OCCULTATION OF PLANETS BY THE MOON IN EUROPEAN NARRATIVE MEDIEVAL SOURCES

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Abstract: Existing research dealing with astronomical observations from medieval Europe have extensively covered topics such as solar and lunar eclipses and sightings of comets and meteors, but no compilation of occultations of planets by the Moon has been carried out, being the data scattered in different publications. The main cause for this is the small number of observations that have reached us, their limited use for calculation of parameters associated with the rotation of the Earth and the fact that between the fifth and fifteenth centuries, the period that we consider, almost none of these observations was made scientifically, since they usually appear in narrative texts, be they chronicles or annals.
Our purpose is to make a compilation of these phenomena, trying to shed light on some of the most controversial observations after examining them in their historical context. We will examine European sources but, occasionally, we will also consider reports from other parts of the world to make comparisons, when necessary.

Keywords: *Medieval Astronomy, Occultations*

1. Introduction

In contrast to what happened in China, Korea or Japan, in Europe there were no "scientific" systematic observations of the celestial sphere until well into the fifteenth century, although we can find essays and translations of works of Astronomy/Astrology as that of Gregory of Tours *De Cursu Stellarum* or the copies written under the protection of some monarchs, such as Alfonso X of Castile, Pere III or Joan I of Aragon in the thirteenth century[1]. That is why the astronomical records from Middle Ages, which we will consider roughly as the period between the fifth and the fifteenth centuries, are found in chronicles and annals devoted to history or to tell the stories of the lives and heroic deeds of kings. These are not scientific documents, but they can be used to extract valuable records of observations of astronomical events.
In chronicles from medieval Europe, it is easy to find records of eclipses, comets, and even meteors or star showers. In particular, eclipse records have been studied in depth and important results related to the rotation of the Earth have been obtained from them[2] such as values of LOD and ancient ΔT. Other phenomena, such as supernovae, novae or occultations are much scarcer or even absent for long periods of time. We will deal with possible registers of novae and supernovae in later works, while in this paper we will focus on the study of the occultations involving the Moon and the brightest planets that we have found by reviewing old chronicles.
Observations of occultations from Eastern cultures have already been studied by different authors, both from a historical and astronomical point of view, and they have provided reliable data used for the calculation of ΔT[3], but we have not found publications that collect and discuss the different occultations from Europe, although some of them have been studied individually. This occurs because of their limited amount, barely a dozen of candidates in contrast to the several hundred from Asia; and the little astronomical skill of the observers.

Our aim is to study the European occultations from the historical point of view, placing them in their context and, in a few cases, obtaining ΔT values, in order to be compared with those computed by other authors or with those currently accepted by the scientific community for the dates considered.

2. Sources

The compilations of eclipses, comets and other phenomena observed in medieval Europe and carried out by Newton, Pingré, Dall'Olmo[4], etc are well known. These authors focused mainly on the classic MGH (*Monumenta Germaniae Historica*) and RIS (*Rerum Italicarum Scriptores ab anno aerae christianae 500 ad 1500*) collections. We have revised these sources and we have also worked with others such as Bohemian[5] and Russian chronicles[6], and a multitude of other major and minor chronicles and annals that we do not believe that it is necessary to mention specifically since they have not provided new records of occultations. The future use of new sources, as they are translated and published, can bring to light new phenomena that have gone unnoticed.
Most of the sources employed are secondary, consisting of compilations written from previous documents that may have been lost, but in many cases they provide valuable information and it is possible to track the original source or, at least, a primary source close enough in time to the event so that it can be considered reliable.
Practically all the documents are written in Latin, although vernacular languages began to become especially visible from the fifteenth century. The literary form in which we find more widespread astronomical records is not scientific, but narrative, in the form of chronicles or annals, sometimes covering several centuries and occasionally contemporary to the events. They are usually written by different successive scribes and sometimes they provide original material, but in other cases, as previously stated, they are compilations of others older and, frequently, disappeared authors. In this last case, it is worth noting the medieval custom of endowing the works with relevance through the citation of previous authors of great influence, such as the case of Venerable Bede or Gregory of Tours. In fact, of all the entries that we present, only one of them was carried out by a "professional" astronomer from the part of the Iberian Peninsula under the influence of Islam. Different documents may use different chronologies, depending on their geographic location and temporal reference. A discussion on the different chronologies used in the sources can be seen in Stephenson[7].
Next, we will make a brief comment of the documents used in which we have found contemporary references to occultations so that we can affirm that the authors have witnessed the event themselves or were based on reliable witnesses of the described phenomenon:

- *Gregorii Episcopi Turolensis Historiarum*[8] better known as the *Historia Francorum*, begins with Creation and covers until AD594. Written by Gregory of Tours (c. 539-594), it is considered the primary contemporary source for Merovingian history.
- *Annales Laurissenses maiores et Einhard*[9] , covering the period AD741-829 and written by at least three different authors, one of whom was Einhard (c.770-840), biographer of Charlemagne.
- *S. Adonis Archiepisc. Vienensis Chronicon*[10] by Ado of Vienne (c. 800- 874) who was archbishop of Vienne, in Lotharingia. The *Chronicon* covers the period from Adam to AD869.

- *Historia Regum*[11] of Simeon of Durham (died after AD1129), an English chronicler and a monk of Durham Priory. About AD1129 Simeon undertook the writing of *Historia Regum Anglorum et Dacorum*, beginning when the *Ecclesiastical History* of Bede ends. Until AD957 Simeon merely copies some old not preserved Durham annals and then until AD1119 he mainly follows John of Worcester. Within AD1119-1129 it is an independent and practically contemporaneous work.
- *Historical Works of Gervasio of Canterbury*[12]. Gervase of Canterbury (c. 1141 – c. 1210) The Chronicle covers the period from AD1100 to AD1199.
- *Armenian chronicle of Hetum*[13], by Hayton of Corycus (c.1240-c.1310-1320) an Armenian nobleman, monk, and historiographer.
- *Cronica Ecclesiae Pragensis Benessii Krabice De Weitmile*[14], a source of history written in the fourteenth century by Benes Veitmiliskis (born AD1375). Its main source is the chronicle of Francis Prahiskis, which covers from the thirteenth century until mid-1353. The second part describes events until AD1374. Charles IV's autobiography is used, but the rest of the text is original.

3. The Occultation Records

We carry out our study for the Medieval period, roughly understood as the period comprised between the fifth and fifteenth centuries, and in the European context. Although we mention authors or areas under the Islamic domination of southern Europe, in general, we will not take into account reports from Arab authors from outside the European territory which have been collected and studied by scholars such as Delambre, King and Gingerlich, and Goldstein and Chabás[15].

Little can be said about the motivations of the medieval authors, beyond that the main reason seems to be to provide a reinforcement to the historical context. Sometimes, the celestial signals are seen as an ominous warning of what is about to happen (the death of Charlemagne, for instance) mainly a disaster. Other reports only describe the phenomenon, and they are not clearly intended to be used in any other sense. A recent interesting approach to these issues related to occultations can be seen in Włodarczyk et al.[16], although this study is situated in the context of the seventeenth century.

