing the abovementioned Ptolemaic coverings of stars by planets. Ptolemy had used each of the following three eras at least twice: the era of Nabonassar, the era of Alexander and the era of Dyonisius.

We end up with the following intervals between the coverings:

a) A maximum of one year between the coverings by Venus and Mars (476 and 476). If the "misprint version" contains no misprint really, the interval shall equal 70 years: 476 – 406 = 70.

b) 32 years by the era of Dionysius between the coverings by Mars and Jupiter (45 – 13 = 32), or, alternatively, circa 31 years by the era of Alexander (83 – 52 = 31).

c) Around 11 years between the Jupiter and Saturn coverings (519 – 508 = 11).

If the abovementioned discrepancies between the translations of the Almagest made by C. Tagliaferro and I. N. Veselovskiy aren't a result of misprints but rather stem from actual discrepancies between actual manuscripts of the Almagest (of which there were many, qv in Chapter 11), table 10.1 demonstrates that the Ptolemaic chronology contains possible errors. The other possibility, and also an interesting one, is the presence of errors even in the modern editions of the Almagest which were meticulously verified by scientists. The fact that Ptolemy's chronology wasn't error-free is demonstrated by table 10.1 as cited above. Indeed, the interval between the coverings by Mars and Jupiter equals 32 years by the era of Dionysius (45 – 13 = 32). If we are to take the era of Alexander, this

The covering of a star by a planet	*Year according to Ptolemy*		
	Nabonassar's Era	*Alexander's Era*	*The Era of Dionysius*
1) Venus	476 or 406 (406 is a misprint?)		
2) Mars	476	52 or 42 (42 is a misprint?)	13
3) Jupiter		83	45
4) Saturn	519		

Table 10.1. The datings of planets covering stars as indicated in the Almagest.

interval equals 31 years (83 – 52 = 31). The discrepancy equals one year.

The star in question was covered by Jupiter in the year 508 after Nabonassar, according to Ptolemy. This is easily implied by Table 10.1.

Let us formulate a precise mathematical problem, qv in fig. 10.1. We have to determine the following combination of astronomical events:

1) In a certain year *N*, or the year *N* – 70, Venus covered the η of Virgo around 12 o'clock.

2) In the year *N* Mars covered the β of Scorpio in the morning.

3) In the year *N* + 32 (or *N* + 31) Jupiter covered the δ of Cancer at dawn.

4) In the year *N* + 43 Saturn was located near the γ of Virgo in the evening, being somewhat lower than the star in question.

Let us now discuss the issue of just what precision rate is needed to satisfy to the time intervals between the planetary coverings of the stars as listed above. It is obvious that we need a leeway of two years minimum, since all the dates were rendered to a single era, which can yield the natural error of 1-2 years in formal calculation due to the simple fact that different eras used different points to mark the beginning of the year (such points are known to have included March, August, September, October and January). Variable beginning of the year was also used ([1155]). We have agreed upon the acceptable discrepancy interval of 4 years, which means that the discovered time interval cannot differ from the Ptolemaic by more than 4 years.

As a result, we have to find four coverings with the following intervals between them:

a) A maximum of one year between the coverings by Venus and Mars, with the aberration rate of 4 years. If the "misprint version" contains no misprint in reality, the interval must cover 70 years, maximal aberration rate equalling 4 years.

b) 31 or 32 years between the coverings by Mars and Jupiter with the aberration rate of 4 years.

c) 11 years between the coverings by Jupiter and Saturn with the aberration rate of 4 years.

We have therefore formulated a precise mathematical problem. Let us proceed to formulate the solution we came up with, which is the result of middle element calculations.

There are only three solutions of the formulated mathematical problem on the historical interval between 500 B.C. and 1700 A.D. These solutions are approximated and not precise.

The first solution (mediaeval, X-XI century).

This solution was obtained by A. T. Fomenko, V. V. Kalashnikov and G. V. Nosovskiy and described in [METH3]:2.

1a). On 18 October, 960 A.D., Venus covered the η of Virgo. The calculated distance equals 1'-2' in this case.

1b). In the "misprint version" (qv above) this covering took place in 887 A.D., on the 9th of September. The calculated distance between them is less than 1'. However, the observation conditions here were rather poor.

1c). The "misprint version" allows for another solution – namely, the Venus covering in question may have taken place a year later, in 888 A.D., on the 21st of October. The calculated distance between then is less than 5' in this case.

2) In 959 A.D. Mars covered the β of Scorpio on the 14th of February. The calculated distance between them equals 15'.

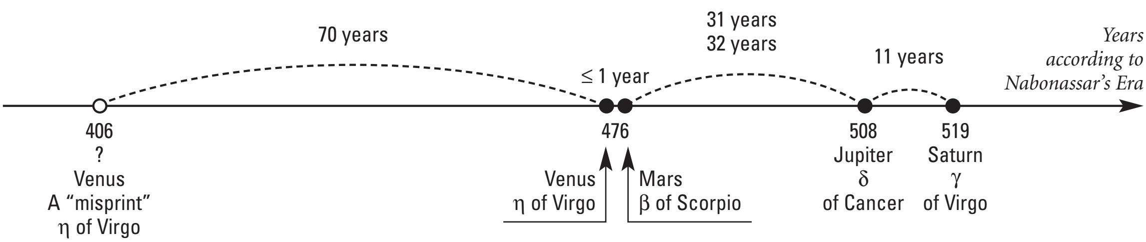

Fig. 10.1. Four observations of planets covering stars as mentioned in the Almagest. The datings are given according to the Era of Nabonassar used by Ptolemy.

3) In 994 A.D., on the 25th of July, Jupiter was at the distance of roughly 15' from the δ of Cancer. A propos, this distance is close to the minimal possible distance between the star and the planet in question on the entire historical interval under study.

4) On the 16th of August, 1009 A.D., Saturn was at the distance of 25'-30' from the γ of Virgo, below the star.

The maximal "leeway interval" in the intervals between the subsequent observations equals 4 years for the first solution if we are to measure all of the Ptolemaic distances in years. Indeed:

a) The interval between the Venus and Mars coverings equals one year, namely, 960 A.D. for Venus and 959 A.D. for Mars. The maximal distance we need is one year ± 4 years.

b) The interval between the Mars and Jupiter coverings equals 35 years: 959 A.D. for Mars and 994 A.D. for Jupiter. We needed 31 or 32 ± 4 years.

c) The interval between the Jupiter and Saturn coverings equals 15 years: 994 A.D. for Jupiter and 1009 A.D. for Saturn. We needed 11 ± 4 years.

The second solution ("traditional", III century B.C.). It is exposed, for instance, in Robert Newton's book ([614], page 335).

1) The night of 11-12 October, 272 B.C. (or the year –271) saw Venus approach the η of Virgo. The distance between Venus and the Star in question equalled about 1'-3'.

2) In the morning of either the 18th or the 16th of January, 272 B.C. (or the year –271) Mars "approached" the β of Scorpio. However, according to Y. A. Grebenikov, the scientific editor of the Russian edition of R. Newton's book, on the 18th of January, in the morning, "Mars was at the distance of circa 50' from the β of Scorpio at the moment of observation [ARO, section XI.4], and such a distance can hardly be regarded as close proximity. However, Mars and the star in questions were very close to each other on the 16th of January, –271, and so the date may have either been written erroneously or misinterpreted by Ptolemy"([614], page 312, comment 3). According to our calculations, the distance between Mars and the star equalled circa 50'-55' on the 18th of January, 272 B.C., and was more than 15' (more precisely, 17'-18') on the 16th; this solution is therefore a dubious one.

3) In the morning of the 4th September, 241 B.C., Jupiter "approached" the δ of Cancer. However, calculations demonstrate that the distance between Jupiter and the star in question was greater than 25'.

4) On the 1st of March, 229 B.C., Saturn was at the distance of some 30' from the γ of Virgo.

All the datings are given according to the Julian calendar with the beginning of the year falling on the 1st of January.

In the "ancient" solution the intervals between the coverings are as follows: the Mars and Venus coverings took place the same year, the Mars and Jupiter coverings were separated by the interval of 31 years, and the Jupiter and Saturn coverings are located at the distance of 12 years from each other.

The third solution (late Middle Ages, XV-XVI century). This solution was discovered by A. T. Fomenko and G. V. Nosovskiy.

1) On the 19th of September, 1496 A.D., Venus covered the η of Virgo. The calculated distance is less than 1' in this case.

2) In 1497 A.D., on the 19th of January, Mars covered the β of Scorpio. The calculated distance between them is circa 15'.

3) In 1528 A.D., on the 3rd of June, Jupiter approached the δ of Cancer, the distance between them equalling circa 25'.

4) In 1539 A.D., on the 5th of September, Saturn was some 25' below the γ of Virgo.

The late mediaeval XV-XVI century solution has a leeway of 1 year maximum for the datings of the Ptolemaic intervals between consecutive observations. From the point of view of time intervals between coverings, this solution is the best of the three – it is ideal. Indeed:

a) The interval between the coverings by Venus and Mars equals a mere four months (19 September 1496 A.D. for Venus and 19 January 1497 A.D. for Mars). Less than one year, in other words; this fits into the required Ptolemaic interval perfectly.

b) The interval between the Mars and Jupiter coverings equals 31 years: 1497 A.D. for Mars and 1528 A.D. for Jupiter. According to Ptolemy, we need 31 or 32 years.

c) The interval between the Jupiter and Saturn coverings equals 11 years: 1528 A.D. for Jupiter and 1539 A.D. for Saturn. This is the exact period required according to Ptolemy – eleven years.

As we shall see below, the "ancient" solution is visibly worse than the mediaeval solutions that we calculated. The chronologists who studied the Almagest could not satisfy to Ptolemy's specifications. It is also obvious that the chronologists didn't make the emphasis on either the correspondence between the observation described by Ptolemy and modern calculations, or even the datings of these observations given by Ptolemy himself, but rather the ambiguous interpretation of Ptolemy's names for months and such astronomical characteristics as the longitude of the sun, the moment of observation, planetary longitude etc, which were calculated by Ptolemy with the use of a rather imprecise theory.

These data cannot serve as basis for the dating of the actual observations, at any rate. The dating should be based on the observation characteristics that Ptolemy cites as opposed to calculating, namely, the year when a star was covered by a planet and the actual fact of this covering.

The X-XI century solution satisfies to Ptolemy's description the best. Let us point out that it is located in the middle of the possible dating interval that we calculated for Ptolemy's star catalogue. The late mediaeval solution of the XV-XVI century A.D. is also possible from the point of view of the New Chronology. As a matter of fact, the ancient solution is located at the distance of 1800 years from the late mediaeval solution, which is the value of one of the key chronological shifts inherent in the Scaligerian version of history, qv in CHRON1. The existence of several solutions, among them the "ancient" one of the III century B.C. is explained by the existence of certain periods in planetary coverings of the stars. The flat configuration of the Earth and the planets that defines the possibility of observing these coverings from the Earth (provided that the planetary orbital planes are located at a satisfactory angle from the ecliptic) changes over the course of times; these changes conform to an approximated periodic law. Indeed, the dynamics of this configuration can be described as the movement of a point along the winding of a multidimensional torus. However, the angles between the orbital planetary planes and the ecliptic gradually alter with the course of time. It turns out that an entire period can pass over the time needed for these alterations to "distort" the necessary configuration of planetary orbits.

3. THE DATING OF THE PLANETARY STAR COVERINGS DESCRIBED IN THE ALMAGEST. A MORE PRECISE CALCULATION

3.1. The adjusted algorithm

Our calculations of the planetary coverings of the stars cited in the previous section were based on the astronomical formulae taken from the reference book by G. N. Duboshin ([262]). Also, when A. T. Fomenko, V. V. Kalashnikov and G. V. Nosovskiy were conducting these calculations in 1990, only the middle orbital elements were used. These were estimated precisely enough in the XIX-XX century; however, if we don't account for periodic additions, we shall come up with somewhat rough planetary positions. The lack of these periodic additions in our calculations of planetary coverings is clearly visible from the planetary formulae that we cited in [METH3]:2. These calculations sufficed for the ends we were pursuing at the time. Indeed, purely geometrical considerations make it obvious that the approximated solution that we came up with using the middle elements happens to be stable enough. We can therefore use it for obtaining a precise solution if we "move the dates about" somewhat. We weren't looking for this precise solution at the time and didn't go beyond rough calculations (which reflected the situation well enough all the same) for the following reasons.

Firstly, the calculations of the planetary coverings of the stars are of secondary importance. They are beyond the scope of the primary issue, which is the dating of old star catalogues, and can only be used for defining the possible directions of further analysis of the Almagest with the aim of dating its other parts, not just the star catalogue.

The second reason why we hadn't used the more precise planetary theory back then and resorted to the rather rough yet stable middle element formulae is as follows. Before the 1980's there were several different versions of the planetary calculation theory which gave inconsistent answers for distant epochs. This is easy to understand. All attempts of making the planetary formulae more precise are based on different empirical corrections to a large extent. These corrections result from modern observations. This implies their utility for the purpose of making modern formulae more precise. However, the issue of just how useful these corrections are for faraway epochs, and whether any such corrections can be made at all, is far from simple.

Over the last couple of years, the calculation methods used in planetary theory were improved to a great extent. Different teams of astronomers were using different approaches, and they all came up with formulae which give very precise solutions even for distant epochs.

This is far from being absolute proof of the validity of such theories as applied to the epochs in question, but it is valid enough. In general, the present situation in planetary theory calculations differs from the one reflected in the book by G. N. Duboshin ([262]) in 1976.

Therefore, nowadays it makes sense to return to the problem of dating the planetary coverings of stars with the use of more precise and up-to-date formulae accounting for periodical perturbations. We have done this in 1997-1999 using the Turbo-Sky software as well as more precise software.

We have used the well-known PLANETAP application for precise calculations. Its authors are J. L Simon, P. Bretagnon, J. Chapront, M. Chapront-Touze, G. Francou and J. Laskar (Bureau des Longitudes, URA 707. 77, Avenue Denfert-Rochereau 75014, Paris, France). It is used for calculating the heliocentric coordinates, radius vectors and instantaneous speeds for the 8 main planets of the Solar System (PLANETAP, Fortran 77) – Astron. Astrophys, 282 and 663 (1994).

This software allows to determine the visibility conditions of celestial bodies in relation to the local horizon for any location on Earth, depending on the time and the place of the observation. It can therefore be used for the verification of such details found in Ptolemy's descriptions of coverings as the time of day (morning, dawn, evening etc). Our previous and less precise calculations did not allow for taking these details into account.

3.2. The discussion of the mediaeval X-XI century solution

Let us begin with the discussion of the mediaeval solution (the X-XI century A.D.) in its final, somewhat adjusted version (as compared to the one found in [METH3]:2). The solution is as follows:

Venus: 960 A.D. We come up with either 888 A.D. or 887 A.D. for the "misprint version", which is worse.

