

But the situation in the Almagest's case is such that we do not need very exact formulas for Jupiter and Saturn. Really, according to the Almagest, the observation of Saturn has only auxiliary meaning because Saturn did not cover the star but was at a distance of uncertain "two units (digits)" from the star. What Ptolemy meant here by the term "digit" (unit)—is not quite clear. Consequently, it is senseless to calculate here the position of Saturn with an accuracy of 1'.

In the case of Jupiter, Ptolemy states that "*Jupiter covered (occulted) the star*". But our computer calculations based on modern theory shows that the angular distance between Jupiter and δ -Cancer has never been less than 15' (!) in the entire historical time interval. Consequently, we can try to find such moments only when the distance between Jupiter and δ -Cancer is about 15'–20'. We do not need the high accuracy of the formulas for this purpose. The accuracy which is guaranteed by the modern theory is sufficient for us.

Let us discuss the question of how Ptolemy distributes the astronomical events (1)–(4) over the time axis. The universal "era" for Ptolemy is "the Era of Nabonassar". Usually, Ptolemy assigns different astronomical events to the dates in terms of this era, though sometimes he uses other eras. Table 1 contains all datings of the coverings according to Ptolemy. One can see that Ptolemy used (at least twice) the following three eras: Nabonassar, "after the death of Alexander", Dionysius.

Table 1

The occultation of the star by the planet	Year according to Ptolemy		
	Era of Nabonassar	Era "after the death of Alexander"	Era of Dionysius
1. Venus	406		
2. Mars	476	42	13
3. Jupiter		83	45
4. Saturn	519		

A study of this table shows that the chronology of Ptolemy contains some errors (disagreements). The time distance between the occultations of the stars by Mars and Jupiter is equal to 41 years if we use the era of Alexander. But the same distance is equal to 32 years if we use the era of Dionysius. This implies two versions in terms of the era of Nabonassar: 517 and 508 years. We consider both versions.

Thus, we can now formulate an exact mathematical problem. Namely, we must find the year N , launching the following chain of astronomical events:

- 1) In the year N , Venus covered the star η -Virgo about midnight.
- 2) In the year $N + 70$, Mars covered the star β -Scorpio in the morning.
- 3) In the year $N + 111$ (or $N + 102$), Jupiter covered the star δ -Cancer at sunrise.
- 4) In the year $N + 113$, Saturn was near the star γ -Virgo (below).