

The role of the astrolabe in the pursuit of an ordered cosmos



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The theme of this Summer School has been the idea of “Sacred Place”. It’s easy to fall into the trap of thinking that both history and astrology are something to do with time rather than place. In looking at an historical event, we tend to ask WHEN did it happen? For most lay people, astrology means looking up their horoscope in a magazine column, and knowing their Sun sign involves knowing WHEN they were born. And “WHEN” is a time-based question, not a place-based one.

The astrology transmission river



However, on the MA History of Astrology module, we've seen that the history of astrology isn't just asking questions about "WHEN".

This is a picture taken back in 2006 of the meandering Elan river, about 60km north east of Lampeter (where our university is based), in the heart of mid Wales. On the MA, we've been looking at how astrology has been transmitted, and I like to think of the transmission of astrology as a river, that meanders from place to place, growing and developing like a living thing.

The astrology transmission river



In the distance, we can see the source of our river – Mesopotamian skywatching, with ancient astronomers looking at the comets and stars, and noting the rising and setting of Venus. This tablet, from the Library of Ashurbanipal and currently housed in the British Museum is a copy of the Venus tablet of Ammisaduqa, whose original observations date from the mid seventeenth century BCE.

The astrology transmission river



These early observations led onto much more detailed ones later one – this tablet, also in the British Museum, shows MUL.APIN – a tablet no bigger than a smartphone – showing rising and setting details of key stars, and a proto-zodiac: a list of constellations in the path of the Moon. This dates from about 1000 BCE.

The astrology transmission river



Dorian Greenbaum and Alexander Jones, *P.Berl. 9825: An elaborate horoscope for 319 CE and its significance for Greek astronomical and astrological practice*, *ISAW Papers* 12 (2017).
Image credit: Sandra Steif – SMB Ägyptisches Museum und Papyrussammlung, CC-BY

The proto-zodiac became fully developed by Hellenistic times. This image shows a Greek papyrus with a horoscope, the analysis of which was done by Dorian Greenbaum, one of our MA tutors.