Mars: 959 A.D.

Jupiter: 994 A.D.

Saturn: 1009 A.D.

This solution satisfies to Ptolemy's description with a great deal more precision than our previous middle element calculations. In other words, the astronomical software PLANETUP ([1405:1]) didn't simply confirm the prior rough result, or the very fact that the astronomical solution of the problem does in fact exist, but also demonstrated an almost complete concurrence of this astronomical solution to the additional details reported by Ptolemy in the Almagest.

Below we shall discuss yet another solution that we found – the late mediaeval one (XV-XVI century).

Let us remind the reader of the exact nature of the problem at hand. The most important fact is that the complete superimposition of stellar and planetary coordinates on the celestial sphere implies the proximity range of less than one minute. Even in the XVIII century, no reverse theoretical calculation of such an event could have been made. Unfortunately, there is no ideal solution to be found anywhere. For instance, Jupiter does not get closer than 10' to the star that it is supposed to cover. This makes the observations a lot less useful for the ends of independent dating. One wonders whether the data could be distorted or falsified; this is the consideration voiced by R. Newton in [614]. However, he could not prove the falsity of these observations, and wrote that they "might prove authentic" in the commentary ([614], page 335).

Nevertheless, if we are to interpret Ptolemy's reports of planets covering stars as indicating close proximity between the two, we may well come up with a solution whose temporal intervals shall be just as Ptolemy specifies them. One can naturally find several such solutions since the very concept of covering becomes rather vague. Scaligerian chronologists suggest one such solution – the III century B.C., qv above.

The two other solutions were found by the authors. They are more precise than the "Scaligerian", and one of them corresponds to the very middle of

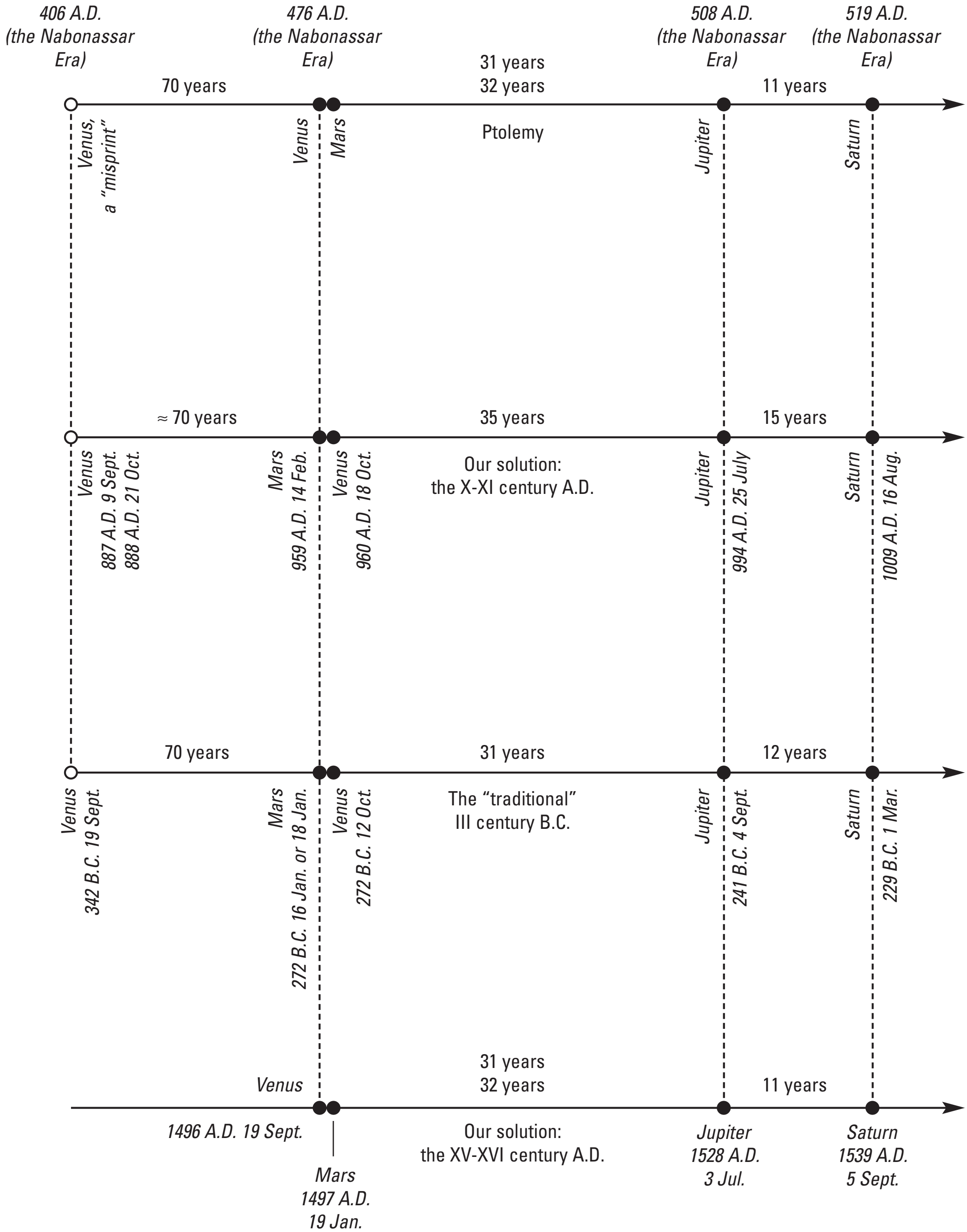

Fig. 10.2. The three astronomical solutions of the problem of planets covering stars. The top line stands for Almagest data, the one in the middle – for our solution of the X-XI century. The third line represents the "traditional" solution of the III century B.C., and the fourth one corresponds to our solution of the XV-XVI century.

the Almagest star catalogue dating interval – namely, the epoch of the X-XI century. This make it concur very well with the independent dating of the star catalogue. The second late mediaeval solution of the XV-XVI century that we discovered is also of interest and shall be discussed below.

Let us emphasize that the only data we used for our choice of a solution were those Ptolemy claims to borrow from his ancient predecessors. His own considerations and calculations based on these observations were not taken into account (such as his "mid-solar position" calculations etc). Among other things, these calculations represent the attempt of either the author himself or a late mediaeval editor to date these "ancient" observations. Therefore, the analysis of these Ptolemaic calculations shall most probably give us the chronological opinions of the XVI-XVII century observer. These may have been taken from the works of either Scaliger or even Kepler in the XVI-XVII century and can only complicate our own calculations. Planetary positions in the past could already be calculated with sufficient precision in the epoch of Scaliger and Kepler; the chronologist who edited the Almagest may well have decided to "date" these observations to the III century B.C.

Let us consider the details. We must reiterate that according to the well-known traditional identifications of Ptolemaic stars as their modern counterparts ([614]), the Almagest reports the following four planetary coverings of stars:

1) Venus covering the η of Virgo "around twelve o'clock", according to Ptolemy.

2) Mars covering the β of Scorpio in the morning.

3) Jupiter covering the δ of Cancer at dawn.

4) Saturn observed "two units below" the γ of Virgo.

Let us point out that we found no reason to doubt the correctness of modern identifications of the Ptolemaic stars.

Let us consider each of these four events separately.

3.2.1 The η of Virgo covered by Venus in 960 A.D.

Bear in mind that Ptolemy's text is as follows: "Among the ancient observations we have chosen one, described by Timocharis in the following manner: in the 13th year of Philadelphus, on the 17th-18th of the Egyptian Messor, in the 12th hour, Venus completely covered the star located on the opposite of Vindemiatrix" ([1355], page 319, Chapter X.4).

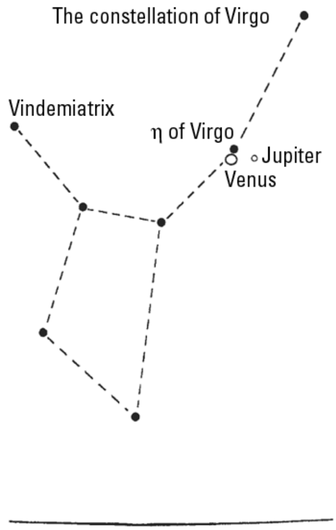

Fig. 10.3. Venus covering the η of Virgo shortly before dawn on 18 October 960 A. D. The observation location that we chose corresponds to Alexandria and Cairo in Egypt. The calculations were made with the aid of the PLANETUP program. We see the local horizon of Alexandria for 5 AM local time. The Sun is below the horizon, at the distance of some 40 degrees from Venus.

The solution we came up with using the middle element method is as follows: Venus covered the η of Virgo in October 960 A.D., which corresponds perfectly to the year 476 from Nabonassar, qv in fig. 10.2. This covering that took place in the morning of 18th October 960 is ideal. The distance between Venus and the star equalled 1-2 minutes, which would make the star invisible due to the radiance of Venus.

At the same time, it has to be pointed out that the covering of the η of Virgo by Venus is an event as frequent as it is uninformative. One would wonder why such an ordinary celestial event would be mentioned by the ancient astronomer and included in the Almagest. A possible answer is implied by fig. 10.3 where we see Venus covering the η of Virgo in 960. It turns out that Jupiter was rather close to Venus that moment – at the distance of some 10 minutes. In other words, Venus covered the star while its position all but coincided with that of Jupiter. This fact is remarkable

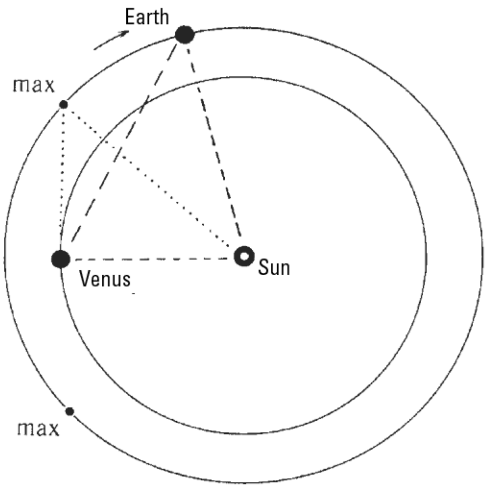

Fig. 10.4. Respective positions of Venus, the Sun and the Earth for the morning of 18 October 960 A. D. Calculated in PLANETUP. Venus had reached its maximal elongation shortly before.

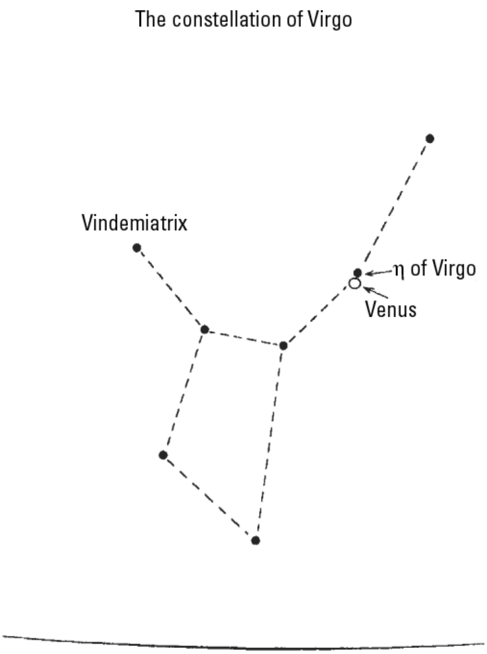

Fig. 10.5. Venus covering the η of Virgo shortly before dawn on 21 October 888 A. D. The observation location that we chose corresponds to Alexandria and Cairo in Egypt. Calculated in PLANETUP. We see the local horizon of Alexandria for 5 AM local time. The Sun is below the horizon, at the distance of more than 40 degrees from Venus.

enough to have attracted the attention of the ancient astronomer who decided to mention Venus covering the star under such rare circumstances.

By the way, the 960 covering of a star by Venus also corresponds to Ptolemy's claim that "Venus had already been past its maximal matutinal elongation" ([1355], page 319); qv in fig. 10.4. Bear in mind that the maximal elongation point of a planetary orbit is the point where the planet in question is at the maximal distance from the sun as observed from the Earth. The solar and telluric vectors of the star give a right angle.

Let us now consider the "misprint version" for Venus. The previously-discovered middle element solution is as follows: Venus covered the η of Virgo in September 887 A.D. The η of Virgo is usually identified as the Ptolemaic "star on the opposite of Vindemiatrix" that we are referring to.

A more precise calculation made with the aid of the PLANETUP software ([1405:1]) demonstrates that Venus had indeed covered the η of Virgo completely on the 9th of September 887 A.D., at 16:12 GMT. However, the visibility conditions of this covering have been rather poor in Europe, qv below.

However, Venus frequently passes near the η of Virgo, covering it completely in many cases. It is little wonder that another solution exists for Venus, one that is rather close to the first one temporally and happens to be ideal.

On the 21st October 888 A.D. Venus passed the η of Virgo at the distance of less than 5 arc minutes at about 1 AM GMT, or 3-4 AM for Eastern European longitudes. The comparative luminosities of Venus and the η of Virgo differ by 8 stellar magnitudes ($M = -3.4$ for Venus and $M = 3.89$ for the η of Virgo). Such a drastic difference in luminosity may have made 5-minute proximity look like perfect covering, since the dim star would be outshone by the brightness of Venus that approached it rather closely (see fig. 10.5).

Astronomical visibility conditions for the covering of the η of Virgo by Venus were outstandingly good on the 21st October 888. In Alexandria, for instance, Venus rose around 3 AM local time (1 AM GMT). In the Volga region the time was 4 AM. The sun rose three hours later; therefore, one may have observed Venus covering the η of Virgo for three hours before sunrise.

Let us point out that a slight shift of the covering date for Venus forwards (888 A.D. instead of the initially calculated 887 A.D.) affects the mediaeval solution that we come up with for Venus in a positive way, making the chronological concurrence with the Almagest descriptions better. This is plainly visible from fig. 10.2.

Let us briefly discuss the initial solution that we got for Venus (the evening of the 9th September, 887 A.D.)

According to the PLANETUP software ([1405:1]), the 887 A.D. covering was precise even when observed through a 25x telescope – in other words, Venus would continue covering the η of Virgo even if magnified by a telescope. This covering lasted for an hour – between 15:00 and 16:00 GMT. However, the visibility conditions were poor due to the close proximity of Venus to the sun.

On the other hand, the more precise solution of 888 A.D. for Venus conforms to Ptolemy's description perfectly well. One could observe Venus covering the star at any latitude in 888.