Throughout our research in European sources, we have found about a dozen candidates for occultations. Many of the situations described fit the terminology that Dall'Olmo[17] uses for occultations, but after the calculation of the astronomical situation, they turned out not to be. A paradigmatic case is the one we found for AD577 in the *Chronicon S. Benigni Divionensis*[18]:

> *Filii Guntranni duo continuo moriuntur. Guntrannus Childebertum adoptavit in filium. Anno quoque tertio Childeberti regis, qui erat Chilperici et Guntani sextus decimus, stella in medio lunae visa est fulgens.*
>
> The two sons of Gontrand died one after the other. Gontrand adopted Childebert as his son. The same third year of Childebert, who was the sixteenth of Chilperic and Gontrand, was seen a star shining in the center of the Moon.

In the beginning, the fragment refers to the death of the two sons of Gontrand: Clotaire, and Clodomir, in AD577. Gontrand I was king of Burgundy between AD561-592 and Chilperic I was king of Neustria from AD561 until his death. In AD587 Gontrand adopted Childebert II, who became his successor. This happened in the 16th year of Gontrand and Chilperic's reigns, which takes us around year AD577.

The *Chronicon S. Benigni* is not contemporary, being the primary source for this time Gregory of Tours, who indeed, seems to mention this phenomenon in his book V of the

Historia Francorum[19] in the year AD577, immediately after the death of Samson, son of Chiperic I:

> *Post haec in nocte, quod erat tertio Idus Novembris, apparuit nobis beati Martini vigilias celebrantibus magnum prodigium; nam in medio lunae stilla fulgens visa est elucere, et super ac subter lunam aliae stillae propinquae apparuerunt.*
>
> Then, on the night of the third day of the Ides of November, while we celebrated the Vigils of St. Martin, a great miracle appeared to us: we saw in the middle of the Moon shine a flaming star, and near the Moon, above and below, appeared other stars.

There are other secondary references[20] that use similar words. Gregory of Tours provides a precise date: November 11. No occultation on this date or around was visible from France, with the possible exceptions of June 2 (visible only in Northern Europe) and July 31 for Mercury, but in this later case Mercury had almost a 4th magnitude and it was barely visible. The observed event was surely a meteor, probably a Leonid bolid, crossing the full Moon on November 11.

Other observations that appear relatively often are those that refer to planetary conjunctions, especially Jupiter and Saturn. For example, consider the following from the *Cronaca Fiorentina*[21] for AD1384, contemporary to the event, that reports a conjunction together with other astronomical phenomena:

> *In questo medesimo anno del mese di maggio si congiunse Iove con Saturno nel principio di Cancro (…) Lo sole oscurò lo primo dì di gennaio tra la sesta e terza, e se non che fu nuvolo, si sarebbe quasi veduto tutto il corpo del sole scurato, perocchè scurò quasi ¾ d'esso(…) La luna oscuro poi appresso il detto mese a' dí 13 del detto mese, vegnente 16 dì, innanzi di circa due ore.*
>
> In this same year in May, there was a conjunction of Jupiter and Saturn at the beginning of Cancer (...) The Sun darkened the first day of January between the sixth and the third, and if it were not because it was cloudy, you would almost have seen the whole body of the Sun darken because it almost obscured ¾ of it (...). The Moon then darkened that month beyond the 13th of that month, coming the 16th, approximately for two hours.

There was indeed a close encounter of Jupiter and Saturn in Geminis (at the beginning of the sign Cancer), their minimum angular distance was about 40' on May 3, 1385, and Venus was very near too. The eclipse of the Sun happened in AD1386. It was large but partial as seen from Florence, with a magnitude of 0.99, reaching the maximum at 10 am. It was cloudy, so the maximum of the eclipse could not be observed. The eclipse of the Moon happened on January 16 that same year and was partial in Florence.

Although there was great interest in the conjunctions of Jupiter and Saturn (or "great conjunction") since they were attributed serious consequences, we are not going to deal with them along this paper. A careful study of such phenomena was done by Etz[22].

Our study will be reduced to nine occultations (See Table 1. Also in Figures 1 and 2, we see the path followed by the planet and the Moon and the visibility zones for some of these occultations). Among these, seven involve Venus or Jupiter with the Moon and another one Saturn and the Moon. Especially interesting is the case of AD755, November 23, with an occultation involving Jupiter and the eclipsed Moon. It is also remarkable the occultation of Venus by the Moon in AD1075 and AD1086, that some authors have identified with the European sighting of the supernova SN1054.

Although it is out of the scope of the paper, we have included a brief subsection to consider the occultations observed and collected by Bernard Walther from Nürnberg. We also will dedicate a section to the brief study of three cases related to remarkable

phenomena but were certainly not occultations. Finally, we include in an Appendix some occultations of planets by other planets.

Occultations were mostly observed from different parts of Europe by contemporary (or almost) witnesses. The typical angular separation for astronomical observation without the aid of telescopes is approximately 1' of arc for a dark sky and without pollution, as it should be the case. All observations were carried out without the help of equipment and, since some of them happened close to the sunset or the sunrise it is also important to consider the luminosity of the sky in order to determine the time in what they could or could not be observed. To expand this issue, see Schaeffer[23] and Włodarczyk el al[24] who have also dealt with the visibility of the bodies involved in an occultation. The times of the phenomena are given in UT. We have taken as the beginning of the occultation (immersion) the moment when the limb of the Moon touches the planet, although a naked eye observer would have considered that the occultation began earlier. For all the calculations we used the VSOP87 theory, with a value for the lunar acceleration of $\dot{n} = -25.826''/cy^2$. The obtained ΔT, when applicable, is compared with the published by other authors[25].

Date	Place	Bodies involved	Beginning (UT)	End (UT)
October 9, 554	Metz 49º07N, 6º10'E	Moon-Venus	5h16m	6h31m
November 23, 755	York 53º57'N 1º5'W	Moon (eclipsed)-Jupiter	17h47m	20h43m
February 12, 806	Aachen? 50º46'N 6º5'E	Moon-Saturn	23h55m (11 Feb)	0h 58m
January 31, 807	Aachen? 50º46'N 6º5'E	Moon-Jupiter	1h40m	2h37m
February 20, 1075	Brescia 45º32'N 10º12'E	Moon-Venus	16h47m	18h04m
February 17, 1086	Cava de Tirreni 40º42'N 14º42'E	Moon-Venus	17h02m	17h36m
April 2, 1283	Parma 44°48′N 10°20′E	Moon-Venus	16h48m	18h00m
July 24, 1476	Salamanca 48º58'N 5º39'W	Moon-Venus	21h01m	Not visible

Table 1: Main data for the occultations found in European narrative sources as seen from the main observational place.

3.1 *Occultation of Venus by the Moon: AD554, October 9*

Pingré[26] collects a variety of reports about this event, that he sets in the year AD547, as:

> *Une etoile entra sur le disque de la Lune.*
>
> A star entered the disk of the Moon.

although he points out that different authors assign different dates, between AD547 and AD549, to the phenomenon. The primary source is Gregory of Tours[27] who states:

> *Sub huius tempore uvas in arbore quem savucus vocamus absque vistis coniunctione natas vidimus et flores (…) Tunc et in circulum lunae quintae stella ex adverso veniens introisse visa est. Credo haec signa mortem ipsius regis adnuntiasse.*
>
> In his time, we saw grapes grow on the tree we call saucum* without having any vine on it, and the blossoms of the same trees (…) Then a star coming from the opposite direction was seen to enter the disk of the fifth Moon. I suppose these signs announced the death of the king.

* Elder tree.