The astrology transmission river



Persian
astrology

Mesopotamian
skywatching

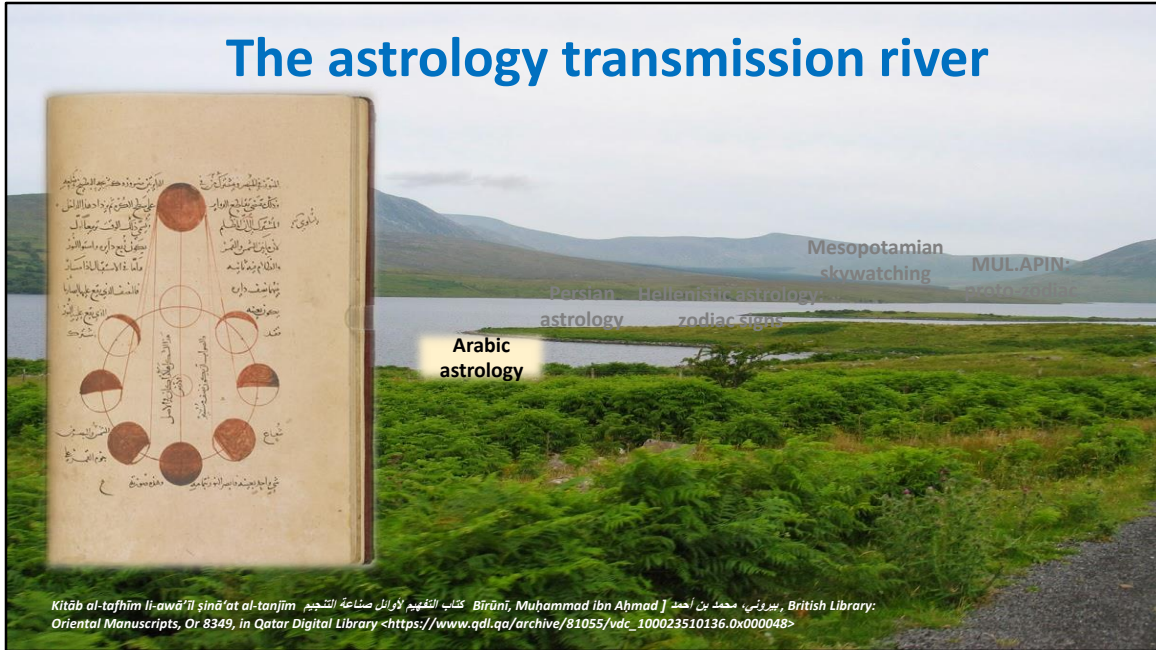
MUL.APIN
proto-zodiac

Hellenistic astrology
zodiac signs

*Sasanian plate with youths and winged horses – possibly a representation of Gemini. 5th/6th century.
Image: Metropolitan Museum of Art, New York, www.metmuseum.org. Accession number 63.152. Permission for educational use.*

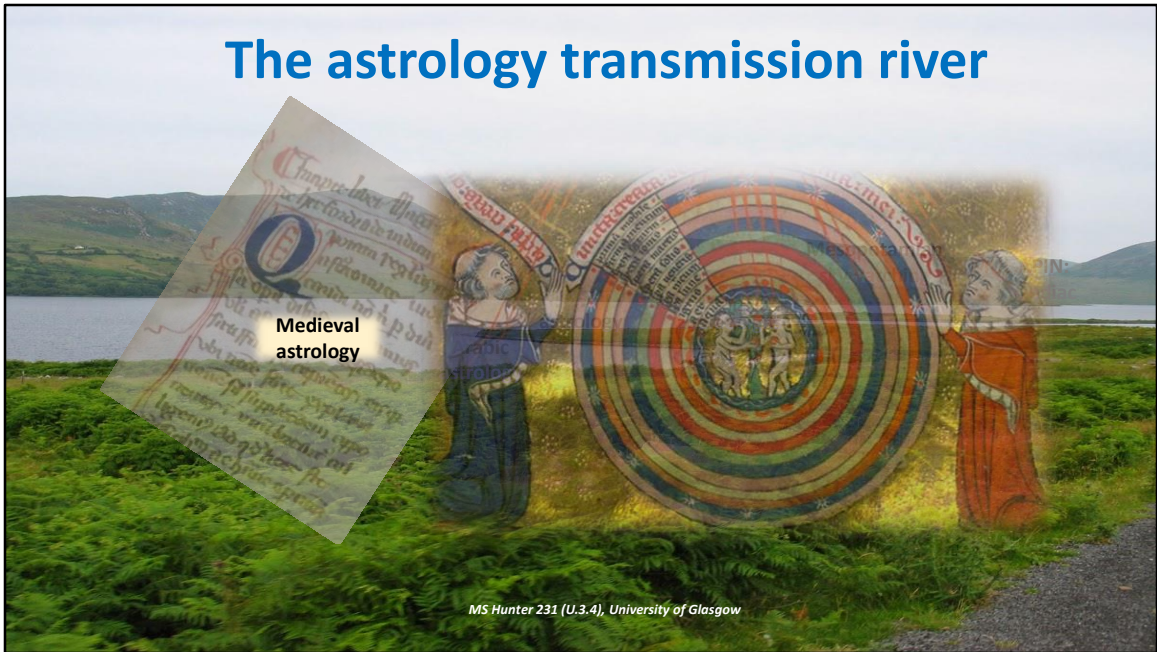
Hellenistic astrology fed into Persian astrology, which also borrowed from India. This 5th or 6th century Sasanian plate from Iran depicts two youths, and borrows from Greek imagery and may represent Gemini.

The astrology transmission river



After the rise of Islam, Hellenistic, Persian, and Indian texts were translated into Arabic, and astrological concepts from those societies became incorporated into Arabic astrology.

The astrology transmission river



These Arabic texts, as we saw on the history module, came into Christian Europe thanks to the twelfth-century translation movement, forming the corpus of what is known as medieval astrology.