As for the time of observation indicated in the Almagest as "the twelfth hour", it can be said to fit Venus well at any rate, since Venus is never too far away from the sun and can be observed around either 6 PM or 6 AM local time – at or around either the dawn or the dusk. The Almagest indicates the "twelfth hour"; bear in mind that in the Middle Ages time was often counted from 6 AM or 6 PM – the vernal (autumnal) dusk or dawn. Both the sunrise and the sunset would thus take place at roughly twelve o'clock as opposed to the six o'clock in either the morning or the evening in modern interpretation.

3.2.2. Mars covering the β of Scorpio in 959 A.D.

Ptolemy's text runs as follows: "We considered one of the old observations, which makes it clear that in the 13th year of Dionysius, on the 25th of Aigon, Mars covered the northernmost star on Scorpio's forehead in the morning" ([1355]), page 342, Chapter X.9).

The solution we have previously found with the middle element method is as follows: the covering of the β of Scorpio ("the northernmost star on Scorpio's forehead") by Mars took place in February 959 A.D., qv above.

More precise calculations made with the aid of the PLANETUP software ([1405:1]) tell us the following. In 959 A.D., on the night of the 13th-14th February, Mars passed by the β of Scorpio, the distance between them equalling circa 15 arc minutes. The modern formulae of the French astronomers J. Simon and P. Bretagnon have been used by M. Y. Polyakov for additional calculations at our request. These calculations also confirmed the distance between Mars and the star in question to have equalled some 15 arc minutes that night, qv in fig. 10.6.

We might encounter the objection that such propinquity between Mars and the star cannot be considered an exact covering, since a person with keen eyesight is capable of distinguishing between two stars at this distance. Let us however point out that in case of Mars Ptolemy does not use the phrase "completely covered" as he does in his description of the Venus covering, simply telling us that "Mars covered the star". Is Ptolemy's choice of words arbitrary in this case? Let us consider all four coverings (see table 10.2).

Let us recollect that the coordinates of all the stars

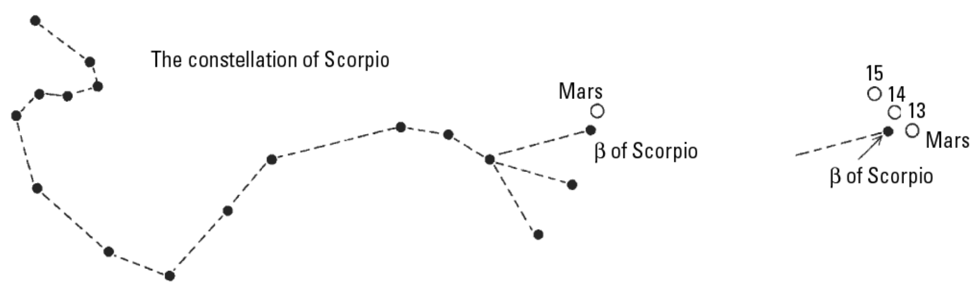

Fig. 10.6. Mars covering the β of Scorpio on the night of 13-14 February 959 A. D. On the right we see the position of Mars in relation to the β of Scorpio for the morning of the 13, 14 and 15 February indicated separately. Calculated in PLANETUP.

in the Almagest star catalogue are rounded off to 10'. In other words, the measurements of stellar coordinates in Ptolemy's epoch were made with the measurement unit value of circa 10'. This very distance must have therefore been the "unit" that Ptolemy refers to. We see a very good concurrence of Ptolemy's text with the astronomical solution that we found – namely, the fact that the distance of 25' between Saturn and the star was estimated as equalling "two units" by Ptolemy. This is high precision for a naked eye observation.

Our mediaeval astronomical solution for the planetary coverings of the stars mentioned in the Almagest is presented as table 10.2. This table implies the following:

1) A "unit", or the measurement unit used in the Almagest, roughly equals 10-15 arc minutes, which is very close to the Ptolemaic coordinate grid measurement unit value in the star catalogue.

2) The proximity of 10'-15' between a star and a planet (one unit) is referred to as a "covering" in the Almagest (qv applied to Mars and Jupiter).

3) The proximity of 1'-2' is naturally referred to as an "complete covering" in the Almagest, since even an observer with exceptionally keen eyesight could not see the rather dim star at such a small distance from the extremely bright Venus.

It is therefore obvious that Ptolemy's choice of expressions ("covering" and "complete covering") is far from arbitrary. They refer to the following: a "complete covering" means that two luminous dots on the sky cannot be told apart in case of a naked eye observation. A simple "covering" implies that the distance between the luminous dots is comparable with the measurement unit (which equals 10' for the Almagest).

Bear in mind that Ptolemy tells us that the Mars covering took place in the morning, which corresponds perfectly to the astronomical environment of 959 A.D. Mars only rose after midnight local time this year at the longitudes of Alexandria and Eastern Europe. The covering could therefore only be seen in the morning, or after midnight, which is what the Almagest tells us.

3.2.3. Jupiter covering the δ of Cancer in 994 A.D.

Ptolemy's text tells us the following: "We have once again considered a very accurate old observation telling us that in the 45th year of Dionysius, on the 10th of Parthenon, Jupiter covered the Northern Asse" ([1355], page 361, Chapter XI.3).

The solution that we found earlier using the middle element method is as follows: in July of 994 Jupiter really passed by the δ of Cancer at the distance of circa 20'.

More precise calculations with the aid of the PLANETUP software ([1405:1]) confirm the fact that Jupiter did indeed pass the δ of Cancer at the distance of some 15 arc minutes, qv in fig. 10.7.

Pay attention to the fact that Ptolemy emphasises

The covering of a star by a planet as described by Ptolemy in the Almagest	*Calculated distance between the planet and the star at the moment of observation*	*The date*
Venus "covered the star completely"	1' – 2'	The morning of the 18th October, 960 A.D.
For the "misprint version"	Less than 5'	888 A.D., 21st October
For the "misprint version"	Less than 1'	9th September, 887 A.D. (poor observation conditions)
Mars "covered the star"	15'	The morning of the 14th February 959 A.D.
Jupiter "covered the star"	15'	The dawn of the 25th July 994 A.D.
Saturn was at the distance of "two units" from the star	25' – 30'	The evening of the 16th August 1009 A.D.

Table 10.2. Mediaeval solution of the X-XI century for the coverings of stars by planets as described in the Almagest.

that Jupiter had covered the star at dawn. Indeed, on the 25th of July 994 Jupiter rose above the horizon just one hour before sunrise; therefore, the covering of the star in question by Jupiter could only be seen at dawn, which is meticulously pointed out by Ptolemy.

Once again we see that the time of day Ptolemy specifies for the planetary covering of the star concurs very well with our mediaeval solution, as is the case with Venus and Mars.

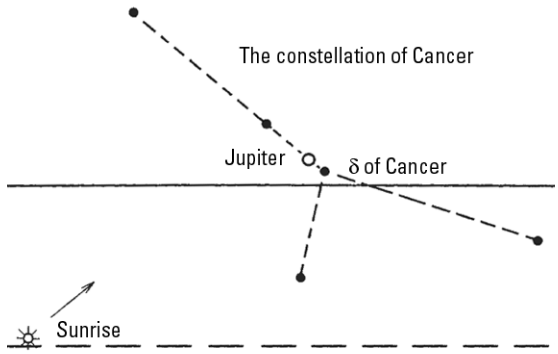

Fig. 10.7. Jupiter covering the δ of Cancer on 25 July 994 A.D., observed at dawn. We chose Sebastopol in Crimea as the observation point. Calculated in PLANETUP. The continuous line represents the local horizon at 1:30 GMT (the rising of Jupiter), and the dotted one stands for the local horizon at 2:30 GMT (sunrise).

3.2.4. Saturn approaching the γ of Virgo in 1009 A.D.

The Ptolemaic text is as follows: "We have considered yet another accurate observation of old, according to which Saturn was located two units below the southern shoulder of Virgo on 5 Xanticus of the Chaldaean year 82" ([1355], page 379, Chapter XI.7).

The solution we found before using the middle element method tells us that in August of 1009 A.D. Saturn passed the γ of Virgo at the distance of less than 50', being below the star in question.

More precise calculations conducted with the aid of the PLANETUP software demonstrated that Saturn did indeed pass the γ of Virgo at the distance of some 25-30 arc minutes on the 16th August 1009 A.D., qv in fig. 10.8.

Why does Ptolemy refer to a distance of "two units" in this case? We have already seen that the proximity of 15 arc minutes between a star and a planet is called a "covering" in Ptolemy's text, as is the case with Mars and Jupiter. The distance is two times as great in case of Saturn, equalling circa 30 minutes. Ptolemy deems this distance to equal "two units"; therefore, a single "unit" is approximately equal to 10-15 arc minutes. If the distance between a star and a planet equals one such unit, Ptolemy calls it a "covering"; should there be several such units between the planet and the star in question, Ptolemy tells us just how many units comprise the distance. In case of an observable superimposition of a planet over a star, Ptolemy uses the term "complete covering".

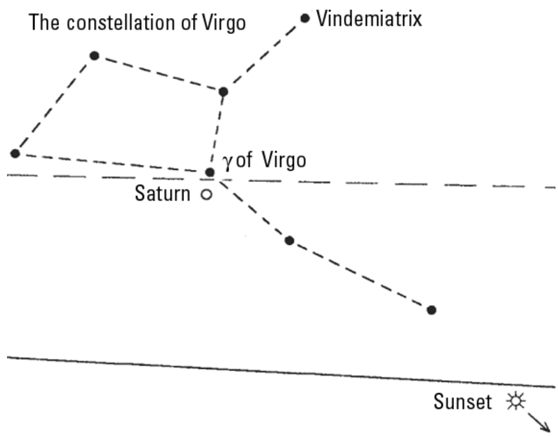

Fig. 10.8. Saturn passing under the γ of Virgo at the distance of "two units" (or 30 arc minutes) in the evening of 16 August 1009 A. D. Sebastopol in Crimea was chosen as the observation point. Calculated in PLANETUP. The continuous line represents the local horizon at 16:40 GMT (for the moment of sunset), and the dotted line represents the same at 17:50 GMT (for the moment that Saturn had set). Sunset followed the setting of Saturn by an hour; therefore, the planet could only be seen in the evening.

As is the case in all of the examples listed above, Ptolemy indicates the time of day with the utmost precision if we are to adhere to our mediaeval X-XI century solution. Namely, Saturn set below the horizon a single hour later than the sun on the 16th August 1009. Therefore it could only be seen in the evening, right after dusk, having disappeared below the horizon immediately afterwards. It could actually be observed below the star in relation to the local horizon line in Alexandria, just as Ptolemy tells us (fig. 10.8).

Therefore, this mediaeval solution corresponds to each and every Ptolemaic indications concerning the observation conditions in this last case as well.

As for the "Scaligerian" solution of the III century B.C., Jupiter, for instance, could be seen near the δ of Cancer all night long, which makes the ancient author's indication that Jupiter covered the star "at dawn" bizarre – or unnecessary at the very least. The same is true for Saturn, which could be observed near the star all night long and not just in the evening, as is the case in our solution. The Almagest explicitly tells us that Saturn had approached the star in the evening. Our solution is therefore in better correlation with the ancient descriptions cited by Ptolemy than the Scaligerian version.

Corollary. It turns out that the mediaeval solution that we have discovered, namely:

- 18 October 960 A.D. for Venus (21 October 888 A.D. or 9 September 887 A.D. in case of the "misprint version", the latter solution being less fitting);
- 14 February 959 A.D. for Mars;
- 25 June 994 A.D. for Jupiter, and
- 16 August 1009 for Saturn

corresponds to all of the descriptions provided by Ptolemy perfectly, even the ones we paid no attention to before, in our approximated calculations (such as "in the morning", "at dawn" etc). This serves as additional evidence in support of the statement that the Almagest contains the descriptions of astronomical events that took place in the epoch which cannot possibly predate the IX-XI century A.D.

However, let us reiterate that one needs to be aware that such precision of planetary coverings of stars (around 15 minutes) could be obtained by calculations using the Kepler theory in the XVII century. In Chron6 we cite the data concerning false date-lines in many books of the alleged XVI century which were really published in the XVII century and contain a false earlier dating. This fact makes us uncertain of whether the version Almagest that we have at our disposal nowadays really dates to the XVI century. It is very possible that the Almagest version known to us nowadays was created in the XVII century, in which case it may contain the results of astronomical calculations made in accordance with Kepler's theory. These "calculated" astronomical events may be referred to as actual observations in the Almagest, which is detrimental to the value of "planetary covering datings", since one cannot help suspecting these coverings to have been *calculated* as late as the XVI-XVII century in order to fit the Scaligerian chronology, which is the case with several other "ancient astronomical observations", or even with the purpose of "confirming" it, since the freshly-fabricated Scaligerian chronology had been in dire need of "documental proof" in the XVII century. Such proof was hastily produced via the "correct editing" of such authentic old documents as the Almagest.

Such suspicions do not concern the Almagest star catalogue, which we demonstrate to be a really old document compiled with the use of the X-XI century observations above.

3.2.5. The chronology of the Almagest according to the X-XI century solution

According to the dating of the planetary coverings resulting from the X-XI century solution, the beginning of the Nabonassar era as reflected in the Almagest dates to 480-490 A.D. More precisely, the polar values of this era beginning for which we have strict correlations between the calculated and Ptolemaic datings of the coverings in question are 483 and 492 A.D., respectively (see table 10.1 above which contains Ptolemaic datings of the coverings that use the Nabonassar era).

Let us point out the most noteworthy fact that 492 A.D. is exactly the year 6000 by the Byzantine era "since Adam", which was used extensively up until the XVII century. In particular, it had been used in Russia and Byzantium before the Anno Domini era was introduced in the XVI-XVIII century. What would make the year 6000 in this chronology important to us? Firstly, this is a good round figure divisible by 1000 years, which would make it a natural simplification of the chronological initial reference point. Millennia would often be omitted from mediaeval datings, qv in Chron1. Therefore "year zero" of the Byzantine era "since Adam" was de facto the year 6000 up until the end of the XV century, or 492 A.D. Secondly, the birth of Christ is dated to this very year in some of the old chronicles. We must make the observation that Christ is apparently referred to as "the celestial king" (or "Nabo-na-sar") in the Almagest, although the author (editor) of the Almagest is likely to have not been aware of this. Said year is used for the dating of Christ's birth by the mediaeval Byzantine chronicler John Malalas ([338] and [503]). His ***Chronograph***, which had been a very widely-distributed work in the Middle Ages and whose Slavic and Greek copies had reached our day, tells us that "everyone is of the opinion that the Lord's advent took place in the year 6000" ([503], page 211). In other words, John Malalas dates the advent of Christ to the year 6000. If we are to convert this dating into modern chronology, we shall come up with 6000 – 5508 = 492 A.D. Malalas tells us that everyone adhered to this opinion, which goes to say that the dating of Christ's birth to the year 6000 since Adam, or 492 A.D., was a common one in his epoch.