The mentioned king is Theodobald of Reims, who was king of Metz and died in AD555 after an illness that paralyzed him from the waist down, according to Gregory of Tours. Perhaps the explanation for the confused chronology is that the authors of the secondary sources, although citing Gregory of Tours, confused the king with Theudebert I, who died in AD547 or AD548, although the biographical features provided by Gregory of Tours point to his son, Theodebald. In addition, although Pingré gives the precise date of AD547, the texts state that the phenomenon happened "in times of Theodebaldus" (547-555) so there is a wide range of time. The reference to the “sambuco” tree and its fruits, collected at the end of summer or autumn, seems to indicate an event that happened at the beginning of autumn.

It should be pointed that nowhere does the fragment even mention the star was especially bright. Therefore, in the first place, we conducted a study of visible occultations of stars with brightness greater than magnitude 2. Then we searched for occultations of the brightest planets, including Saturn and Mercury. In total, we found four possible cases: two involving α Scorpii and α Virginis and two more with Saturn, all of them in winter.

The data provided leads to accept the date of October 9, 554 as the most likely for the occultation, involving Venus and the Moon. Gregory of Tours (538-594) could have witnessed it in his youth, perhaps this explains the error in the appreciation "the fifth Moon" since the Moon would have been, in fact, on his 26th day.

The capital of these Merovingian kings was Metz. We assume this place as a place of observation. That day the sunrise was at 5h50m. The first contact of Venus with the limb of the Moon occurred at 5h15m and the end of the occultation at 6h30m. A $\Delta T <$ 3000s would have meant that the occultation occurred after sunrise, while a ΔT greater than 5500s would have led to seeing the Venus emersion. Therefore, the values obtained are consistent with those of Espenak & Meeus[28] and with those of Stephenson et al.[29]

It is interesting to compare our result with those obtained by Soma and Tanikawa[30] who performed a calculation of ΔT for the beginning of the sixth century using occultations of planets by the Moon and solar eclipses. They obtained a ΔT between 2893 and 5246s. The result that we have obtained is a refinement for the lower limit of this interval.

Although it is out of the aim of this paper, which is focused on narrative sources, for the purposes of the ΔT study we could include the almost contemporary observations carried out by Heliodorus and analyzed by Neugebauer[31]. Heliodorus made several observations of occultations among which are two of Venus with the Moon (AD475 November 18, made at Athens) Saturn with the Moon (AD503 February 21/22, made at Alexandria). The characteristics of both occultations, which we will discuss in depth in a further paper, provide a ΔT between 3000 and 4500s.

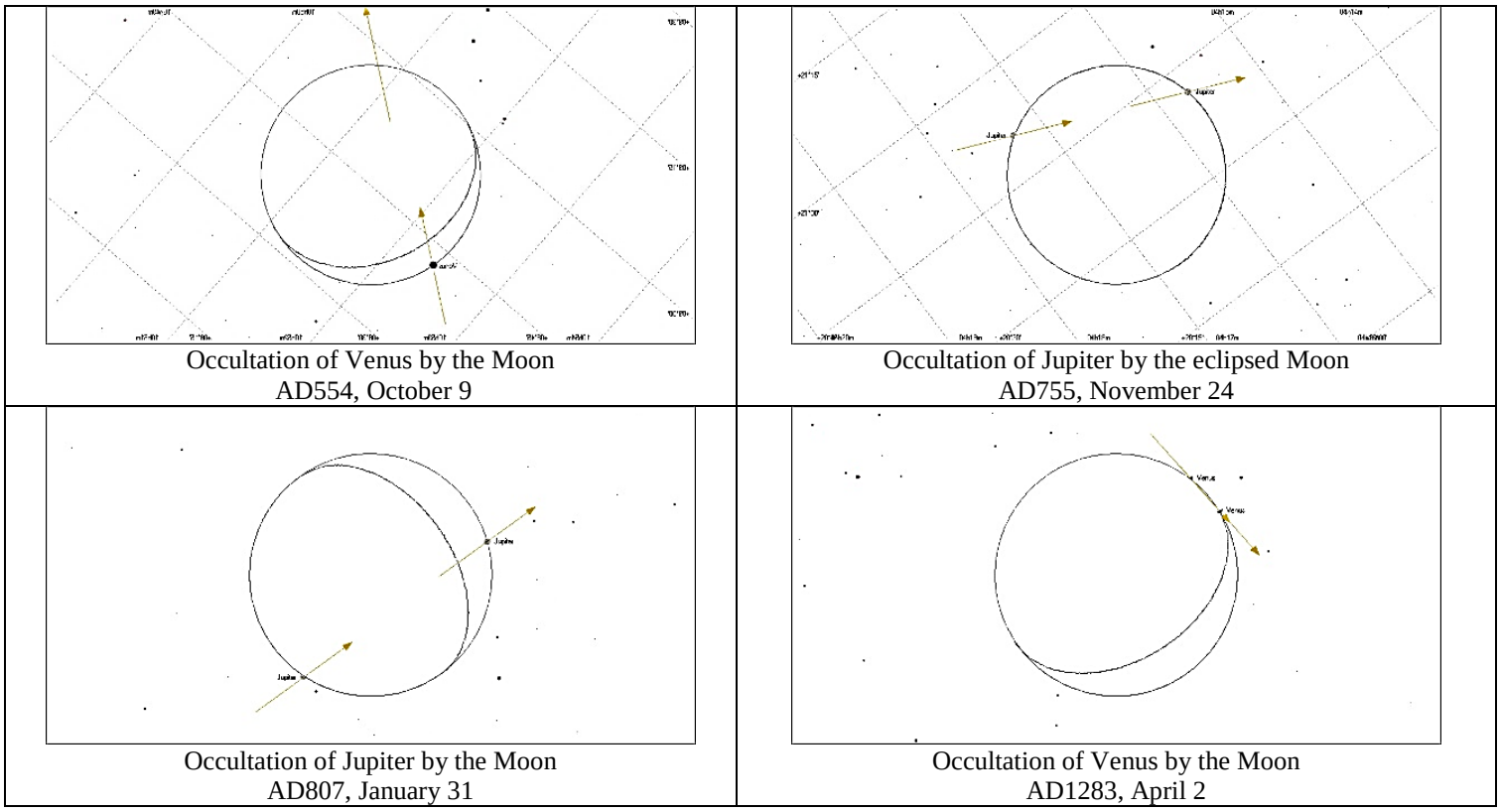

Figure 1: Some Occultations of planets by the Moon as seen from the respective assumed main observational places, using Occult v4.5.5[32]

3.2.Ocultación of Júpiter by the eclipsed Moon: AD755, November 23

This well-known record of the occultation of a planet by the eclipsed Moon, the only one recorded in medieval times, is found in the *Historia Regum* of Symeonis de Durham[33]

> *Luna autem xv sanguine rubre superducta viij kal. Decembris, xv aetate, id est plena luna. Sicque paulatim decrescentibus tenebris ad lucem pristinam pervenit. Nam mirabiliter ipsam lunam sequente lucida stella et pertranseunte, tanto spatio eam antecedebat illuminata, quanto sequebatur antequam esset obscurata.*

And its translation, from *The Historical Works of Symeonis of Durham*[34]:

> On the eight of the Kalends of December, the Moon fifteen days old, that is, at the full Moon, was suffused with a blood-red color; and then the darkness gradually diminishing, it returned to its former lustre. For, very remarkably, a bright star following the Moon itself, and passing across it, excelled it in brilliancy, as much as it was inferior before the Moon's obscuration.

It also appears, with almost the same words, in the *Chronica magistri Rogeri de Houedene*[35]. On the other hand, at the beginning of the nineteenth century, Olbers[36] already points to this record and states that it was Jupiter and not Venus the star eclipsed, as it was currently supposed. Also, Stephenson[37] made a study of this event in order to obtain values of ΔT.