The astrology transmission river

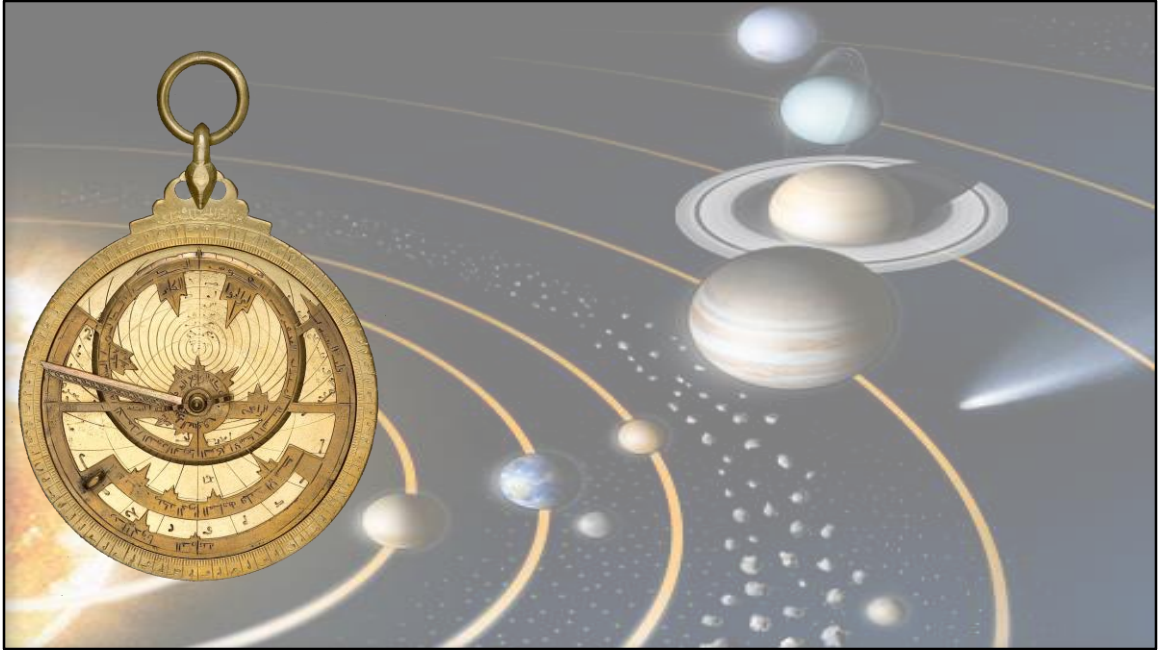


Many of the techniques in medieval astrology have followed through into modern astrology too.

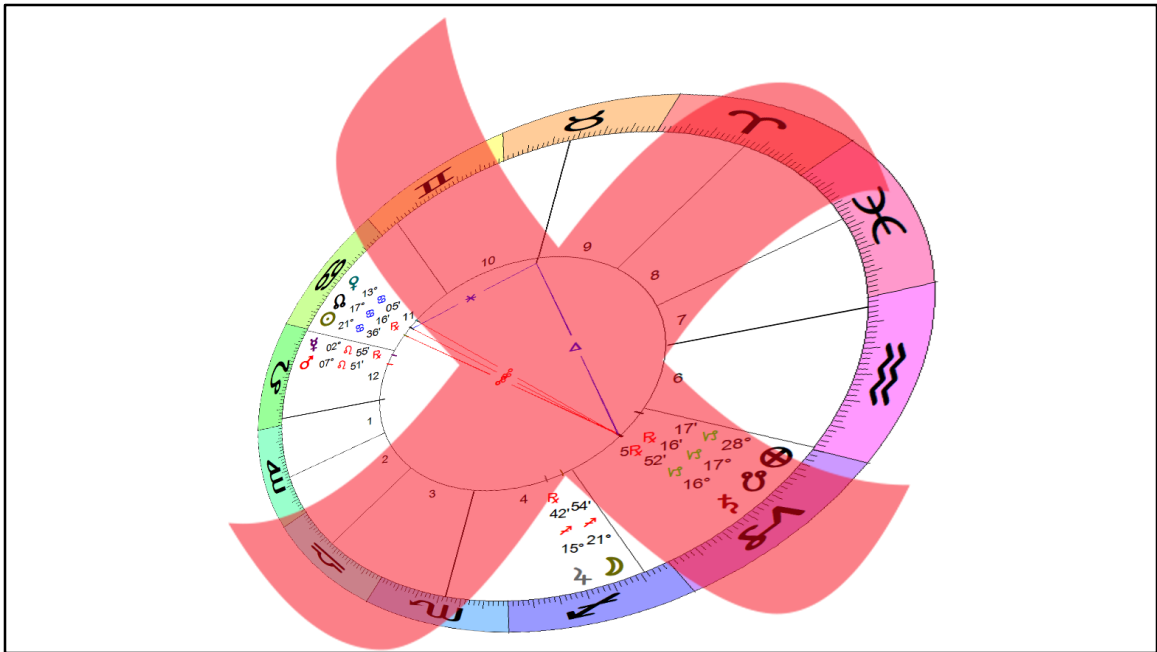
The history of astrology, then, isn't just time-based. As we've seen on the MA course, it doesn't just progress through time – it meanders through places too. It thrived in the Roman Empire, then as it declined there it blossomed in the Islamic world. Later on as it declined in the Islamic world, it blossomed again in Christian Europe and in the universities. History, then, isn't just about "WHEN", but about "WHERE", too.