This would make the year 492 as the initial reference point of the Almagest chronology a natural choice. If the Almagest dates to the late Middle Ages, this is the chronological concept that we should expect either Ptolemy himself or the editor of the book to hold true.

The initial reference point of Nabonassar's era allows us to reconstruct the chronology of the Almagest in general. One has to make the important observation here that a study of the chronology reflected in the Almagest texts that had reached our day is really a reconstruction of the opinion of the XVI-XVII century editor who had made the Almagest look the way it does today and not the opinion of the ancient XI-XIII century authors who had created the first versions of the Almagest, and its star catalogue in particular. Nevertheless, this later chronology can also be of interest to us. The chronological version of more recent editors may still be at odds with the consensual Scaligerian version since in the epoch of the XVI-XVII century, when the final editions of the Almagest were made, the authority of the Scaligerian chronology was only beginning to establish itself. Other chronological schemes of the XIV-XV century had also been in use at the time, and we hardly know anything about those nowadays. Those versions differed from the Scaligerian version considerably; below we shall witness this to be the case with the Almagest.

The era of Nabonassar is the standard era used in the Almagest, which occasionally refers to it simply as to the "initial epoch" ([704], page 130). All the other eras and chronological landmarks mentioned by Ptolemy are dated in relation to Nabonassar's era in the Almagest. We encounter the following era and reign datings in the Almagest:

The first year of Mardokempad's reign = the 25th year of Nabonassar ([704], pages 129, 130, 126 and 200).

The first year of Nabopallasar = the 123rd year of Nabonassar ([704], page 161).

The first year of Cambyses = the 219th year of Nabonassar ([704], page 161).

The first year of Darius = the 226th year of Nabonassar ([704], pages 128 and 129).

The reign of Phanostratus, the Archon of Athens = the 366th year of Nabonassar ([704], page 132).

The reign of Evandrus, the Archon of Athens = the 367th year of Nabonassar ([704], page 133).

The beginning of the 76-year period of Calippus = the 418th year of Nabonassar ([704], pages 133, 80, 81, 182, 216, 133, 182 and 222).

The first year of the era counted from the death of Alexander = 425th year of Nabonassar ([704], pages 99-100, 80, 336-337 and 349-351). It is usually considered that the Alexander in question is Alexander the Great, however Ptolemy simply mentions "Alexander" by name. According to the Almagest, "424 Egyptian years passed between the beginning of Nabonassar's reign and the death of Alexander" ([704], page 99). According to Ptolemy, there are 365 days in an Egyptian year ([704], page 80).

The first Chaldaean era year = the 438th year of Nabonassar ([704], page 305). Modern commentators are of the opinion that the "Chaldaean era" of the Almagest is really the so-called "Seleucidean era" ([704], page 595). However, Ptolemy himself does not use this name and always refers to the "Chaldaean era".

The first year of Philadelphus = the first year of the Dionysian era = the 464th year of Nabonassar ([704], pages 304, 305, 321-322 and 336-337).

The first year of Philometor = the 568th year of Nabonassar ([704], page 181).

The first year of Augustus = the 719th year of Nabonassar ([704], pages 99-100).

The first year of Domitian = the 829th year of Nabonassar ([704], page 220).

The first year of Trajan = the 845th year of Nabonassar ([704], page 331).

The first year of Adrian = the 863rd year of Nabonassar ([704], pages 99-100, 126, 157, 326 and 340).

The first year of Antoninus = the 884th year of Nabonassar ([704], pages 139-140, 80, 216, 311, 326 and 340).

The text of the Almagest dates the firsthand astronomical observations (which are supposed to have been made by Ptolemy himself) to the epoch of Antoninus, qv on page 311 of [704], for instance. The text of the Almagest is as follows: "we observed Mercury in the second year of Antoninus, or the 886th year of Nabonassar" ([704], page 311, section IX.9). Another passage we encounter in the Almagest tells us that "the most precise observations of the equinoxes and the summer solstice were conducted by us in the 463rd year since the death of Alexander" ([704], page 91, section III.3).

The observations of Hipparchus, for instance, are dated to the year 197 since the death of Alexander in the Almagest, or the year 621 of Nabonassar ([704], page 142). The text of the Almagest tells us the following: "Hipparchus writes that he used instruments to observe the Sun and the Moon on Rhodes in the 197th year since the death of Alexander" ([704], page 142, section V.5). One must naturally bear in mind that the final datings are most likely to have been introduced into the text of the Almagest in the XVI-XVII century. It is possible that this Hipparchian observation of the sun and the moon with the use of instruments was really made by Tycho Brahe in the late XVI century which was ascribed to the "ancient Hipparchus" in the final edition of the Almagest.

In accordance with the above, let the year 492 A.D. stand for the year 6000 "since Adam" in the old Russian and Byzantine chronology. We shall come up with the following datings for the chronological landmarks of the Almagest:

The first year of Nabonassar's era – 493 A.D.

The first year of Mardokempad – 517 A.D.

The first year of Nabopallasar – 615 A.D.

The first year of Cambyses – 711 A.D.

The first year of Darius – 718 A.D.

The archonship of Phanostratus – 858 A.D.

The archonship of Evandrus – 859 A.D.

The first year of the first cycle of Calippus – 910 A.D.

The death of Alexander – 916 A.D.

The first year of the Chaldaean era – 930 A.D.

The first year of Philadelphus – 956 A.D.

The first year of the Dionysian era (era of Philadelphus?) – 956 A.D.

The first year of Philometor – 1060 A.D.

The observations of the sun and the moon made by Hipparchus – 1113 A.D.

The beginning of Augustus' reign – 1211 A.D.

The first year of Domitian – 1321 A.D.

The first year of Trajan – 1337 A.D.

The first year of Adrian – 1355 A.D.

The first year of Antoninus – 1376 A.D.

The observations of the equinoxes made by Ptolemy – 1379 A.D.

The actual observations of Ptolemy ascribed to the epoch of Antoninus are thus dated to 1370-1380 A.D. in the Almagest. The abovementioned observation of Mercury ([704], page 311) is dated to 1378, for instance. The observations of the equinoxes and the solstice ([704], page 91) are dated to 1379, or the end of the XIV century. The observations of Hipparchus are dated to rougly 1113 A.D., or the beginning of the XII century. We can see that the last editors of the Almagest had a concept of chronology that was completely different from the Scaligerian version (which dates Hipparchus to the II century B.C., for instance).

We have to point out that the resulting chronology of the Almagest concurs well with that of the famous mediaeval author Matthew Vlastar ([518] and [17]). See CHRON6 for our study of Vlastar's chronology. The work of Matthew Vlastar is presumed to have been written in the XIV century ([17], page 18). We see that the Almagest in general corresponds quite well with the chronological tradition of the XIV-XVI century.

The picture of the chronological concepts that the authors and the editors of the Almagest adhered to (fig. 10.9) is in ideal correlation with our dating interval of the Almagest star catalogue (600-1300 A.D.). Indeed, fig. 10.9 demonstrates this interval to include the planetary coverings of the stars as well as a manifest mass concentration of the Almagest's chronological reference points. In particular, the possible dating interval of the Almagest star catalogue covers the initial counting point of the Calippus cycles, the beginning of the era starting with the death of Alexander, the beginning of the Chaldaean era and the beginning of the Dionysian era. Four out of five eras

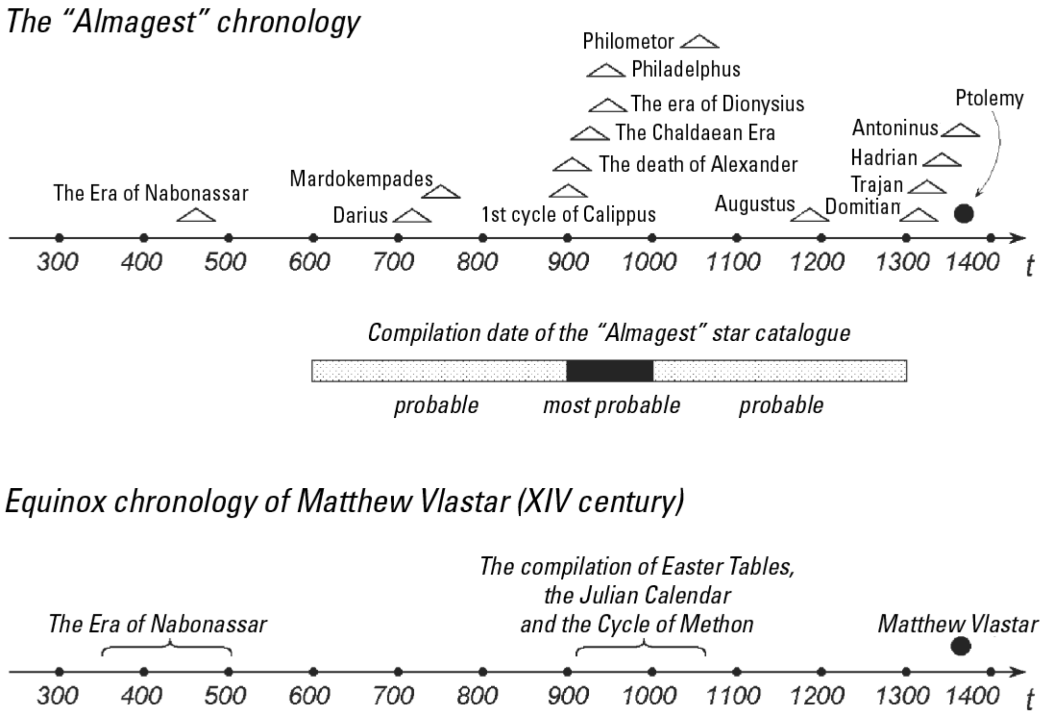

Fig. 10.9. The chronology of the "Almagest" in accordance with the mediaeval solution obtained from the coverings of stars by planets and shifted into the X-XI century, which makes the beginning of the Nabonassar era shift into the second half of the V century A.D. We provide another chronology for comparison – a very uninformative and rudimentary version suggested by the Byzantine author Matthew Vlastar, whose works are usually dated to the XIV century. We see a correspondence between the two chronologies in question.

used in the Almagest, in other words, excepting the era of Nabonassar.

Furthermore, all of the Roman emperor reigns mentioned in the Almagest (those of Augustus, Antoninus, Adrian, Trajan and Domitian) become dated to the epoch of the XIII-XIV century A.D. according to fig. 10.9. This is the very epoch that follows the compilation of the Almagest star catalogue, which is when the first "ancient" versions of the Almagest are most likely to have been edited and expanded. Those were based on the initial "royal" star catalogue of the XI century.

We must also note that the date of "Alexander's death" is roughly 916 A.D. according to fig. 10.9. The resulting date corresponds perfectly to the reign of the only emperor with the name of Alexander in the entire history of Byzantium and mediaeval Europe – 912-913 A.D. ([495], page 18).

Let us also point out that the rough dating for the beginning of the Calippus cycle chronological scale is 910 A.D. according to fig. 10.9. It is rather close to the beginning of the Great Indiction calendar in 877 A.D., although the difference is far from being marginal and equals some 35 years. Bear in mind that the beginnings of the Great Indictions are separated by 532-year intervals in the Julian calendar, which is the cycle period after which the combination of the mediaeval calendarian characteristics of a year (the Indiction, the circle for the Moon and the circle for the Sun) begins to repeat itself. See more details in our study of the calendar issues contained in CHRON2 and CHRON6. Apart from the Great Indiction, the calendars also used a shorter 76-year period – the so-called cycle of Calippus. Bear in mind that a Great Indiction consists of seven cycles of Calippus, which is an integer. Indeed, 532/76 = 7. If the "ancient"

Greek cycle of Calippus comprised a subsection of the Great Indiction, each of the latter should begin at the same time as the first cycle of Calippus. The approximate Calippus cycle beginning date of 910 A.D. does not contradict this. The difference of 911 – 877 = 34 years is marginal compared to the 532 years of the Great Indiction. However, a cycle of Calippus does not necessarily have to begin at the beginning of the Indiction.

However, it isn't quite clear why the cycle of Calippus beginning in 910 A.D. does not correlate with the Paschalian 19-year "circle for the Moon", or the cycle of Methon. According to the Paschalian tables, the circle for the Moon equalled 15 and not 1 in 910 A.D., qv in Chapter 19 of CHRON6. The cycle of Calippus and the Paschalian lunar cycle begin to correlate with each other if we are to presume that what we're dealing with here is a 100-year shift in the Almagest chronology which moved the XI century events backwards into the X. This phantom reflection is present and indeed well-manifest in the Scaligerian version, qv in CHRON1. A centenarian shift transforms 910 into 1010, which is the exact first year when the 19-year Paschalian "circle for moon" begins.

The suspicion that there is a 100-year shift present is also backed up by the following fact. The Almagest contains numerous references to the era of Dionysius whose beginning coincides with that of the Philadelphus' reign (956 A.D., qv above). However, the Dionysian era was the mediaeval name used for the Anno Domini era. For instance, in the early XVII century "Kepler dated his ***New Astronomy*** as follows: *Anno aerae Dionisianae 1609* [or the 1609th year of the Dionysian era – Auth.]" ([393], page 248). A propos, this name of the A.D. era is explained by the fact that the monk who was the first to have calculated the year of Christ's birth is presumed to have been called Dionysius ([393], page 240). However, another explanation is also possible. The actual word "Dionysius" stands for "god" or "divine" in Latin; the era of Dionysius is therefore the era of the Lord, or the Anno Domini era.

Furthermore, according to the New Chronology, Christ was born around 1152 A.D., qv in our books entitled "King of the Slavs" and "The Foundation of History". The Crucifixion took place in 1185 A.D. However, later chronologists of the Middle Ages miscalculated the birth of Christ by 100 years initially, shifting the date in question into the XI century. The error was aggravated by a further shift of 1050 – to the beginning of the New Era. Vestiges of the erroneous mediaeval tradition of dating the Nativity to circa 1050 A.D. have survived until our day and age – for instance, if we are to believe the indications given by mediaeval sources concerned with the Passover and the calendar, the alleged year of the Crucifixion is 1095 A.D., qv in Chapter 19 of "Biblical Russia".

Let us now consider the Almagest chronological landmark table cited above. It gives us a single isolated chronological landmark for the period of the XI-XII century, which is the reign of Philometor. According to the chronology of the Almagest, this reign begins almost exactly a hundred years after Dionysius (or Philadelphus). This falls on the year 1060 A.D. according to our table, which is very close to the first erroneous dating of the Nativity (the XI century, according to the learned chronologists). The reign of Philometor ends in the 631st year of Nabonassar according to the Ptolemaic ***Canon of the Kings*** ([704], pages 458-459), or 1093 A.D. by our table. Once again, we see that this date all but coincides with 1095 A.D., or the first erroneous dating of the Crucifixion. By the way, historians are of the opinion that Philometor was named Ptolemy, likewise Philadelphus ([704], pages 458-459). The Ptolemaic ***Canon of the Kings*** contains three "divine" names of Ptolemaic kings that follow Philometor immediately: king Evergetoy *Dey*teroy (*Dey* = God), king *Soteros* (*Soter* = Saviour), and king *Dio*nysoy Neoy (*Dio* = God), qv in [704], pages 458-459. We see no other royal names containing the root "god" or "saviour" anywhere else in the ***Canon of the Kings*** ([704], pages 458-459). This is the only such fragment in the entire ***Canon of the Kings***.