Although Symeonis is not contemporary, he could have copied the record from lost Durham annals making an error of one year because he dates the phenomenon in AD756 when, in fact, it happened in AD755. The chronicler makes another mistake in the date when he states that eclipse and occultation happened on December 24 when, in fact, they both happened a day earlier. Stephenson assumes the existence of York

chronicles now lost and, therefore, provides the data as if York were the place of observation.
An idea of how particular is this account is the small number of similar phenomena that could have been seen in Europe in the period that we consider[38] (See Table 2).

Planet	Date	Visibility
Mars	October 14, 916	Europe
Jupiter	November 7, 458	Center-Southern Europe
	November 23,755	Europe
	December 9-1052	Europe

Table 2: Occultations of planets by the eclipsed Moon visible from Europe between the fifth and the fifteenth centuries.

The beginning of the totality of the eclipse was at 18h06m, its maximum at 18h52m and the end of the total phase at 19h37m. Jupiter contacted the Moon's limb at 19h47m and reemerged at 20h40m. The range of possible values for ΔT is too large to be considered significant. It is only possible to assert that with a $\Delta T > 6000$s the occultation would have become a graze, but an observer without instrumental help would probably not have noticed the difference. It can be highlighted that the current values are in accordance with the data provided by the historical record.

3.3.Occultations of Saturn and Jupiter by the Moon: AD806, February 12 and AD807, January 31

For the dates of February 12 and January 31 of AD806 and AD807respectively, we find records that apparently refer to the same phenomenon. The oldest ones seem to be *S. Adon Vienensis* [39] and *Annales Einhardi*[40], although there are other versions collected in secondary sources[41]. Let us examine, in the first place, the record provided by *S. Adon Vienensis*:

> *Eclipsis lunae quarta Nonas Septembris fuit, stante sole in decima sexta parte virginis: luna autem stabat in decima sexta parte piscium. Ipso anno pridie Idus Februarii, luna decima septima stella quae vocatur Jovis visa est transire per eam. Tertio Idus Februarias fuit eclipsis solis media die.*
>
> An eclipse of the Moon happened the fourth of the nones of September, the Sun being in the sixteenth part of the Virgin: and the Moon in the sixteenth part of Piscis. In the same year, the day before the Ides of February, Moon seventeen, the star called Jupiter crossed through it. On the third Ides of February, there was an eclipse of the Sun at noon

It is assumed that Ado de Vienne was born around AD800 and died in AD875, so he could hardly have been a first-hand witness of these events. His chronicle is based primarily on that of Bede, who died in AD735 so this particular passage cannot come from this source either.
We will see later that the astronomical data offered by this entry are not totally accurate, as the age of the Moon on Pridie Idus February (February 12) which was 20 days for AD806 and 1 day for AD807. It is evident, in any case, that the last two phenomena, the occultation, and the solar eclipse, cannot refer to the same year, since a Moon of age around 17 on February 12 could not produce a solar eclipse one day earlier. This leads us to suspect that the eclipse occurred in AD807 and the occultation a year earlier.
Regarding the record provided by Einhard, also included in other secondary sources[42], and considered contemporaneous:

Anno superiore 4 Non. Septemb. Fuit eclypsis lunae; tunc stabat sol in decima sexta parte Virginis, luna autem in decima sexta parte Piscium; hoc autem anno pridie Kal Feb. fuit luna decima septimal, quando stella Iovis quasi per eam transire visa est, et 3. Id. Febr. fuit eclipsis solis media die, stante utroque sidere in vicesima quinta parte Aquarii. Iterum 4. Kal Mart. fuit eclipsis lunae, et apparuerunt acies eadem nocte mirae magnitudinis, et sol stetit in undecima parte Piscium, et luna in undecima parte Virginis. Nam et stella Mercurii 16. Kal. Aprilis visa est in soli quasi parva macula nigra, paululum superius media centro eiusdem sideris, quae a nobis octo dies conspicitur. Sed quando primum intravit vel exivit, nubibus impedientibus minime notare potuimus. Iterum mense Augusti 11. Kal. Septemb. eclypsis lunae facta est hora noctis tertia, sole posito in quinta parte Virginis et luna in quinta parte Piscium. Sicque ab anni superioris Septembrio usque ad anni praesentis Septembrium ter luna obscurata est et sol semel.

Last year on 4 Nones September there was an eclipse of the Moon; at that time the Sun was in the sixteenth part of Virgo and the Moon in the sixteenth part of Pisces; this Pridie Kalendas February, Moon seventeen when the star Jupiter was seen as passing through it and on 3 Ides February there was an eclipse of the Sun at noon, both stars being in the twenty-fifth part of Aquarius. Once again on 4 Kalendas March, there was an eclipse of the Moon, and the same night, wonderful signs appeared, and the Sun was in the eleventh part of Pisces and the Moon in the eleventh part of Virgo. The star Mercury was seen in the Sun on 16 Kalendas April as a small black dot a little above the center of the planet, which was observed eight days. However, the clouds prevented us from observing when it entered or left for the first time. On August 11 Kalendas September a lunar eclipse happened in the third hour of the night, the Sun was in the fifth part of the Virgin and the Moon in the fifth part of Pisces. Thus, from September of the previous year until September of this year the Moon darkened three times and the Sun once.

What Einhard intends is to make a compilation of the many prodigies and signs that preceded the death of Charlemagne, in AD814. This paragraph deserves an analysis if only to see if Einhard is accurate to describe the abovementioned phenomena. We consider Aix-la-Chapelle, (also known as Aachen in German), capital of the empire as the observational place:

- *Anno superiore 4 Non. September. Fuit eclypsis lunae; tunc stabat sol in decima sexta parte Virginis, luna autem in decima sexta parte Piscium;* That is on AD806, September 2. There was a total eclipse of the Moon on September 1. The Moon was in Pisces and the Sun in Virgo.
- *Hoc autem anno pridie Kal Feb. fuit luna decima séptima, quando stella Iovis quasi per eam transire visa est.* AD807, January 31. It corresponds to an occultation of Jupiter by the Moon. The age of the Moon was 18.5 days.
- *3. Id. Febr. fuit eclipsis solis media die, stante utroque sidere in vicésima quinta parte Aquarii.* On February 11, 807 there was an annular solar eclipse, which was partial in Aachen to 82% and which occurred around 12 noon. The Sun was in Aquarius.
- *Iterum 4. Kal Mart. Fuyt eclipsis lunae, et apparuerunt acies eadem nocte mirae magnitudinis, et sol stetit in undecimal parte Piscium, et luna in undecimal parte Virginis.* On AD807, February 6 there was a total eclipse of the Moon. The Sun was in Pisces and the Moon in Virgo.

- *Stella Mercurii 16. Kal. Aprilis visa est in soli quasi parva macula nigra, paululum superius media centro eiusdem sideris, quae a nobis octo dies conspicitur*. According to all appearances, a sunspot, which began to be seen on AD807, March 17[43]. There is no way to verify the accuracy of this statement since there is no other independent record in contemporary sources, although there are authors who have associated this observation with a period of maximum solar activity.
- *Iterum mense Augusti 11 Kal. Septemb. eclypsis lunae facta est hora noctis tertia, sole posito in quinta parte Virginis et luna in quinta parte Piscium,* partial eclipse of Moon on August 21/22, AD807 large enough to be noticed. The Sun was entering Virgo and the Moon was in Pisces.