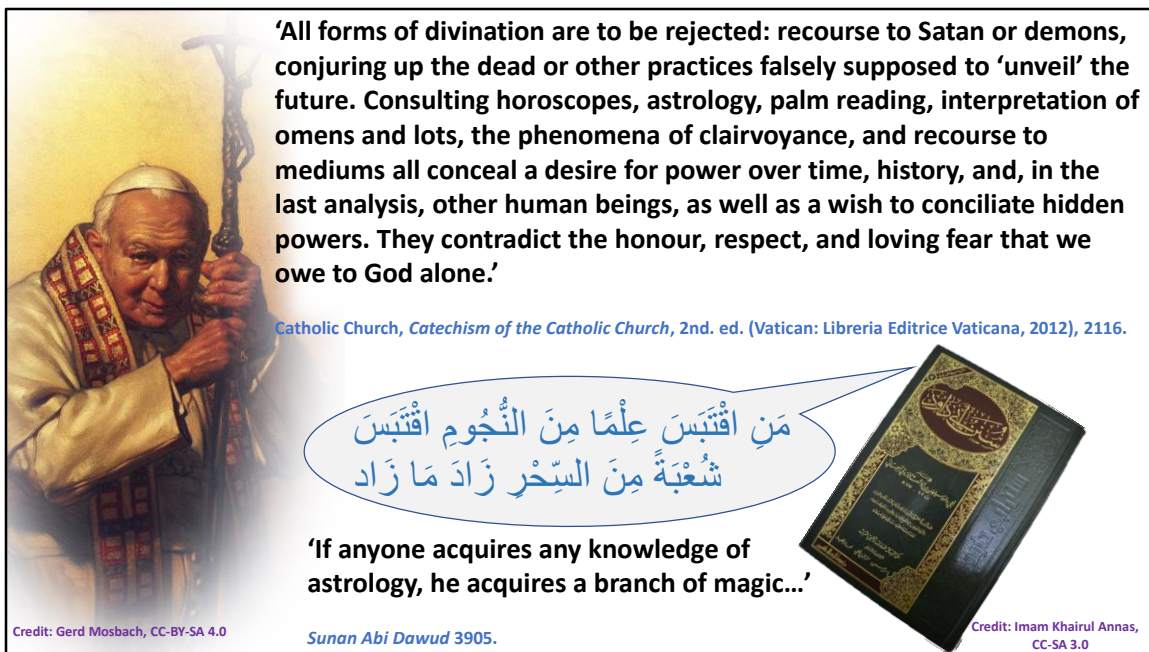
Astrology, as any astrologer knows, is also highly dependent on place if you want to delve any deeper than the “I’m a Pisces” style of astrology. All astrological charts are based on EVENTS – for example, a birth – and any event has both a time and a place. An astrological chart is a snapshot of WHERE planets are in the sky at any given moment. The WHERE is the broad sweep of the planets through the sky – the WHEN decides the snapshot when the question is asked, or the baby is born.



Creating astrological charts, then, involves being able to take that snapshot, and in this presentation looks at an instrument that helped make that possible. It's all very well knowing that having Mercury in the third house will make you a good magician, healer, or astrologer, as Firmicus Maternus tells us, but that's not much use unless you can work out where those planets were when you were born, and what bit of the sky was rising at that time. One instrument that helped pave the way to being able to do these calculations was the astrolabe.



However, despite my river analogy, we can't really assume a nice smooth transition from the pagan astrology of Mesopotamian and Hellenistic times into Christian Europe, because astrology was treated with suspicion by the Christian Church. So what happened?