It is therefore possible that the A.D. era is referred to as the Philometor era in the Almagest. It is duplicated as the Dionysian era after a 100-year shift backwards, and is also known as the era of Philadelphus.

Let us conclude this section with an observation concerning the beginning of the Nabonassar era which is dated to the V century A.D. according to fig. 10.9. Let us emphasize that the use of an era beginning in the V century A.D. in the Almagest by no means implies the existence of a continuous astronomical tradition between the V century and Ptolemy's epoch. According to CHRON7, people are most likely to have known no literacy in the V century. The matter is that the stable chronological reference points were often introduced as events with an a priori calculated date, just like they are today. On the other hand, the eras that begin with a current event which is well-dated initially, were seldom used for hundreds of years, being too closely-tied to contemporaneity and subject to being replaced by new ones with the change of generations. A good example is an era counted from the beginning of a living emperor's reign. Such eras are still used in Japan, changing every time that a ruler dies.

The "long-term" eras most probably resulted from chronological calculations of the datings of important events in distant past, already with no connections to contemporaneity and unlikely to make the subsequent generations want to replace them with new ones. It is a well-known fact that the modern Anno Domini era, for instance, came to existence in this manner. This is the era whose beginning was calculated, and we have been using it for the last couple of centuries. The era "since Adam" (or Genesis) in its numerous versions, which was used in the XIV-XVII century, must have been introduced in a similar way. All these eras are based on the chronological calculations of events dating to the distant past, or *forgotten datings.* See our analysis of calendar issues in CHRON6, Chapter 19.

However, the mediaeval chronological calculations tend to contain enormous errors resulting from the poorly-developed science of the time as well as certain characteristics of the old calendar systems resulting in the "instability" of the latter. See more about it in CHRON6, Chapter 19. Coupled with the natural desire of the chronicler to date important events to as distant an era as possible ("the older, the better" principle), these errors often gave birth to extremely ancient chronological reference points in the past, which would then be considered the beginning of an era and used to tens and hundreds of years on end, as is the case with the Anno Domini era which we already cited.

Therefore the several chronological landmarks located at some distance from the XI-XIV century epoch as seen in fig. 10.9 (the beginning of the Nabonassar era, the reigns of Mardokempad and Darius etc) are most likely to result from different erroneous chronological calculation of the XIV-XVII century, which would obviously manifest in the Almagest.

Let us also pay attention to the resulting datings of the reigns of the Roman emperors who were Ptolemy's contemporaries and got mentioned in the Almagest. They are Domitian, Trajan, Adrian and Antoninus. All of these reigns date to the end of the XIV century, qv in fig. 10.9, while Ptolemy himself (the author of the Almagest) winds up in the late XIV century – the epoch of the Kulikovo battle.

The conclusion we can make in this respect is as follows. The mediaeval datings of the planetary coverings of stars correspond perfectly with the dating of the Almagest star catalogue as calculated above, and make the epoch when the main part of the Almagest was created fall upon the XII-XIV century A.D., qv in fig. 10.9. The imperial reigns contemporary to Ptolemy and mentioned to the Almagest date to the end of the XIV century.

The resulting picture correlates well with our dating interval of the Almagest star catalogue. As we have already pointed out, the catalogue is most likely to be the oldest part of the Almagest, and the remaining text was added thereto. This text must have transformed into the fundamental astronomical tractate by the end of the XIV century. It would then be edited and developed up until the XVI-XVII century which is the epoch when the Scaligerian version of chronology was created. The final version of the Almagest must have been tailored to fit the Scaligerian chronology already in Kepler's epoch. However, it also contains traces of older chronological concepts dating to the XIV-XVI century. This is how the Almagest looks today.

3.3. Discussing the late mediaeval solution of the XV-XVI century

This solution is of interest to us since it falls into the epoch of the first editions of the Almagest. It is presented in fig. 10.10.

3.3.1. The η of Virgo covered by Venus in 1496 A.D.

Venus covered the η of Virgo around 4 PM GMT on the 19th September 1496, the covering being ideal since the distance between Venus and the star in question equalled 1 minute. However, this covering was neither observable in Europe, nor in Asia. It could

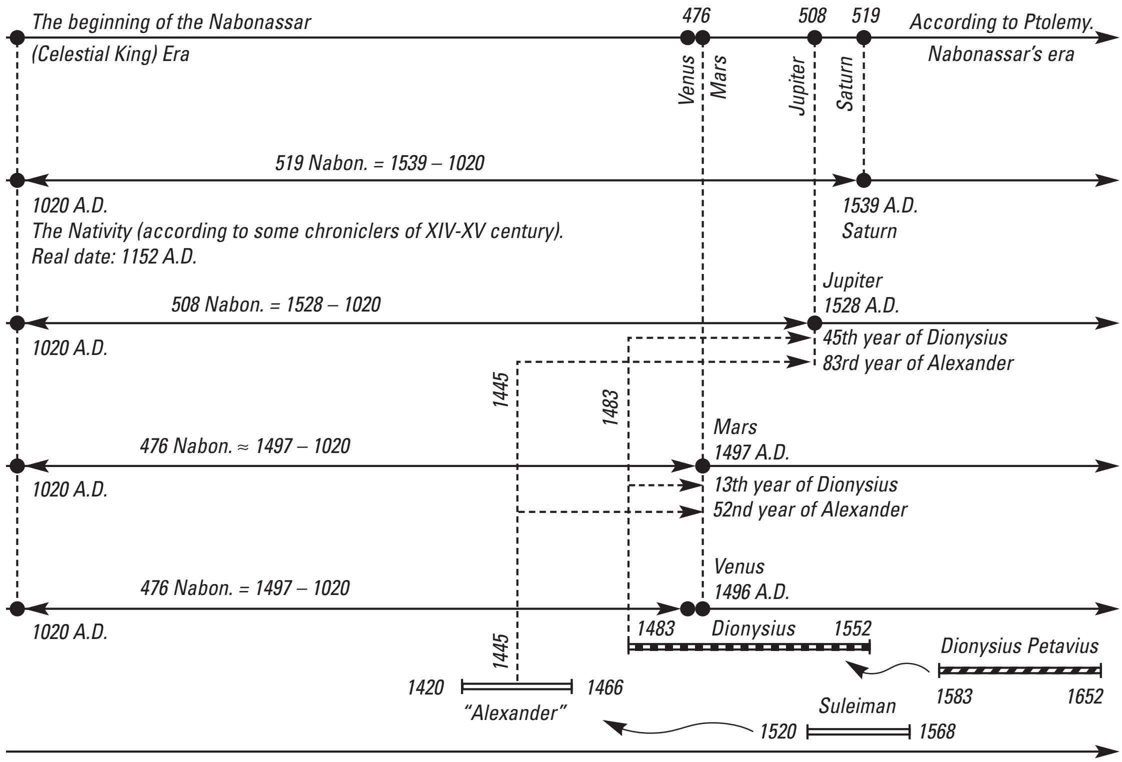

Fig. 10.10. The chronology of the Almagest in relation to the late mediaeval dating of the four planetary coverings of the stars. These coverings were possibly observed in the XV-XVI century. However, in this case the Ptolemaic "Era of Nabonassar" is nothing but the Anno Domini era, which may have been counted from 1020 A.D. in certain documents, according to our reconstruction. The diagram also demonstrates how the eras of Dionysius and Alexander may have come into existence.

only be seen from the Pacific region and Alaska. Nevertheless, an observer located in Alexandria who was watching Venus approach the star on the morning of the 19th September and move away from the star on the morning of the 20th September may well have calculated the exact moment of the almost complete covering, namely, 16:00 GMT, or around 18:00 local Alexandria time. Bear in mind that in the Middle Ages one would often begin to count the day from 6 PM; therefore, 6 o'clock in the morning and 6 o'clock in the afternoon as we understand them today would be referred to as "12 o'clock" back in the day. Therefore the moment that Venus covered the star completely around 18:00 Alexandria time on the 19th September 1496 is in ideal correspondence with Ptolemy's indication that Venus covered the star completely in the twelfth hour ([1355], page 319, Chapter X.4).

Calculations this precise are hardly phenomenal for the end of the XV century.

In the moment of the covering on 19th September 1496 Venus had indeed already been past its maximal morning visibility elongation, which is exactly what Ptolemy tells us. Maximal elongation was passed in the end of March 1496.

3.3.2. Mars covering the β of Scorpio in 1497 A.D.

Mars covered the β of Scorpio at night and in the morning of the 19th January 1497. Ptolemy reports the covering to have been visible in the morning. The minimal distance between Mars and the star in question equalled some 13-14 minutes approximately at 1 AM GMT on the 19th of January 1497, or at 3 AM local time in Alexandria. The distance between Mars and the star equalled circa 15 minutes by the moment of sunrise in Alexandria. Sunrise at the longitude of Alexandria or Cairo, for instance, took place at 4:50 GMT. Mars rose above the horizon around midnight on the 18th-19th January, and remained in close proximity to the star all that night, approaching the β of Scorpio ever closer in its movement. Therefore, Mars covering the planet was visible perfectly well in the morning of 19th January 1497. The position of both Mars and the star in relation to the horizon is qualitatively identical to scheme drawn for the X-XI century solution as seen above.

In full accordance with Ptolemy's specifications, the interval between said coverings of stars by Venus and Mars does not exceed a single year. Indeed, the interval equals four months starting with 19th September 1496 (Venus) and ending with the 19th January 1497.

3.3.3. Jupiter covering the δ of Cancer in 1528 A.D.

Jupiter covered the δ of Cancer in the evening of the 7th March 1528, and remained in close propinquity with it all the following night, the distance between the two equalling some 25 minutes. The visibility of the covering was rather good on the evening of 7th March 1528, at dusk. The sun had set around 17:00 GMT at the longitude of Alexandria, whilst Jupiter in conjunction with the star had remained visible up until 17:40 GMT when it disappeared below the horizon. Thus, the covering of the star by Jupiter remained visible in the evening sky for a certain amount of time. The respective positions of Jupiter, the star and the horizon are qualitatively identical to scheme drawn for the X-XI century solution, qv above, the only difference being in the direction of Jupiter's motion vector.

Ptolemy tells us that Jupiter covered the star in the morning, which correlates well with our solution. One has to remember that the actual motion of Jupiter is rather slow, and it remains near a star for about 12 hours without changing its position visibly. In the present case, it had remained rather close to the star all night between the 7th and the 8th of March 1528. Therefore, on the morning of 8th March Jupiter rose being rather close to the star, just the way it had been the previous evening. It would naturally become invisible after sunrise; however, Ptolemy's reference to Jupiter having covered the star in the morning is absolutely correct, since this covering really took place in the morning and lasted all night between the evening of the 7th March and the morning of the 8th.

There is also the possibility that Ptolemy's text in its present form contains a misprint owing to the fact that the Latin for "after sunset" is *supremo sole*, whilst *sole primo* stands for "the dawn" ([237], page 937). It would suffice for the first two letters in the word *supremo* to become obscured, and one could easily read it as *premo* or *primo*. Sunset could easily turn into sunrise this way. The Slavic for "the setting" (of a planet) is *v zakhode,* and is also easy enough to transform into *voskhod* (sunrise).

3.3.4. Saturn approaching the γ of Virgo in 1539 A.D.

Saturn approached the γ of Virgo on the evening of 5th September 1539. This event could be observed in the evening, just as Ptolemy tells us. The distance between Saturn and the star roughly equalled 30 minutes, and could therefore be declared to equal "two units". Saturn and the star were observable quite well in conjunction on the evening of 5 September 1539, at sunset. The sun had set around 16:00 GMT at the longitude of Alexandria, and Saturn remained observable in conjunction with the star up until 16:40 GMT when it had set. The location of Saturn and the Star in relation to the horizon is qualitatively identical to the scheme for the X-XI century solution as presented above.

In full accordance with Ptolemy's report, Saturn was located below the γ of Virgo in relation to the local horizon.

3.3.5. Commentary to the late mediaeval solution

Our reconstruction makes the late mediaeval XV-XVI solution of the covering problem quite possible. We come up with the following hypothetical picture.

The astronomers of the XV-XVI century are most likely to have really observed the four cases of planets covering stars as described above – in 1496, 1497, 1528 and 1539, qv in fig. 10.10.

Several decades later, in the end of the XVI – beginning of the XVII century, the new version of history was spawned by a certain group of chronologists, historians and astronomers who based it on the erroneous "extended" chronology. The most active ones must have been J. Scaliger (1540-1609), D. Petavius

(1583-1652) and J. Kepler (1571-1630); one also has to point out that Kepler had exchanged a number of letters with Scaliger in which the two were discussing chronological issues. Real events of the X-XVII century would wind up in distant past as a result. This activity concerned the editing of the Almagest in particular; the necessary astronomical knowledge of planetary cycles had already been available, and so the four planetary coverings of stars mentioned above may well have travelled backwards in time as well.

The falsifiers may have discovered two "ancient" solutions when they used the astronomical theory of the XVI-XVII century for the calculation of old planetary covering dates, or just one. They may have decided to choose the more ancient solution of the two (X-XI A.D. and III B.C.) – the latter. The observations of the real XV-XVI century astronomers (Timocharis, etc.) were arbitrarily cast into deep antiquity together with the observers themselves, possibly under altered names.

We still have to find out which one of the real XV-XVI century astronomers could have transformed into the "ancient" Timocharis after a chronological shift of circa 1800 years, for instance. What could his real name have been? As for the "ancient" Hipparchus, we shall relate our theory of his real identity below.

Let us emphasize that the resulting 1800-year shift backwards concurs perfectly with one of the three primary chronological shifts that A. T. Fomenko has discovered in his analysis of the "Scaligerian history textbook". Fomenko has called this shift Graeco-Biblical, since it is manifest best in the "ancient" Greek and Biblical history, qv in CHRON1.

4. THE ERA OF NABONASSAR IN ACCORDANCE WITH THE LATE MEDIAEVAL SOLUTION

Our late mediaeval solution for the four planetary coverings of stars leads us to the following concept of the origin of the Almagest chronology. As we already pointed out, the main era used by Ptolemy is the era of Nabonassar. Apart from that, Ptolemy refers to the eras of Alexander and Dionysius, qv above. What eras would all of them be exactly? If the astronomical events reflected in the Almagest took place in the epoch of the XII-XVII century, what real eras could become reflected in the Almagest? In other words, what is the real identity of the Ptolemaic Nabonassar, Alexander and Dionysius?