The similarity between the texts of *S. Adon Vienensis* and *Einhardi Annales* is evident, with the exception of the date on which the occultation happened. The eclipse of the moon took place on the night of September 1 to 2, 806, and Adon states that the alleged Jupiter's occultation happened that same year on February 12. This leaves us with two possibilities, and both imply an error on the part of the author: either he wanted to write Pridie Kalendas Februarii (January 31) in which, indeed, happened an occultation of Jupiter by the Moon, but in the year 807; or wrote Jupiter when, in fact, he referred to any other bright star hid by the Moon on Pridie Idus Februarii (February 12). Although there were occultations of bright stars (α Taurii) at that time that were visible in Western Europe none of them occurred in the vicinity of the date given, so this possibility should be excluded.
Several factors made us choose the second possibility: The writer states that the Moon eclipse and the occultation occurred in the same year; On Pridie Idus Februarii there was an occultation of Saturn. If this had been a typo, there was very little chance that it coincided with a relatively rare phenomenon such as the occultation of a planet by the Moon; Additionally, the estimated magnitude for Saturn on February 12, 806 was around 0.3-0.4, which would make the planet bright enough to be observed by the naked eye without problems.
Although having complete security is, obviously, impossible, it seems an excessive chance that the typo coincided on the day when a relatively infrequent phenomenon occurred, such as an occultation of Saturn by the Moon, also having Saturn a magnitude low enough to be easily observed. In conclusion, our opinion is that Adon de Vienne reports an occultation of Saturn in AD806, obtained from an unidentified source, while Einhard refers to the one of Jupiter in AD807.
As for the astronomical results themselves, for the occultation of Saturn on February 12, 806, the Moon occulted Saturn at 0h and Saturn emerged at 1h8m. For the occultation of Jupiter one year later, the Moon occulted the planet at 1h49m and Jupiter emerged at 2h56m. The ranges of ΔT that both occultations provide are too large to be useful.

3.4.Occultation of Venus by the Moon: AD1075, February 20

The next record is found in the *Chronicon Brixianum ab origine urbis ad annum usque 1332*[44] written by Jacopo Malvezzi, who lived in the fifteenth century in Brescia.

> *Et diebus illis Stella fulgoris immensi intra circulum Lunae apparuit circa dies primos post ipsius separationem à Sole.*
>
> And in those days a star of immense brilliance appeared within the circle of the Moon around the first days of its separation from the Sun.

This text was proposed as a possible reference to the supernova of AD1054 by Umberto Dall'Olmo[45], but this would mean assuming very large dating errors because the entry is

dated between an earthquake happened in AD1064 and the calamities from AD1083, also reported in the *Chronaca Rampona*[46]. Stephenson and Green[47] already studied this possibility, rejecting the identification with the supernova and pointing, among other things, that the Moon did not hide M1, the remnant of the supernova SN1054, at any moment from Brescia. As an alternative, they suggested an occultation of Venus in the spring of AD1054, although they warned that this event was not visible from Europe. In our opinion, it seems unlikely the relationships between this occultation and the report.
Malvezzi also points out that the sighting happened a few days after the new Moon, which can give the key to select among the possible occultations in the period AD1064-1083. In addition, the star appeared from the Moon circle, which may indicate that the moment of immersion was not seen.
Although there are occultations of bright stars by the Moon in this period of time, the reference to a "stella fulgoris immensi" seems to mean a celestial body brighter than α Tauri, which is the brighter star than the Moon can hide with a magnitude of 0.85. Considering that it was a star of immense brightness and having already excluded SN1054, the logical thing is to think of an occultation of Venus or Jupiter (although we also investigate those of Mars since its magnitude can become -3 in the most favorable situation, but in any of the cases the magnitude was far from this value) We obtained six possible events. All but one were disregarded because they did not fit the description given by the escribe. Taking all of this into account, the occultation that suits best is the one of Venus on February 20, 1075, with a 3-day-old Moon. The occultation began at 17h7m and ended at 18h21m, which agrees with the fact that only the end of the phenomenon could be observed.
As for the ΔT, its range is too large to be useful, since any value greater than -2500 and lesser than 5000s would have made it possible to contemplate the phenomenon with the mentioned conditions.

3.5.Occultation of Venus by the Moon: AD1086, February 17

Again, this occultation is related to a large number of records that have been, in some way, linked to SN1054, especially the *Cronaca Rampona* and *Corycus Hayton's Cronica*. Other authors have compiled a list of possible SN1054 historical sources, not all of them related to the Moon[48], that we will not discuss here, focusing only on those that hint at the possibility of an occultation.
We focus on the report of the *Annales Cavenses*[49] for the year 1086 that, although it may not be contemporary, it is the oldest source we have. Collins, Stephenson and Green[50] and other researches discuss this source, together with the *Cronaca Rampona* and *Corycus Hayton's Cronica*:

> *13 Kal. Martii incipiente nocte stella clarissima in circulum lunae primae ingressa est.*
>
> On the 13 Kal. Martii at the beginning of the night, a bright star entered into the circle of the new Moon[51].

While the astronomical interpretation of this paragraph seems to be clear, the historical context is somehow a focus of controversy, so it seems adequate to reproduce the next paragraph in the *Anales Cavenses*:

> *Desiderius abbas Romae in Victorem papam invitus eligitur ab episcopis et cardinalibus Romanis ipso die Pentecosten.*
>
> Desiderius, the abbot of Rome, was chosen Pope Victor by bishops and cardinals in Roma the same Pentecosts day.

Now the temporal context becomes much clearer. Two Popes named Victor were chosen in the eleventh century: Victor II (1055-1057) and Victor III (1086-1087).

Dauferio of Fausi (he changed his name to Desiderius after entering the monastery of S. Sophia at Benevento) was appointed Pope with the name of Victor III on May 24, 1086, on the day of Pentecost.

There is no doubt that the most problematic text is *Cronaca Rampona* for the year 1058 (in brackets and cursive, the alternative translation proposed by Collins et al.[52]):

> *Anno Christi Ml8 Henricus tertius imperavit annix xl9. Hic primo venit Romam in mense maii. Cuius tempore fames et mortalitas fuit fere in universa terra. Et obscedit civitate Tiburnam diebus 3 mense iunii. Hic Henricus pater fuit matris comitisse Mathilde ex cua Bonifacius marchio genuit ipsam Matheldam. Tempore ipsius Henrici. Tempore huius stella clarissima in circuitu prime lune ingressa est, 13 Kalendas in nocte initio.*
>
> Also in this year of Christ 1058, Henry III reigned [*lived*] for 49 years. He went to Rome for the first time in the month of May. At this time, famine and death was upon the whole world. He stayed in the province of Tibur for three days in the month of June [...] At that time, a very brightly-shining star entered into the circle [*or the circuit*] of the new Moon, in the thirteenth calends at the beginning of the night.

According to the translation provided by Stephenson and Green the precedent paragraph states that "In the year of Christ 1058, (Pope) Stephen IX was enthroned on the 28th day of the 9th month", providing further noisy data, because the only Pope enthroned in September was Alexander II, on September 30, 1061. However, this text has been discussed in depth[53] and it was suggested that it corresponds to an early observation of SN1054 on May 20, 1054. It seems that the text is a fifteenth-century edition of an event that occurred in the eleventh century. Many authors have pointed out the historical inconsistencies of this text[54], which can be roughly summarized in the difficulties in reconciling the dates when Stephen IX was proclaimed Pope on August 2, 1057, and the death of King Henry III, who died on AD1056 October 5, after a reign of about eighteen years, when he was 49. We think that the point is a confusion between the Holy Roman Emperors Henry III (1017-1056) and Henry IV(1050-1106), who became king of the Germans in 1056 until 1105 and so reigned 49 years.