'All forms of divination are to be rejected: recourse to Satan or demons, conjuring up the dead or other practices falsely supposed to 'unveil' the future. Consulting horoscopes, astrology, palm reading, interpretation of omens and lots, the phenomena of clairvoyance, and recourse to mediums all conceal a desire for power over time, history, and, in the last analysis, other human beings, as well as a wish to conciliate hidden powers. They contradict the honour, respect, and loving fear that we owe to God alone.'

Catholic Church, *Catechism of the Catholic Church*, 2nd. ed. (Vatican: Libreria Editrice Vaticana, 2012), 2116.

**مَنْ اقْتَبَسَ عِلْمًا مِنَ النُّجُومِ اقْتَبَسَ
شُعْبَةً مِنَ السِّحْرِ زَادَ مَا زَادَ**

'If anyone acquires any knowledge of astrology, he acquires a branch of magic...'

Credit: Gerd Mosbach, CC-BY-SA 4.0 *Sunan Abi Dawud* 3905. Credit: Imam Khairul Annas, CC-SA 3.0

Today, we're used to both Christianity and Islam condemning astrology. The Catechism of the Catholic Church, issued by Pope John Paul II in 1992, states that all forms of divination are to be rejected, including astrology. The Islamic view is very similar – although there is no one “official” view of Islam, most Islamic authorities condemn astrology based on a sunnah attributed to a ninth-century Persian scholar, Abu Dawud, who equated astrology with magic. Modern authorities, such as the widely-cited IslamQA website run by the very conservative Saudi cleric Shaykh Muhammad Saalih al-Munajjid, take this association further and use a quote attributed to another ninth-century Persian scholar, Sahih Muslim, that ‘whoever approaches a fortune-teller and asks him about anything will not be accepted for forty days and nights’ (Sahih Muslim, vol. 4, p.1211, no. 5440), and use this to say that the practice of astrology is haram (forbidden), and that it is also forbidden to visit an astrologer, buy astrology books or read one’s horoscope.

Early church views on astrology



Credit: Wikimedia Commons user
Kleon3, CC-BY-SA 4.0

St. Augustine of Hippo (4th century)

THEOLOGICAL OBJECTIONS

‘To be sure I continued to consult those cheats known as astrologers, because it seemed to be the case that they practised no sacrifice nor did they invoke any spirits in making their predictions. Even so, true Christian faith quite properly rejects and condemns that art’

Augustine, Confessions, Volume I: Books 1-8, C. Hammond (trans.), Loeb Classical Library 26 (Cambridge, MA: Harvard University Press, 2014), 4.3.4, p.137.

‘By now I had already rejected the false divinations and blasphemous nonsense of astrologers’

Confessions 7.6.8 p.309.

St. Augustine of Hippo certainly took a dim view of astrology, although he had studied and practiced it himself. He objected to it on both theological grounds, and logical grounds. Theologically, he conceded that it didn't involve invoking spirits, but was nevertheless blasphemous.

Early church views on astrology



Credit: Wikimedia Commons user
Kleon3, CC-BY-SA 4.0

St. Augustine of Hippo (4th century)

LOGICAL OBJECTION

'It commonly happens that in these respects the twins resemble many strangers more than they resemble each other. And yet in birth they were separated by a very brief interval of time, and in conception they were begotten at one moment, by one act of intercourse.'

Augustine, City of God, Volume II: Books 4-7, W.M. Green, (trans.), Loeb Classical Library 412 (Cambridge, MA: Harvard University Press, 1963), 5.1, p.139.

On logical grounds, he used the twins argument.

Early church views on astrology



Credit: University of Antwerp, CC0 1.0

St. Eligius of Noyon (7th century)

CONDEMNED ALL FORMS OF DIVINATION

'Nullus sibi proponat fatum vel fortunam aut genesim, quod vulgo nascentia dicitur...'

B. Krusch (ed.), *Vita Eligii Episcopi Noviomagensis* (Hannover: Hahn, 1902), II 16a, p.707.



Members of Royal Electrical and Mechanical Engineers unit celebrate St. Eligius weekend

St. Eligius of Noyon founded various monasteries and converted various communities of pagans on the North Sea coast. He condemned astrology, saying that nobody should attribute fate or fortune to themselves from their horoscope.