Let us put forth the following hypothesis. The era of Nabonassar is most likely to stand for the era of the "Divine King", *nabonas* standing for "divine", or "celestial" (*nebyesniy* in Russian), and *sar* for "czar". Alternatively, Nabon-Assar might be a reference to Assyria, since "Assar" and "Assyria" are virtually the same word. Who would this "divine king" be, then? Possibly, Jesus Christ, which explains why this era is the primary one used by Ptolemy. This era was simply the Christian era, which was the basic chronological scale in the late Middle Ages – the Anno Domini era, in other words.

According to our reconstruction, Jesus Christ had lived in the XII century A.D. and, after a 100-year chronological shift backwards, became reflected in mediaeval history under the name of "Pope Gregory VII Hildebrand" (this important parallelism is discussed in greater depth in "Methods"). As we expound it in "The Foundations of History", the initial "A.D." mark was set at 1053 or 1054, instead of the authentic date – 1152 A.D. This is the year of the supernova explosion – stellar debris are known to us today as the famed Crab Nebula. This very star was described in the Gospels as the Star of Bethlehem. See more on the dating of this explosion in our book entitled "King of the Slavs". Mediaeval chronologists were 100 years off the mark, having shifted the date of the explosion to circa 1053 A.D. from its correct XII century location.

This is the very reason why certain old chronicles have preserved the information about Hildebrand (translated as "Ablaze with Gold") being born in 1020 A.D. ([64], page 216). Therefore, the Nativity date could be chosen as 1020 A.D., with a discrepancy of roughly 100 years. The final formulation of this idea is as follows. The Nabonassar Era, or the era of the "Celestial King", is none other but the A.D. era, erroneously counted off 1020 A.D. instead of 1152 A.D.

Let us now check whether this concept corresponds with the datings of the planetary coverings given by Ptolemy in the Nabonassar era chronology. It turns out that it does, and ideally so. Indeed, let us see what happens when we superimpose the beginning of the Nabonassar era over 1020 A.D., qv in fig. 10.10.

Ptolemy claims that the coverings of stars by planets as discussed above took place in the following years:

the 476th year of Nabonassar for Venus,
the 476th year of Nabonassar for Mars,
the 508th year of Nabonassar for Jupiter,
and the 519th year of Nabonassar for Saturn.

If we add 1020 years to each of these figures, we shall come up with the following datings:

1496 A.D. for Venus,
1496 A.D. For Mars,
1528 A.D. for Jupiter,
and 1539 A.D. for Saturn.

The concurrence is ideal. The only discrepancy is a one-year difference for Mars: 1496 instead of 1497.

This provides us with perfectly independent proof of the theory formulated above, according to which the late mediaeval astronomical solution of the XV-XVI century for the planetary coverings is a veracious one.

What could be said about the two other eras, then – the era of Dionysius and the era of Alexander (or "since the death of Alexander"), the ones that Ptolemy occasionally refers to? The picture isn't quite as clear here, but there is a self-implied possible explanation. In CHRON1 we discovered a 100-year chronological shift that moved certain late mediaeval events backwards in time. Moreover, in CHRON1, Chapter 6:13.9, CHRON6, Chapter 4 and CHRON6, Chapter 5 we demonstrate that the "ancient Dionysius" is but a reflection of the famous mediaeval chronologist Dionysius Petavius (1583-1652), whereas the "ancient" Alexander the Great is a phantom reflection of the famous sultan Suleiman I the Magnificent (1520-1566) to a large extent.

Apparently, the centenarian chronological shift made Dionysius Petavius "travel backwards in time", which gave birth to the XV-XVI century "Dionysius", a phantom double of his who had presumably lived in 1483-1522 A.D. Similarly, Suleiman the Magnificent became reflected as the phantom "Alexander the Great", whose lifetime was ascribed to the years 1420-1466.

Let us see what happens if we are to count the Ptolemaic datings given for Mars and Jupiter coverings from these "phantom dates" in the eras of Dionysius and Alexander. We come up with a perfect concurrence. See for yourselves. Since the "era of Dionysius" is counted from 1483, the Jupiter covering that took place in 1528 took place *exactly in the 45th year of Dionysius,* just like it had been reported by Ptolemy (1528–1483=45). See table 10.1 above. The Mars covering that dates to 1497 took place in the 14th year of Dionysius (1497-1483-14), while Ptolemy cites the 13th year of Dionysius. The discrepancy equals a single year.

The situation with the era of Alexander is somewhat more ambiguous. A correspondence with the Ptolemaic datings (the 83rd year of Alexander for Jupiter and the 52nd year of Alexander for Mars) shall be achieved if we are to count the era of Alexander from 1445, which falls on the middle of Suleiman's reign shifted backwards by a hundred years. If we are to count the dates from the "death of Alexander", the intervals shall be some 20 years smaller.

The final hypothetical picture of the Almagest chronology based on the late mediaeval solution is as follows.

The final editions of the Almagest date to the early XVII century – the epoch of Scaliger, Petavius and Kepler. The four planetary coverings in question were observed by astronomers in the XV-XVI century, or circa 100 years before the lifetimes of the late mediaeval characters in question. These coverings were initially dated correctly; their era in the Almagest is the era of Anno Domini = Nabonassar = The Divine King. The Nativity date was erroneously chosen as 1020 (instead of 1152 A.D., which is the authentic dating), being one of the two possible versions. Let us remind the reader that the second erroneous version adhered to by certain mediaeval chronologists dates this event to 1053 or 1054 A.D. – 33 years further into the future). Once again, let us reiterate that the correct date is 1152 A.D.

Mediaeval chronologists presided over by Scaliger, Petavius and, possibly, Kepler, began to create the erroneous "extended chronology". The first step had been the backdating of many XV-XVII century events by a hundred years, which gave birth to the phantom "ancient characters" such as "Dionysius" and "Alexander", who were the reflection of the real chronologist Dionysius Petavius and the real sultan Suleiman I the Magnificent. The datings of the planetary coverings were re-calculated for these two eras, which gave the very numbers that were written into the Almagest as the datings of the coverings given in the eras of Dionysius and Alexander.

The process of creating the false chronology by no means ended there. In the next stage, real events of the XV-XVI century were shifted by the XVII century chronologist backwards by circa 1800 years, which resulted in the existence of such "ancient characters" as the phantom Nabonassar, Alexander, Dionysius etc.

5. THE DATING OF THE ALMAGEST'S CREATION AND HOW THIS BOOK ASSUMED ITS PRESENT FORM. PTOLEMY AND COPERNICUS

Ptolemy is presumed to have written the voluminous ***Geogrpaphy*** as well as the gigantic volume of the Almagest, which is the encyclopedia of mediaeval astronomy and applied mathematics that European and Asian scientists had presumably used for some fifteen hundred years.

"The last famous name we encounter in Greek astronomy is that of Claudius Ptolemy. We know nothing about his life except for the fact that he had lived in Alexandria starting with 120 A.D. His fame is based on the large astronomical tractate entitled the Almagest for the most part – the primary source for our knowledge of the Greek astronomy, which can undoubtedly be called the astronomical encyclopedia of the Middle Ages. Ptolemy is also the alleged author of several lesser tractates on astronomy and astrology … Apart from that, he is the author of an important work on geography and, possibly, another tractate on optics" ([65], pages 64-65).

As we already pointed out, one of the primary sections of the Almagest is the famous star catalogue contained in books 7 and 8. There are 13 books in the Almagest altogether. The catalogue contains descriptions of about a thousand stars complete with their coordinates (latitude and longitude) in the ecliptic coordinate system. Historians are of the opinion that the catalogue was compiled in the II century A.D. from the results of observations carried out by Ptolemy around 140 A.D., or, presumably, more than fifteen hundred years ago. However, starting with the XVIII century the astronomers who study the Almagest have been running into numerous oddities resulting from this Scaligerian dating. It was estimated that stellar coordinates in their Almagest rendition could not have been measured in that epoch, which led to extensive research of the Almagest star catalogue and numerous hypotheses concerning it. The history of this problem is related by the authors above in great detail.

We already mentioned that the results of a great body of research conducted rather recently by the American astrophysicist and astronomer Robert Newton with the aid of precise modern theories and computers came out in 1978 ([614]). The name of his book is eloquent enough – it is called ***The Crime of Claudius Ptolemy***. Robert Newton came to the conclusion that nearly all of the alleged "observations" collected in the Almagest are false. It turns out that the Almagest astronomical data either fail to correspond to the astronomical situation for the II century A.D. altogether, or represent exercises in theoretical calculation. That is to say that in many cases Robert Newton proved them to be results of mediaeval theoretical calculation as opposed to actual astronomical observations. In other words, the author of the Almagest simply wrote the results of his theoretical calculations into the Almagest claiming them to be observation results.

When we conducted an independent study of the issue, we were forced to develop a special method of dating old star catalogues based on the concept of dating the catalogue by the shift values of several stars as observed upon the background of their "immobile" neighbours. Although these shifts are rather small, it turns out that they alter the configuration of bright stars upon the celestial sphere rather visibly. Precise modern measurements of these shifts gave us the proof that the Almagest star catalogue is based on the observations of the VII-XIII century A.D. epoch, and not the II century A.D. (see above). More specifically, the "Ptolemaic" observations of bright stars which were deemed the most important in mediaeval astronomy were carried out in that epoch. It is very likely that the Almagest catalogue was expanded with the inclusion of dimmer and less famous stars in a later period, up until the XVI century. Let us emphasize that it is based on real astronomical observations erroneously dated to the II century A.D. by later chronologists. These observations really date to a much later epoch.

The Almagest was extremely important for the creation of the Scaligerian chronology – this is why Ptolemy is also credited with the authorship of such works on chronology as the chronological "Canon" of kings referred to by Sir Isaac Newton in his tractate on chronology, for instance ([1298], page 294).

Let us formulate our reconstruction, basing it on everything we managed to learn about the epoch of the XVI-XVII century.

1) Ptolemy's Almagest is an encyclopaedia that contains the results of real astronomical observations carried out over the period of several hundred years. The earliest such observations date to the epoch of the X century A.D. the earliest. The Almagest observations may well date to the period up until the XVI century A.D. It had been a famous astronomical encyclopaedia of the Middle Ages which reflected the state of the epoch's astronomical science; the book would be changed, expanded and re-worked over the years. It may really have been printed in the XVI century.

2) However, even if printed XVI century editions of the Almagest did exist, they haven't reached our day. Ptolemy's Almagest, being a work of paramount chronological importance, was re-written to a large extent in the XVII century when the Scaligerian chronology of the "antiquity" was being introduced as part of the history falsification programme – this concerns the XV-XVI century history primarily. Its subsequent publication contained erroneous XVI century datings and numerous fabricated "ancient observations" which had really been the results of calculations based on the mediaeval astronomical theory of the XVII century. The theory related in the Almagest in its XVII century version is the very theory that served as one of the main foundations of the Scaligerian chronology.

The coordinates of planets, positions of the sun and the moon etc would be calculated backwards to fit the Scaligerian datings. The calculated astronomical configurations would then be declared the results of observations and written into the Almagest as carried out by certain astronomers in certain (Scaligerian) years. However, since the astronomical theory of the XVII century was a great deal less precise than today, calculations employing the modern formulae sometimes allow us to expose the fraud, as Robert Newton had done ([614]).

This is our reconstruction in a nutshell.

However, one cannot help asking about the theory of Copernicus, or the heliocentric theory, and its correspondence with all of the above. Ptolemy's theory turns out to have appeared around the same time as the theory of Copernicus. However, we were taught to think that there is an enormous temporal gap to separate the theories of Ptolemy and Copernicus and that they correspond to completely different levels of scientific knowledge, which makes their contemporaneity impossible. Ptolemy is presumed to have been bound by the superstition that a truly harmonious cosmology requires its centre to be the Earth, whereas Copernicus was free from such doctrines and bravely made the Sun the centre of the Universe.

However, this isn't quite so. It turns out that locating the centre of the Universe upon the Earth wasn't the only mediaeval doctrine. Another such doctrine was concerned with the ideal nature of the circle and the theory that a celestial body must necessarily move along an ideal circumference, which was backed up by the Ptolemaic scheme which claims planet to have complex trajectories representing the sum of several rotational movements. Copernicus was basing his theory upon this very doctrine of the ideal nature of circular movement. According to Robert Newton, "Copernicus in his rejection of the equant needed a model to replace it which would satisfy to the pure doctrine of even circular movement … The scheme of Copernicus is more complex than the equant … he did not regard the sun as the focal point of his theory – he uses the centre of the telluric orbit as such … in total, Copernicus uses four different models to represent six planets. Ptolemy needed just three different models for this purpose. It is therefore untrue that Copernicus had created a theory which was a lot more primitive than Ptolemy's … on the contrary, his theory was a great deal more complex than Ptolemy's despite the fact that he could have come up with a much simpler theory had he been quite as vehement a follower of the idea that the heliocentric theory is based upon as he had been insofar as the concept of even circular rotation was concerned" ([614], page 328).

Robert Newton proceeds to point out that the real "heliocentric concept only became widely accepted a hundred years later than the works of Copernicus came out" ([614], page 328). The XVII century, in other words. "Kepler was the first to have accepted the real heliocentric concept" ([614], page 328). This fact is important enough since it leads us to the following question: what epoch does the edition of the Copernican work that reached our day really date to? Could it have undergone heavy editing a century later, in Kepler's epoch, or the first half of the XVII century?

We thus see that the theories of Ptolemy and Copernicus can really be ascribed to the same knowledge level of celestial mechanics, and could therefore have appeared simultaneously. Both of them are based on obsolete mediaeval doctrines which were detrimental to the construction of a correct cosmology, the sole difference between them being in the doctrines that they're based upon.

Ptolemy's theory was more advanced calculation-wise. It must have been acknowledged as more correct in the XVI-XVII century and "set down as numbers". The parallel theory of Copernicus enjoyed a great deal less attention – although, as we can see nowadays, it is closer to the truth in principle than Ptolemy's theory, its more approximated results notwithstanding. It was only in the XVII century that the correct heliocentric theory was formulated, and it hadn't received recognition until the publication of Kepler's works.