Regarding the possibility of a link to SN1054, Stephenson and Green[55] accept that it is most likely that the text refers to a planetary event than a supernova because they noticed the remarkable similarities between this document and the *Annales Cavenses.* In fact, these authors linked the Venus occultation collected in the *Annales Cavenses* with the phenomena of the *Cronaca Rampona* but concluded that they had been unable of identifying any close conjunction of the Moon with Venus or Jupiter satisfying the description in the *Cronaca Rampona.*

Polcaro and Martocchia[56] also attempted to reconstruct a light curve from these data, and these same authors made a critique of Collins' research[57], reaching the conclusion that the main European registers related to the supernova have not been treated in an appropriate form and, therefore, should be rejected as SN1054 records. They remark that the Latin expression "in circuito prime lune" could be translated as "on the first day of the new Moon" which also represents a major issue for most of the interpretations attempted. As we see next, this would not alter our own interpretation of the entry.

To have a complete view of the sources, we must also mention *Corycus Hayton's Cronica*. Collins et al[58] highlighted the interest of this chronicle, stating that it would be necessary to undertake a new translation of the document. This was carried out by Gurzadyan[59], who provides the following translation:

> AD 1048. There was the 5th year, 2nd month, 6th day of Pope Leo in Rome. Robert Kijart arrived in Rome and sieged the Tiburtina town. There was

starvation over the whole world. That year a bright star appeared within the circle of the Moon, the Moon was new, on May 14th, in the first part of the night.

This author points out a relation between the sources of this chronicle and the *Cronaca Rampona*. The paragraph begins with Pope Leo IX, indicating the time of his papacy, that went on from February 12, 1040, to April 19, 1054. Then, it mentions Robert Kijart, who is, in fact, Robert Guiscard (c. 1015-July 17, 1085) In May 1084, Guiscard entered Rome and forced Henry IV to retire. This is a detail that indicates that the dating of the events may be wrong and later than AD1048.

This being the case and following the data from *Cronica Rampona* we searched occultations of bright planets from the year 1045 to 1090 that happened near 13 Kalendas of any month, and that were visible in Western Europe. We found seven: two for Mercury on April 18, 1056 and March 19, 1075 (both unobservable due to the reduced distance of the Moon to the Sun), two for Venus on October 20, 1085, and February 17, 1086; two for Jupiter on 17/18 June, 1046, and September 18, 1052; and one for Saturn on December 18, 1089.

If we took as the main source the *Anales Cavenses,* we should consider Cava de Tirreni as the observational place. From this place, the Jupiter and Saturn occultation did not happen at the beginning of the night and, in fact, the Jupiter occultations were grazes. Only the occultations of Venus remain, but for the one in October the Moon was 20 days old, so it did not happen at the beginning of the night, either. Only the occultation of Venus on February 17 meets the conditions.

Our conclusion is that all the presented documents refer to the occultation of Venus on February 17, 1086, that is the XIII Kalends of March, in a context that mixes temporal data referred to Henry III and IV. It is also remarkable that on May 14, 1086 (and also on May 14, 1048), the Moon was new, as *Corycus Hayton's Cronica* state.

If the observation was made in Cava de Tirreni, the only conclusion is that a $\Delta T > 2500$ would have made very difficult the observation, which is a little relevant data, since the currently accepted ΔT for this time is around 1150s.

3.6. *Occultation of Venus by the Moon: AD1283, April 2*

A contemporary record is provided by the *Chronica Fratis Salimbene de Adam Ordinis Minorum*[60]:

> *Secunda die Aprilis cum luna esset prima, stella clarissima, que dicitur Venus, circulum primitive lune videbatur ingressa. Et de nocte post matutinum alia clarissima stella, que dicitur Iupiter, videbatur versus meridianam partem Scorpionis superiorem branchiam occupare.*
>
> The second day of April, at the first Moon, the bright star named Venus entered the circle of the Moon. And the morning after the night other bright star named Jupiter was seen towards the South in the upper part of Scorpius.

The astronomical data are accurate. In Parma, the sunset was at 17h54m. The occultation began at 17h23m and ended at 18h19m, being the Moon 3.6 days old. To be seen, a $\Delta T < 1500$ should have been accomplished, which agrees with the computed value for the epoch (around 520s).

Jupiter had a position given by α= 16h11m, δ =-20º02' (J2000) that places it in the head of Scorpius. Its rise had an Azimuth of about 118º.

There are other registers, all of them virtually identical[61], coming from Bohemia that also speak of the rainbow that was seen in the sky on December 26 in the previous year, on the day of Saint Stephen and, together with the star that was seen between the horns of the Moon on April 5 next year, was interpreted as a sign of the effective advent to the

throne of Wenceslaus II in AD1283. See, for instance, the report from the *Annales De Rebus Gestis Post Mortem Przem. Ottakari Regis*[62]:

> *Anno domini 1283, VII Kal. Januarii, hoc est in die beati Stephani, contigit, quod raro contingere solet. Apparuit iris mirae pulchritudinis, quae circumdabat totam civitatem Pragensem, (...) Sicut et in alio signo, videlicet in stella, quae visa est Nonas Aprilis super cornu lunae lucidissimo splendens fulgore.*
>
> AD 1236, VII Kalendas January, that is the day of St Stephan, something happened that very rarely happens. A rainbow appeared that encompassed the entire city of Prague (….) As other sign, like a very bright star that was seen on Nones April above the horns of the Moon

No star was seen above the horns of the Moon on April 5, but the occultation of Venus on April 2 was seen in Prague in such a way that Venus was observed grazing the Moon from 17h38m to 17h56m.

In addition, we have an Arab report seen in Alexandria[63]:

> The Moon occulted Venus on the night of Saturday, Muharram 4, in the year 682. The beginning [of the occultation] was at the end of the second hour of that night and [Venus] remained covered until the middle of the fourth [hour] of the night at Alexandria.

The date corresponds to April 4, 1283. The occultation began in Alexandria at 17h47m and ended at 18h45m