He is now, bizarrely enough, the patron saint of the Royal Electrical and Mechanical Engineers of the British Army (despite being French). He was a goldsmith by trade. Perhaps given modern science's antipathy towards astrology, it's appropriate for electrical engineers to have an astrology sceptic as their mascot.

Early church views on astrology



St. Bede (8th century)

Bede divides time into “atoms” (15/94ths of a second, or about 0.16 seconds) and says astrologers use these units too, but:

‘these [astrological] things are avoided, because such observance is futile and alien to our faith’

Bede, Bede: The Reckoning of Time, F. Wallis (trans.) (Liverpool: Liverpool University Press, 1999), pp.15-16.

‘The Venerable Bede Translates John’
by James Doyle Penrose (1862-1932)
Public Domain

Bede, often known as “The Venerable Bede”, spent his life at the monastery in Jarrow in Northumberland, and he wrote numerous texts including ones dealing with calendars and time. He broke down the hour into smaller and smaller parts, ending up with the “atom”. It derives from a biblical reference where it was equivalent to “the twinkling of an eye” – it is equal to 15/94 of a second. Astrologers used this time period too – but, says Bede, we shouldn’t be doing what astrologers do.

So we can see that the early church view on astrology was similar to the modern view we saw on the page about contemporary Catholic and Islamic views.

Christian interest in Islam



'Alcuin of York teaching Charlemagne to read',
Otto Rethel.

Photo: The Centre Charlemagne, Aachen.

- Bible translated into Arabic in 724
- Charlemagne receives a water clock from a caliph
- Christians in Córdoba wrote better Arabic than Latin
- Alcuin of York describes disputation between a Spanish bishop and a Saracen
- Byzantium/Baghdad connections

References:

- D. Metlitzki, *The Matter of Araby in Medieval England* (New Haven: Yale University Press, 1977), p.5.
K. von Stuckrad, 'Interreligious Transfers in the Middle Ages: The Case of Astrology', *Journal of Religion in Europe*, 1.1 (2008), pp.49-50.
N. Campion, *A History of Western Astrology Volume II - The Medieval and Modern Worlds* (London: Continuum, 2009), p.20.
J. Freely, *Aladdin's Lamp: How Greek Science Came to Europe Through the Islamic World* (New York: Alfred A. Knopf, 2009, p.71.

Since we're going to be looking at how Arabic science came into Europe, let's have a quick tour of Christian attitudes towards Islam.

John, Bishop of Seville, had the Bible translated into Arabic in 724.

By the 9th century, the bishop of Córdoba was lamenting the fact that 'our young Christians... are perfected in Arabic eloquence... Scarcely one in a thousand can be found in the Christian community who is able to compose a well-written Latin letter to a friend. But there are a great many among them who can expound the Arabic pomposity of language with the greatest erudition, and adorn the final clauses of verses more elegantly than the Arabs themselves!'

Alcuin describes a disputation between a Spanish bishop and a Saracen – Metlitzki calls this the first hint of an interest in Islam.

Byzantium had access to Greek texts, and there were interchanges between Baghdad and Constantinople in both directions. For example, Nick Campion describes how Stephanus the Philosopher, a student of the Caliph's astrologer moved to Constantinople; Leo the Mathematician went to Baghdad to translate Greek texts.

Early Islam and astrology



Aristotle and Plato by Raphael

- Muslim scholars had access to Greek and Persian texts
- Aristotle's works translated
- Aristotle opened the door to astrology

The rise of Islam was fast and dramatic – within a few years of Muhammed's death, Muslim armies had conquered the mighty Persian empire. This gave Muslim scholars access to astrological texts that had originally been written in Greek, and Persian texts too.

This didn't happen overnight, though. Islam is a monotheistic religion, suspicious of "pagan" astrology as we saw in the first slide. However, the utility of a lot of these texts, especially in medicine and engineering, were obvious and by the 8th century a translation movement was underway. The gateway for the acceptance of astrology was through the works of Aristotle, whose philosophy was broadly accepted and didn't clash with Islam, but which also recognised the influence of planets.

There are many key figures in the translation movement – Masha'Allah, al-Kindi and Abu Ma'shar being three giants.