We come up with an important corollary in this respect. Ptolemy's Almagest in its present shape was created in the seventeenth century, and made to look "ancient" by its creators in order to serve as the foundation of the Scaligerian chronology which was being created in this exact epoch. Therefore, the astronomical events which could be calculated backwards with the aid of the XVII century theory are dated according to Scaligerian chronology in the Almagest, with as much precision as the imperfect astronomical theory of the XVII century would allow. It would therefore be expedient to treat the Almagest data with the utmost caution if we are to use them for the purposes of chronology, or the reconstruction of the old dates. One has to constantly bear in mind that these data were processed by the XVII century chronologists in order to validate the nascent Scaligerian chronology with the help of "ancient documents". Thus, the only data we can safely use are those which could not have been calculated in the XVII century, such as the solar eclipses, the exact phases of lunar eclipses and the celestial positions of stars. However, the XVII century falsifiers naturally tried to make sure no such data would survive insofar as it were possible at all.

A vivid example is the "mysterious" lack of a single reference to solar eclipses anywhere in the Almagest. Could the ancient astronomers have failed to pay attention to the most spectacular astronomical event of them all? This oddity of the Almagest was pointed out by N. A. Morozov, who wrote the following: "I would like to turn the reader's attention to a very strange characteristic of the Almagest. Why would the author describe so many ancient lunar eclipses (and erroneously for the most part, at that) as well as lunar coverings of several stars, did not mention a single solar eclipse, although such eclipses are a great deal more spectacular? This is perfectly clear from my point of view. Lunar eclipses as well as coverings of stars by the moon are a great deal easier to calculate than the solar eclipses since the former can be observed from the surface of the entire hemisphere where the moon is visible, whereas the solar eclipses can only be seen from the strip of telluric surface which was covered by the eclipse … In this very epoch [the Scaligerian epoch of Ptolemy – Auth.] many rather spectacular solar eclipses were observable from Alexandria [where Ptolemy is supposed to have worked – Auth.]. How could he have failed to mark out the annular solar eclipse of the 21st April 125? … Nevertheless, we see that "his book" contains a detailed description of the lunar eclipse that took place two weeks before it, on the 5th April 125. This fact alone, apart from the lack of any references to the spectacular partial solar eclipses that could be observed from Alexandria on 2nd July 121 and the 3rd September 118, would suffice in order to state with the utmost certainty that someone who failed to observe and point out a solar eclipse like this one hadn't observed the lunar eclipse preceding it, either, since such an observer would pay attention to the solar eclipse first and foremost … Yet Ptolemy appears to have slept through every solar eclipse!" ([544], Volume 4, pages 472-473).

We have used the simple Turbo-Sky application which is very convenient for approximated calculations, as well as the famous solar eclipse canon compiled by Ginzel in the XIX century ([1154]) in order to run a check on the solar eclipses listed by N. A. Morozov. Indeed, all the eclipses in question took place on the dates specified, and they were indeed observable perfectly well from Egypt, including Alexandria. The path of the total eclipse of 125 A.D., for instance, covered Arabia; the eclipse was partial as observed from Alexandria, yet perfectly visible. The solar eclipse of 118 A.D. was the most conspicuous as observed from Alexandria. Thus, a total of three conspicuous solar eclipses fall on the Scaligerian lifetime of Ptolemy; moreover, all of them could be observed from Alexandria where he is supposed to have work. This happens to be a very rare case indeed – yet Ptolemy "failed to have noticed" any of them. None of the above is a mystery to us, since there was no Ptolemy and no Alexandria in 125 A.D. – they cannot possibly predate the epoch of the IX-XI century A.D. The falsifiers of the XVII century who "dated" the Almagest to the second century A.D. could not calculate solar eclipses due to the drawbacks of the theory that they used. Tough luck.

N. A. Morozov also discovered many interesting facts in other works of the "ancient" Ptolemy. His conclusion is as follows: "It is perfectly impossible to allow for such a voluminous and detailed oeuvre which represented the state-of-the-art astronomical science until the very epoch of Copernicus (or 1543) to have been created in this very form more than a thousand years earlier remaining free from additions and corrections … the same is true for the eight volumes of the ***Geography*** ascribed to the same author, where the longitudes and latitudes of places upon the surface of the earth are given in degrees, and the first meridian is considered to be the one that passes through the Canary Islands! The same is true for his ***Optics*** which, among other things, was written in awareness of the modern reflection and refraction theory which remained unknown to the mediaeval Greeks and Italians until the Renaissance" ([544], Volume 4, pages 473-474).

6. THE "ANCIENT" HIPPARCHUS AS THE APPARENT PHANTOM REFLECTION OF TYCHO BRAHE, THE FAMOUS ASTRONOMER

Let us formulate the hypothesis that the prominent "ancient" astronomer Hipparchus is but a phantom reflection of the famous mediaeval astronomer Tycho Brahe who had lived in the XVI century A.D. In the beginning of the XVII century, when the "distant antiquity" was being filled up with the phantom duplicates of mediaeval events, and during the editing of the Almagest, the Scaligerite historians duplicated the astronomer Tycho Brahe, having moved one of the versions of his biography deep into the past, where it had created another mirage, namely, the "great ancient astronomer Hipparchus". Let us briefly study the parallelism between the existing data concerning Tycho Brahe and Hipparchus.

1a. Life dates of the "ancient" Hipparchus.
Scaligerites have placed the "ancient" Hipparchus approximately in 185-125 B.C. ([395], page 123). He is presumed to have been the first great astronomer of the "antiquity". I. A. Klimishin writes that "very little is known about the life of Hipparchus" ([395], page 43).

■ *1b. Life dates of Tycho Brahe.*
The great mediaeval astronomer Tycho Brahe is presumed to have lived in 1546-1601 A.D. ([395], page 123). A comparison of these dates with the Scaligerian dating of the lifetime of the "ancient" Hipparchus demonstrates the difference between them to equal circa 1730 years. This value is very close to that of approximately 1780 years, which is the shift we have discovered in our previous work. We called this shift Graeco-Biblical, since the Scaligerian chronologists would add 1780 years to the datings of the Greek and Biblical historical events. A propos, the actual biography of Tycho Brahe only reached us in an edited form, that is to say, it went through the hands of the XVII century censors, and was thus put in accordance with the Scaligerian version of history.

2a. The compilation of a star catalogue by the "ancient" Hipparchus.
Hipparchus is presumed to have compiled a "star catalogue that included 850 objects" ([395], page 51). Latitudes, longitudes and stellar magnitudes (or brightness) were indicated for every star. Hipparchus divided the stars into six classes, the first of which included the brightest stars, and the sixth – the dimmest. The star catalogue of Hipparchus is presumed to have been very well-known in the "antiquity"; however, it didn't reach our age. Nowadays it is presumed that "the

only surviving oeuvre of Hipparchus is his commentary to the poem of Aratus and its original source (the work of Eudoxus). All our knowledge of Hipparchus and his works comes from the Almagest where Ptolemy expresses his admiration for Hipparchus on every other page" ([395], page 52). Thus, the star catalogue of Hipparchus with the description of 850 stars is presumed to have not survived.

■ *2b. The compilation of a star catalogue by Tycho Brahe.*
Tycho Brahe had compiled a "star catalogue that comprised 788 stars" ([395], page 129). Longitudes, latitudes and magnitudes were stated for every star. However, his catalogue was apparently published a great deal later, in the Rudolphine Tables compiled by Kepler, a student of Tycho Brahe. The following is said about the catalogue of Tycho Brahe: "In 1627 the Rudolphine Tables came out, which were to be used for preliminary calculations of the sun, the moon and the planets for the next 100 years or so, serving as a handbook for the astronomers and seafarers. The book also contained a catalogue that included 1005 stars which was based on the 777-star catalogue compiled by Tycho Brahe" ([395], pages 148-149). Tycho Brahe is supposed to have made a large cosmosphere with "the Zodiacal belt, the equator and the positions of 1000 stars whose coordinates were calculated over the years of Tycho's observations . . . this had truly been a marvel of science and art; sadly, it was destroyed by a blaze in the second part of the XVII century" ([395], page 127).

3a. The "ancient" Hipparchus observed a supernova explosion.
Hipparchus is supposed to have begun his compilation of a star catalogue after having observed a supernova explosion ([395], page 51). This unique event "had led Hipparchus to the thought that the world of stars might be subject to certain changes" ([395], page 51). This is reported by the "ancient" Roman author Pliny the Elder in particular, whose lifetime is dated as 23-79 A.D. by the Scaligerites ([395], page 51). As we understand it nowadays, the "ancient" Pliny was really a contemporary of Tycho Brahe, and therefore he couldn't have lived earlier than the end of the XVI century A.D.

■ *3b. Tycho Brahe observed a supernova explosion.*
"On 11 November 1572 … Tycho Brahe noticed a bright star in the constellation of Cassiopeia, which hadn't been there before … Tycho's supernova (as this star is called nowadays) exceeded Venus in brightness. It could even be observed during the day for some time; it remained visible to the naked eye for 17 months. This event would naturally agitate a great many people. All sorts of theories and presumptions about this strange luminary and what it might portend were voiced" ([395], pages 124-125). Tycho Brahe wrote the following about this star: "I was so amazed by this sight that it did not shame me to question what my own eyes were telling me … could this have been the greatest wonder that ever took place since the Genesis?" Quotation given according to [395], page 124. Kepler said that "even if this star wasn't an omen of any sort, it heralded and created a great astronomer". Quoting by [395], page 124.
This supernova explosion of 1572 became reflected in the biography of Tycho Brahe = Hipparchus, which was shifted by 1730 years into the past by the historians.

4a. The "ancient" Hipparchus built an astronomical observatory on the island of Rhodes.
Hipparchus is presumed to have "worked on the isle of Rhodes, where he had built an astronomical observatory" ([395], page 43). We know of no details; however, our reconstruction shall demonstrate these details to be present in Tycho Brahe's biography.

■ *4b. Tycho Brahe built an astronomical observatory on the island of Hvenna.*
"In 1576 Tycho Brahe received the island of Hvenna as a gift from king Frederick II (20 kilometres to the south-east of Copenhagen) … Tycho Brahe built the observatory of Uraniborg on the island (translates as "the castle of Urania"). [Klimishin's commentary is as

> follows: "bear in mind that Uraniawas the name given by the ancient Romans to the goddess of the skies"]. It was equipped with precise goniometrical instruments. Several years later, the observatory of Stjerneborg (or the "Stellar Castle") was erected nearby, where the measurement instruments were mounted underground in order to be protected from the wind. Thus, the isle of Hvenna became a world centre of astronomical science for twenty years. This is where observations of exceptional precision were conducted and qualified astronomers trained, the ones that later worked in other European cities … The expenses for the construction and maintenance of Tycho Brahe's observatory comprised a significant part of the state budget [of Denmark – Auth.] … The fame of the Uraniborg observatory and its creator had spread all across Europe, and aspiring apprentices and helpers were coming from Tycho from everywhere" ([395], pages 126-127). All of this is presumed to have been financed from the modest treasury of the Danish king. However, it is most likely that the observatory was financed by the Empire.
>
> The observatory of Tycho Brahe did not survived. "A mere couple of decades later, visitors coming to the site of the magnificent astronomical observatory of Uraniborg could see nothing but a pit filled with rubbish there" ([395], page 128).

Commentary. How could the famous observatory have disappeared? We are being told that it had been "levelled", and this "trash-filled pit" marks its former site. However, it would be a great deal more convenient to build an observatory in the south, close to the equator. The isle of Rhodes, where the "ancient" authors report the observatory of Hipparchus (or Tycho Brahe) to have been located is a much more fitting location for astronomical observations. The proximity to the equator implies that a larger portion of the sky is visible due to the rotation of the earth as opposed to the near-polar latitudes. The climate of Denmark is also hardly beneficiary due to fogs etc.

Let us now turn to the inscription on the famous mediaeval portrait of Tycho Brahe ([1460:1], fig. 10.11).

Fig. 10.11. A mediaeval portrait of Tycho Brahe. Taken from [1460:1]. See also [98], page 209.

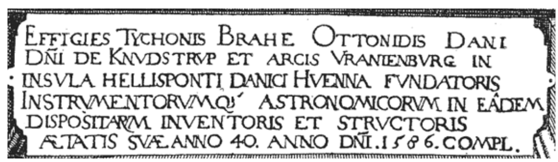

Fig. 10.12. A close-in of the inscription on the old portrait of Tycho Brahe. Taken from [1460:1]. See also [98], page 209.

It tells us the following (see the magnified inscription in fig. 10.12).

What we see here is the clear indication that Uranienborg was located on the isle of Hellespont (in insula Hellesponti). The location of the Hellespont is well known – it is the old name for the Dardanelles straits, whose western coast is the famous peninsula with a very narrow isthmus ([797], page 284). The "isle of Hellespont" could also refer to some island in the vicinity of the Dardanelles.

Where did the mention of Denmark in Tycho

Brahe's biography come from, then? The matter is that the word "Denmark" (or "Dani") often meant "the land on the Danube" in old texts. The Biblical "tribe of Daniel" is of a similar origin. This means the Balkans. The straits of Hellespont and the neighbouring peninsula are located close nearby. This small peninsula is a part of the larger Balkan peninsula, qv on the map. It becomes clear why the inscription on the portrait of Tychon the Varangian (or Tychonis Brahe / Tycho Brahe) mentions the "danio Hvenna", or the "Vienna near the Danube" – Venice, in other words. All these places are in the Mediterranean region, and the isle of Rhodes, where the "ancient" observatory of Hipparchus was located, lays to the south. Therefore, the observatory of Tychon the Varangian from the XVI century (alias Tycho Brahe or Hipparchus) was either located on the Rhodes or the Hellespont peninsula, closer to the capital – Czar-Grad = Istanbul. It was only in the XVII century that Tycho Brahe and his observatory were moved to the misty northern Denmark (on paper). However, his "ancient" duplicate (Hipparchus) remained on Rhodes.

As we can see, a lot of what we're telling the reader is written quite unequivocally in the ancient documents, even the ones that underwent the Scaligerian censorship. One just has to read them from a new point of view, which will make the vague and unclear documents of the old days clear and easily understandable.

5a. The name of Hipparchus. The famous "ancient" astronomer was called Hipparchus.

■ *5b. The name of Tycho Brahe.* The great mediaeval astronomer was called Tycho Brahe. The name of Hipparchus may well be a corrupted version of *TychoBrahe*, or *T-Hoprach* (*T-Hipparch*), due to the similarity between *h* and *ch* and the flexion of *b* and *p*. Having removed the first letter *T* from the name of Tycho Brahe, Scaligerites transformed him into Hipparchus. The fact that Ptolemy makes countless references to Hipparchus means that the edition of the Almagest that we have at our disposal today was created *after Tycho Brahe = Hipparchus*. Hence, it couldn't have taken place before the beginning of the XVII century (bearing in mind that Tycho Brahe died in 1601).