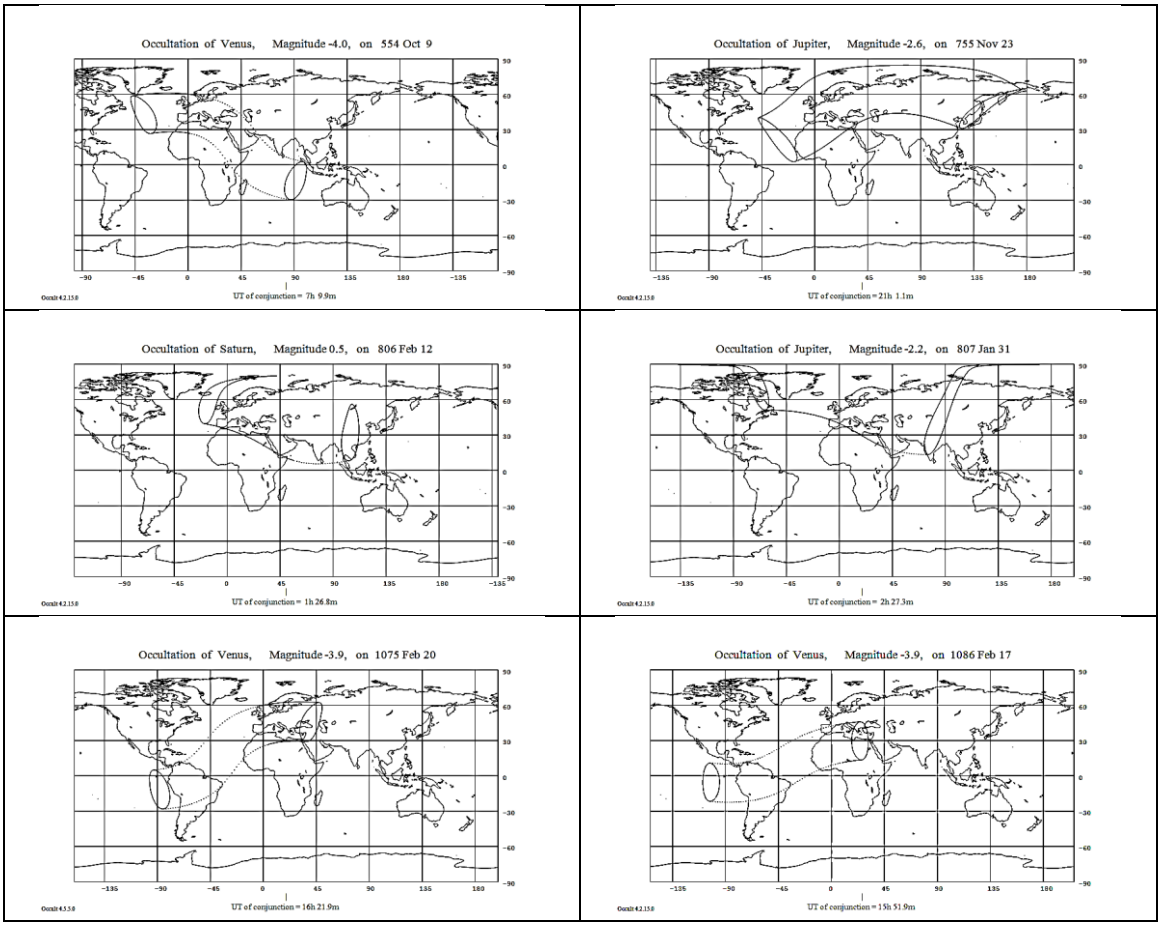

Figure 2: Visibility zones of some of the occultations of the planets by the Moon, using Occult v4.5.5[64]

3.7. *Occultation of Venus by the Moon: 1476, July 24*

A Venus occultation observed by Abraham Zacut from Salamanca was noticed by Goldstein and Chabás[65]. Although the author could be considered a professional astronomer, this observation is reported casually, without the author carrying out scientific comments or measurements:

> Gloss concerning Venus. On Wednesday 24 July 1476, $8^{1/2}$ hours after noon, I saw the Moon occult Venus, and they were both close to the western horizon.

What is interesting about this record is that the author used it to check the astronomical tables with which he made his calculations.

The occultation in Salamanca began at 21h12m, being the altitude of the Moon only 1º and the Moon set at 21h23m. The event would have been difficult to observe, but not impossible. In any case, only the immersion of the planet could be seen and, in these conditions, a ΔT greater than -500s would have allowed the observation, which does not provide valuable information since the estimated ΔT for the time is about 221s.

3.8.*Bernard Walther's observations*

Finally, we will mention the observations made by Bernard Walther in Nuremberg at the end of the 15th century. In fact, these observations, like the occultation witnessed by Peuerbach of August 9, 1451, would be out of the scope of this paper, since we had only proposed to work with narrative sources and with non-professional astronomers, but with the aim to provide a complete overview of the events recorded in Europe between the V-XVth centuries, we will provide a brief review without going into the treatment of astronomical data in depth.

Walther's observations in Nürnberg (49º27'N, 11º5'E, Germany) extended in the period between AD1475 and May 30, 1504. He records Sun altitudes at noon, eclipses, conjunctions and comets. At first, he used a Jacob's staff and then a zodiacal armillary to compute the planetary positions. His reports were collected, fifty years after his death, by Schöner[66]. Kremer[67] made a broad description of them, as well as the method of observation. Among the thirty-nine observations of eclipses, conjunctions and comets appear some interesting annotations regarding with occultations of planets by the Moon or even occultations of planets by other planets. We will only consider the two occultations of planets by the Moon and in any case valuable ΔT values can be derived:

- AD1482, January 12 occultation of Saturn by the Moon

  12 Ianuarii altera media hora ante ortum solis. Luna eclipsabat Saturnum, tempore enim illo nom videbatus[68].

  On 12 January, half an hour before sunrise. The Moon eclipsed Saturn, we could not see this.

The occultation of Saturn began at 4h52m and ended at 5h56m and the Sun rose at 7h4m. The author could not see the occultation because two hours and a half before the sunrise, when the distance between Saturn and the Moon was about 1º the clouds prevented the observation and when he could observe again, the Moon had already occulted Saturn.

- AD1484, November 28, occultation of Mars by the Moon

In this case, the author only provides a brief annotation, which leads us to think that he probably he was not an eyewitness, perhaps because of atmospheric conditions:

> *Die 28 Novembris hora fere tertia noctis post meridiem, Luna eclipsabat Martem*[69].

On November 28, about the third hour of the night, the Moon eclipsed Mars.

The occultation of Mars began at 17h13m and ended at 18h19m, while the Sun set at 15h15m.

4. Other Records

In our review of the sources we have found other records that definitely were not occultations but that have a special astronomical and historical interest:

1. Jupiter and Mars observed near the Moon during a Moon eclipse. AD1074, October 8

This report is taken from the *Notae Weltenburgenses*[70], written in the twelfth century in Regensburg (49º1'N, 12º6'E):

> *Eclipsis lunae facta est circa quintam horam noctis 8. Idus Octobris, luna secundum antiquam computationem 13, quae cum stellis Iovis et Martis illa nocte cursum peregit.*
>
> It was a lunar eclipse the fifth hour of the night on 8 Ides October, according to the ancient computation it was the 13th Moon, that with the stars Jupiter and Mars completed its course that night.

The eclipse took place on the night of April 7 to 8, but on April 8 the Moon was between Mars and Jupiter, just about 6º 30' away from each of them.

The Moon entered the umbra at 20h24m on April 7 and left the umbra at 00h18m.

The Moon did not occulted Mars or Jupiter, although it was in conjunction with Jupiter on October 8 and with Mars on October 9, with a minimum separation in longitude of around 2º4' and 3º9' respectively.

2. Approximation of Jupiter and the eclipsed Moon. AD1096, August 6

The chronicles refer to this phenomenon, found in the *Annales Cavenses*[71], in much the same way that the occultation that did happen in the year 1086:

> *Luna 12ª obscurata est, cum coelum serenum esset, et stella clarissima venit in circulum lunae 8. Id. Auguti.*
>
> The 12th Moon was obscured, the heaven was calm, and a very bright star entered in the circle of the Moon on 8 Ides August.

On August 6, 1096 there was a total eclipse of the Moon visible from Cava de Tirreni, but there was no occultation of Jupiter or any other planet or bright star that day, nor in the previous or later ones. The Moon rose around 18:00, at about the same time with its entry into the umbra. The closest approach between Jupiter and the Moon occurred after the end of the eclipse, with approximately 50' of distance between the limb of the Moon and the planet.