7. PTOLEMY'S ALMAGEST IS MOST LIKELY TO HAVE UNDERGONE ITS FINAL EDITION ALREADY AFTER THE DEATH OF TYCHO BRAHE, OR THE "ANCIENT" HIPPARCHUS

Thus, we have reasons to believe that the famous mediaeval astronomer Tycho Brahe (1546-1601) became reflected in the "Scaligerian antiquity" as the great "ancient" astronomer Hipparchus who is supposed to have lived around 180-125 or 190-125 B.C. ([797], page 307). According to our reconstruction, the final edition of Ptolemy's Almagest took place after the death of Tycho Brahe, in the epoch of Johannes Kepler (1571-1630).

Therefore, Ptolemy's Almagest as well as the star catalogue it contains, had been edited up until the beginning of the XVII century A.D. The 1771 edition of the Encyclopaedia Britannica ([1118]) which we already referred to above gives us an opportunity of supplementing this corollary with another independent fact which is well explained by our reconstruction and was pointed out to us by our readers.

The large section of the 1771 Britannica entitled "Astronomy" contains a noteworthy comparative table with quantities of stars observed by various astronomers of the "antiquity" and the Middle Ages and included into their star catalogues ([1118], Volume 1, pages 486-487). Namely, we see the data pertaining to the catalogues of Claudius Ptolemy (who had allegedly lived around 90-160 A.D.), Tycho Brahe (1546-1601), Johannes Hevelius (1611-1687) and John Flamsteed (1646-1719). This comparative table can be seen in figs. 10.13 and 10.14.

The first column contains the constellation of the Northern and the Southern Hemisphere together with their Latin names.

The second column contains the English translations of the Latin constellation names.

The third column tells us how many stars in each of the abovementioned constellations were mentioned by Claudius Ptolemy.

The fourth column contains the stars mentioned by Tycho Brahe.

The fifth column contains the stars mentioned by Johannes Hevelius.

The ancient Conſtellations.		*Ptolemy.*	*Tycho.*	*Hevelius.*	*Flamſteed.*
Urſa minor	The Little Bear	8	7	12	24
Urſa major	The Great Bear	35	29	73	87
Draco	The Dragon	31	32	40	80
Cepheus	Cepheus	13	4	51	35
Bootes, *Arctophilax*		23	18	52	54
Corona Borealis	The Northern Crown	8	8	8	21
Hercules, *Engonaſin*	Hercules kneeling	29	28	45	113
Lyra	The Harp	10	11	17	21
Cygnus, *Gallina*	The Swan	19	18	47	81
Caſſiopea	The Lady in her Chair	13	26	37	55
Perſeus	Perſeus	29	29	46	59
Auriga	The Waggoner	14	9	40	66
Serpentarius, *Ophiuchus*	Serpentarius	29	15	40	74

Serpens

Fig. 10.13. A comparative table of the stars that entered the catalogues compiled by the four famous astronomers: Ptolemy, Tycho Brahe, Johannes Hevelius and John Flamsteed. The table is taken from the 1771 edition of the ***Encyclopaedia Britannica***, the Astronomy section. In the first column of the table we see the names of the constellations from the Northern and then the Southern Hemisphere of the celestial sphere, together with their names in Latin. The second column contains the English translations of the Latin names. In the third column we find the amount of stars in listed constellations indicated by Ptolemy, in the fourth – the ones indicated by Tycho Brahe, with respective data for Hevelius and Flamsteed in the fifth and the sixth columns. Taken from [1118], Volume 1, pages 486-487.

Finally, the sixth column is reserved by John Flamsteed.

The order of the astronomers is naturally given in accordance with the Scaligerian chronology. The "ancient" Ptolemy is mentioned first, followed by the mediaeval astronomers Brahe, Hevelius and Flamsteed.

The cited table demonstrates the following rather interesting effect (see figs. 10.13 and 10.14). The last three star catalogues (by Tycho Brahe, Johannes Hevelius and John Flamsteed) follow each other in a natural order – chronologically as well as contentwise. This is to say that each of the subsequent catalogues is more complete than the one that precedes it, which is perfectly natural – astronomical instruments were perfected over the course of time, providing for new opportunities. Each of the mediaeval astronomers would try to expand the catalogue of his predecessor, adding new stars thereto.

However, the catalogue of the "ancient" Claudius Ptolemy fails to fit into this natural picture. It turns out to be a great deal more detailed than the catalogue of Tycho Brahe, which can be easily seen from the corresponding table columns. The "ancient" Ptolemy had observed many more stars in almost every constellation than the mediaeval Tycho Brahe. The implication is that the mediaeval Tycho Brahe had "forgotten" the great achievements of the "ancient" astronomy. Specialists in history of astronomy are trying to convince us that the "ancient" Ptolemy could observe a lot more stars than Tycho Brahe who had lived 1.300 years later ([1118], Volume 1, pages 486-487).

Our reconstruction provides a perfect explanation for this oddity, which is a result of the erroneous Scaligerian chronology. The matter is that Ptolemy's catalogue, or, rather, the edition that has reached our day, is simply misplaced chronologically. It contains more stars than Brahe's catalogue, but less of them as compared to the catalogue of Hevelius. What we have to do is make the respective catalogues of Ptolemy and Tycho Brahe swap places; the correct star catalogue should therefore be as follows:

1) The first catalogue should be the rather compact one compiled by Tycho Brahe, which must be the oldest star catalogue to have reached our age.

2) It is to be followed by the more detailed catalogue of Claudius Ptolemy, or, rather, the version that we have at our disposal today.

3) The next catalogue is the one compiled by Johannes Hevelius with even more content.

4) The last catalogue is John Flamsteed's, the most extensive of them all.

This order eliminates all oddities instantly. The Tychonian catalogue turns out to be the oldest of the four and therefore contains less stars than the other

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The ancient Conſtellations.		Ptolemy.	Tycho.	Hevelius.	Flamſteed.
Serpens	The Serpent	18	13	22	64
Sagitta	The Arrow	5	5	5	18
Aquila, *Vultur*	The Eagle	15	12	23	71
Antinous	Antinous		3	19	
Delphinus	The Dolphin	10	10	14	18
Equulus, *Equi ſectio*	The Horſe's Head	4	4	6	10
Pegaſus, *Equus*	The Flying Horſe	20	19	38	89
Andromeda	Andromeda	23	23	47	66
Triangulum	The Triangle	4	4	12	16
Aries	The Ram	18	21	27	66
Taurus	The Bull	44	43	51	141
Gemini	The Twins	25	25	38	85
Cancer	The Crab	23	15	29	83
Leo	The Lion	35	30	49	95
Coma Berenices	Berenice's Hair		14	21	43
Virgo	The Virgin	32	33	50	110
Libra, *Chelæ*	The Scales	17	10	20	51
Scorpius	The Scorpion	24	10	20	44
Sagittarius	The Archer	31	14	22	69
Capricornus	The Goat	28	28	29	51
Aquarius	The Water-bearer	45	41	47	108
Piſces	The Fiſhes	38	36	39	113
Cetus	The Whale	22	21	45	97
Orion	Orion	38	42	62	78
Eridanus, *Fluvius*	Eridanus, *the River*	34	10	27	84
Lepus	The Hare	12	13	16	19
Canis major	The Great Dog	29	13	21	31
Canis minor	The Little Dog	2	2	13	14
Argo Navis	The Ship	45	3	4	64
Hydra	The Hydra	27	19	31	60
Crater	The Cup	7	3	10	31
Corvus	The Crow	7	4		9
Centaurus	The Centaur	37			35
Lupus	The Wolf	19			24
Ara	The Altar	7			9
Corona Auſtralis	The Southern Crown	13			12
Piſcis Auſtralis	The Southern Fiſh	18			24

The new Southern Conſtellations.

Columba Noachi	Noah's Dove	10
Robur Carolinum	The Royal Oak.	12
Grus	The Crane	13
Phœnix	The Phenix	13
Indus	The Indian	12
Pavo	The Peacock	14
Apus, *Avis Indica*	The Bird of Paradiſe	11
Apis, *Muſca*	The Bee or Fly	4
Chamæleon	The Chameleon	10
Triangulum Auſtralis	The South Triangle	5
Piſcis volans, *Paſſer*	The Flying Fiſh	8
Dorado, *Xiphias*	The Sword Fiſh	6
Toucan	The American Gooſe	9
Hydrus	The Water Snake	10

Hevelius's Conſtellations made out of the unformed Stars.

		Hevel.	Flamſt.
Lynx	The Lynx	19	44
Leo minor	The Little Lion		53
Aſterion & Chara	The Greyhounds	23	25
Cerberus	Cerberus	4	
Vulpecula & Anſer	The Fox and Gooſe	27	35
Scutum Sobieſki	Sobieſki's Shield	7	
Lacerta	The Lizard	10	16
Camelopardalus	The Camelopard	32	58
Monocerus	The Unicorn	19	31
Sextans	The Sextant	11	41

There is a remarkable track round the heavens, called the *Milky Way*, from its peculiar whiteneſs, which was formerly thought to be owing to a vaſt number of very ſmall ſtars therein: but the teleſcope ſhews it to be quite otherwiſe; and therefore its whiteneſs muſt be owing to ſome other cauſe. This track appears ſingle in ſome parts, in others double.

There are ſeveral little whitiſh ſpots in the heavens, which appear magnified, and more luminous when ſeen through teleſcopes; yet without any ſtars in them. One of theſe is in Andromeda's girdle, and was firſt obſerved *A. D.* 1612, by Simon Marius: it has ſome whitiſh rays

Fig. 10.14. The table continued. Taken from [1118], Volume 1, pages 486-487.

three. Then either Ptolemy or the XVII century editors of his catalogue expanded the number of stars observed. It was only after that than the more complete catalogues of Hevelius and Flamsteed were compiled.

This is the corollary we can make after the analysis of the information that had been at the disposal of the authors of the 1771 Britannica. It would be most interesting to study the evolution of different Almagest editions preceding and following 1771. Could the data contained in the presumably "ancient" Almagest have been "corrected" in retrospect, already after 1771?

As we demonstrated above, Ptolemy's star catalogue had been compiled in the epoch of the VII-XIII century A.D., and cannot possibly date to the II century A.D. as the Scaligerites tell us. However, we can see that the Almagest had been edited and expanded up until the early XVII century. In particular, it was supplemented by new stars observed in the post-Tychonian epoch.

8. ACCORDING TO ROBERT NEWTON, MOST OF THE LUNAR ECLIPSES REFERRED TO IN THE ALMAGEST HAPPEN TO BE RELATIVELY RECENT FORGERIES

Let us discuss the issue of whether the Almagest can be dated by the Ptolemaic descriptions of lunar eclipses. The Almagest mentions 21 of those, telling us that they were observed by different astronomers over a period of 850 years – from the 26th year of Nabonassar to the 881st. The following characteristics are cited by Ptolemy in his description of the eclipses:

1. The year of the eclipse given according to one era or another – the way it was given in the source allegedly quoted by Ptolemy. These dates are converted into the era of Nabonassar in most cases.

2. The phase of the eclipse according to the source that Ptolemy is presumed to quote from.

3. The date of the eclipse and the moment of the eclipse's central stage. These data were calculated by Ptolemy himself and are of no use for the purposes of dating.

4. The location of the eclipse. Since the eclipse was observable from an entire hemisphere, this information is also of marginal importance to us.

Ptolemy fails to indicate the phase of three eclipses out of twenty-one. An eclipse with some phase can be observed every year, from every point upon the surface of the earth – or even several eclipses. Therefore the mention of an eclipse that took place in one year or another is of no use to us when no phase is specified, since we can find such an eclipse in any year. Thus, only 18 eclipses from the Almagest list can be of interest for the purposes of dating.

A serious analysis of the Almagest lunar eclipses was conducted by Robert Newton in [614]. He had discovered many indications testifying to the fact that most of these eclipses are in fact forgeries. Curious readers can study Robert Newton's book entitled ***The Crime of Claudius Ptolemy*** ([614]). We shall merely cite the table that contains the results of his research herein. Robert Newton claims the following to be true:

"The triad of lunar eclipses (–720), 19 March, (–719), 8 March and (–719), 1 September. One of the them is definitely a forgery, the others are likely to be forgeries as well.

The triad of lunar eclipses (–382), 23 December, (–381), 18 June and (–381), 12 December. Forgeries.

The triad of lunar eclipses (–200), 22 September, (–199), 19 March and (–199), 12 September. Forgeries.

The lunar eclipse of the 25 April (–490) might be authentic [or, as we are beginning to understand nowadays, it had better chances of being reversely calculated in the XVII century – Auth.]

The lunar eclipse of the 5 April 125 might be authentic [or, as we are beginning to understand nowadays, it had better chances of being reversely calculated in the XVII century – Auth.]

The lunar eclipse of the 19 November (–501) might be authentic [or, as we are beginning to understand nowadays, it had better chances of being reversely calculated in the XVII century – Auth.]

The lunar eclipse of the 22 April (–620) is a forgery.

The lunar eclipse of the 16 June (–522) is a forgery.

The lunar eclipse of the 1 May (–173) is a forgery.

The lunar eclipse of the 27 January (–140) is a forgery." ([614], page 334).

R. Newton proceeds to tell us that "Ptolemy does the same for the eclipse triad that he claims to have observed in the years of 133, 134 and 136 … This research is based on a forgery. All the eclipses that he claims to have observed are forgeries, as well as the middle eclipse in the ancient triad. We can make no final corollary concerning the authenticity of the two other eclipses from the ancient triad, but are inclined to believe that they are forgeries as well" ([614], page 147).

Thus, Robert Newton had discovered that most of the lunar eclipses mentioned in the Almagest are forgeries, which means they were calculated theoretically in some later epoch and then included into the Almagest as authentic "ancient observations". As for the few eclipses that Robert Newton made no final conclusion about are most likely to have been calculated by the XVI-XVII century astronomers with more accuracy, as we are beginning to understand nowadays.

Hence we cannot consider the lunar eclipse list from the Almagest to be reliable material fit for the purpose of independent astronomical dating. This false "ancient list" was most probably forged by the Scaligerian astronomers and chronologists in the XVI-XVII century in order to validate the claim that the Almagest is an "ancient" tractate.

Nevertheless, we have conducted the necessary lunar eclipse calculations in order to determine whether the respective Almagest data contradict our mediaeval dating of the book. As a result we managed to find satisfactory mediaeval solutions for almost all of the 18 lunar eclipses that Ptolemy describes in detail, with the indication of the phase. The lunar eclipse solution that we found dates the beginning of the Nabonassar era to approximately 465 A.D., spanning the epoch of 491-1350 A.D. dating-wise. Bear in mind that there are 21 eclipses mentioned in the Almagest altogether.

However, all of the facts mentioned above cannot allow us to present the lunar eclipse calculations as independent proof of our chronological result. One could just as easily find an ancient solution insofar as the eclipses are concerned. All we are claiming is that the Ptolemaic eclipse data do not contradict our dating of the Almagest star catalogue, even if some of them are really XVII century forgeries.