3. Conjunction of Venus and the Moon and diurnal vision of Venus, AD1180, December 21.

> *In festo sancti Thomae circa sextam horam visa est luna cum adhuc esset prima, sidere perlucido eam pariter comitante nec multo ab ea intervallo distante.*[72]
>
> On the feast of St Thomas about the sixth hour the Moon was seen as if it was the first, a star was not far away of it.

Newton[73] examined this record from *Roberti Canonici S. Mariani Autissiodorensis Chronicon* and attributed it to a conjunction of a bright star with the Moon. Actually, it is a conjunction with Venus. The celebration of St Thomas is celebrated on December 21. The author of the story is contemporaneous, and he wrote from Auxerre (47º47'N, 3º34'E) That day the Moon was three days old and Venus and the Moon became

separated by less than two degrees of angular distance. The conjunction of the Moon and a bright planet, Venus or Jupiter, is not a particularly significant phenomenon and, in fact, we find similar chronicles such as, for example, (2) above or in Malgorzata's compilation of astronomical phenomena from Central and Eastern Europe[74]. What is particular about this record is that the vision of Venus was diurnal, it happened at the sixth hour, that is, around 2:00 pm (the sixth hour corresponds to noon, but we use UT). Venus had a magnitude around -4.8

5. *Conclusions*

We have presented a survey of planetary occultations from European medieval annals and chronicles. Many of these occultations were already described in the scientific literature, but some of them had a dubious interpretation. In particular, we have the ones regarding the occultations of Saturn and Jupiter by the Moon in AD806 and AD807 and the ones that other authors attempted to relate to SN1054, which we propose as Venus occultations for the years AD1075 and AD1086. These are alternative explanations to be considered. For some specific cases, we have verified the adequacy of the ΔT values commonly accepted with the observation.

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Appendix

A special case is the occultations between planets. In medieval European narrative sources such observations are very scarce. In fact, we have only found one case, involving Jupiter and Mars on September 13, AD1170. Although it is not the aim of this

paper, in this appendix we have collected this observation along with the aforementioned Bernard Walther's.

- *Occultation of Jupiter by Mars: AD1170, September 13*

This is the only known recorded Medieval European report of the occultation of a planet by another planet[75] in narrative sources.

> *Idus Septembris, nocte media, duo planete sic conjungi videbantur, ut quasi una eademque stella fuissent appareret; sed ilico abinvicem separati Sunt.*
> On the Ides of September at midnight, two planets were seen at conjunction to such a degree that it appeared as though they had been one and the same star; but then they separate from each other.

Gervase of Canterbury was contemporary to the facts. He is also known for having recorded what seemed to be the impact of an asteroid on the surface of the crescent Moon on the night of June 18, 1178, although today it is believed that it was rather a fireball that exploded in the Earth's atmosphere.
Ides Septembris is September 13, Mars and Jupiter are the planets involved and they rose at about 20h35m on September 12, with Mars already crossing Jupiter's disk. At midnight their height above the horizon was about 29º and the separation was limited to about 55", below the resolution of the human eye.
This event was also observed in China and it was analyzed by Hilton et al[76]. The Egyptian author Ibn Yunus did report several planetary approaches[77] that were missed in Europe, including an occultation of Regulus by Venus on September 9, 885 and an occultation of Mars and Venus on October 10, 864 (actually, the occultation happened on October 22)

- AD1477, October 9. Mars eclipsed Saturn.

> *Quinta Septembris de mane quasi hora tertia post medium noctis, uidi Martem et Saturnum distantes (sicut uisui apparuit) ad modum palmi.*[78]
> On September 3, about the third hour after midnight, I saw Mars and Saturn at a distance of approximately one span (at a glance);

The paragraph continues with the consideration that given the initial position and the trajectory that both planets follow, in the next days one will eclipse the other.
Walther begins the observations of the planets on September 5, about three hours after midnight. The separation of Mars and Saturn, which at that moment was somewhat larger than 17º, is reduced in the following days, so that the author foresees that one will pass in front of the other and regrets that this *rarissimus euentus* will be unobservable since it will happen during the day (15h12m UT). So it was, when on the 9th day of October Sunlight hid the planets, they were about 10' apart, with Mars to the west of Saturn, which was the same separation at the time of their ortho a day later, but with the position of the planets inverted.

- AD1479, October 30. Close conjunction of Saturn and Mars. Mars eclipsed η Virginis

> *30 Octobris conjuntionis fuit Saturnus et Martis secundum longitudinem, Saturno uero fuerat septentrionalior quasi ad unum gradum, Martis fuerat propinquissimus sextae Virginis*[79].
> October 30 Saturn and Mars were in conjunction in longitude, and Saturn almost one degree farther north, Mars was closer to the sixth [star] of Virgo

In this case, the author reports a conjunction in longitude of Mars and Saturn about 44' apart. In addition, it indicates the close approach of Mars and η Virginis, in fact it would have been perceived as an occultation since at the moment of its minimum distance (at 8h36m, daylight would have prevented its vision, but one hour before it would have been observable) the separation was well below the resolution of the human eye.

- AD1481, October 22 close conjunction of Mercury and Saturn

  22 Octobris ante ortum Solis fere ad unam horam uidi Saturnum et Mercurium distantes, sicut uisui iudicaui non ultra diametrum Lunae, (...), fueratque Mercurius orientalior[80].

  On October 22 about an hour before sunrise, I saw Saturn and Mercury at a distance not beyond the diameter of the Moon (...) Mercury was farther east.

On October 21 at 22h18m Saturn and Mercury were 4' apart. The moment of maximum approach was not visible from Nuremberg. The apparent diameter of the Moon was about 30' and on October 22, one hour after sunrise the planets were separated by little more than 16'.

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1 Of course, that does not mean a total absence of systematic observations. For example, planets positions and motions were recorded in *Astronomy* of Levi ben Gerson and the planetary tables of Ibn Yūnus' among others.

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19 A French translation may be seen in http://remacle.org/bloodwolf/historiens/gregoire/francs5.htm
20 Such as *Chronicarum quae dicuntur Fredegarii Scholastici. Monumenta Germaniae Historica*, SS rerum Merovingicarum ii. Pag 114.
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27 Gregorii Episcopi Turonensis Historiarum. *op Cit.* (Ref 8), p. 141. Other secondary sources are: *Historia Francorum. Aimoni Monachi Floriacensis*. Migne. PL.139, pag 684, written by Aimoin de Fleury (965?-1010?), who tells the history of the Franks from the earliest times to AD653, and then the chronicle is continued by other writers until the middle of the twelfth century; *Siglos geronymianos*. (Madrid, Imprenta de Bernardo Peralta, 1736), T. 6. p 258, *Historia Ecclesiastica Ptolomaei Lucensis*: Muratoni, *Rerum Italicarum Scriptores ab anno aerae christianae 500 ad 1500*, xi, p 499, and Pingrè also cites *Les grandes chroniques de France, selon que elles sont conservées en l'église de Saint Denis en France* by Paris, Paulin, 1800-1881 and Torom. Collectio Historica & chronographica, liber IV, ex Toromacho. In Basnag. Thesaurus Monumentorum ecclesiassicorum & historicorum, (Antuerpiae, 1725). t. II, but hese later does not differ to the register provided by Gregory of Tours.
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41 In Siglos geronymianos. T.11. Op cit. (Ref 27) p 217 there is a translated version of the report from S. Adon Vienensis, *Op Cit.* (Ref 10)
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