Early Islam and astrology



Abu Ma'shar woodcut
Credit: University of London

- Embraced “pagan” astrology from the 8th century
- Still felt the need to defend astrology
- Split between religious Arabs and Persian scholars

References:

R. Lemay, *Abu Ma'shar and Latin Aristotelianism in the Twelfth Century* (Beirut: American University of Beirut, 1962), pp.68-69.

De confirmatione astrologie' in Abu Ma'shar, *Liber Introductorii Maioris ad Scientiam Judiciorum Astrorum*, Hermann of Carinthia (trans.), R. Lemay (ed.), Volume 8 (Napoli: Istituto Universitario Orientale, 1995), I.4, pp.14-21.

G. Saliba, 'Islamic Astronomy in Context: Attacks on Astrology and the Rise of the Hay'a Tradition', *Bulletin of the Royal Institute for Inter-Faith Studies*, 4.1 (2002), pp.25-46.

G. Saliba, 'The Development of Astronomy in Medieval Islamic Society', *Arab Studies Quarterly*, 4.3 (1982), p.212

G. Saliba, *Islamic Science and the Making of the European Renaissance* (Cambridge, MA: MIT Press, 2007), p.76.

In particular, Abu Ma'shar's magnum opus *The Great Introduction* was highly influential later in Europe. This book has only just been translated into English by Charles Burnett of the Warburg Institute, and the picture in this slide is from the book cover of his translation, which is now available.

Despite the translation of large numbers of astrological texts, authors still felt the need to defend astrology against religious arguments attacking it. These were often done by recourse to Aristotle – if Aristotle was acceptable, and Aristotle accepted planetary influences, then astrology must be acceptable. Aristotelian principles were reframed in Islamic terms. For example, Richard Lemay said that Abu Ma'shar 'rejoices that his search in the realm of natural science... has led him to the discovery of the Creator' but "God's will" scarcely differs from Aristotle's "Prime mover".

In his *Great Introduction*, Abu Ma'shar wrote a chapter devoted to defending astrology against attacks on religious grounds.

One could say that Islam embraced Aristotelianism rather than astrology. Astrology was a by-product. In addition, many of the translators were Persian scholars, not from an Islamic religious background – they included Zoroastrians and Jews. Saliba argues that they seem to have been an elite in the courts, and were often treated with distrust by Muslim clerics.

Cracks in the edifice of Christian objections



Credit: Carlo Joseph Moskito, CC-BY-SA 4.0

- Augustine: allowed some celestial events
- Isidore of Seville: natural versus superstitious
- Bible: uses celestial signs

‘Superstitious astrology was definitely condemned, but natural astrology was not, and that simple fact was bound to lead to later confusion’

Campion, *History of Western Astrology*, p.14.

Other references:

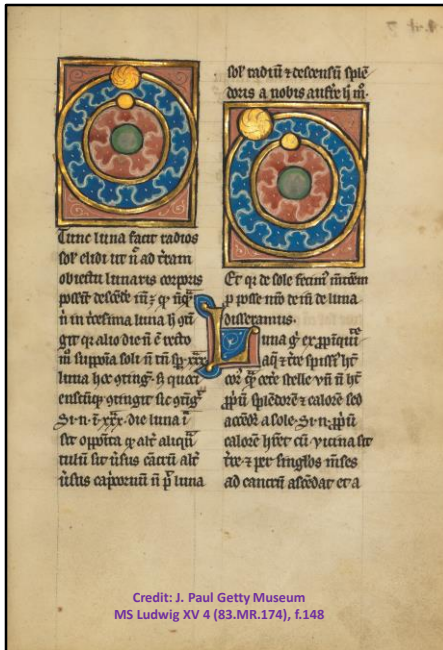
Augustine, *The Letters of St. Augustine*, J.G. Cunningham (trans.) (Altenmünster: Jazzybee Verlag, 2015), Letter LV Chapter VIII.15, p.100

V. Flint, *The Rise of Magic in Early Medieval Europe* (Princeton, NJ: Princeton University Press, 1994), p.96

Isidore of Seville, *Etymologies*, S. Barney, W.J. Lewis, J.A. Beach, O. Berghof (eds) (Cambridge: Cambridge University Press, 2006), 3.xxvii, p.99. G. Saliba, *Islamic Science and the Making of the European Renaissance* (Cambridge, MA: MIT Press, 2007), p.76.

St. Augustine allowed celestial events for weather forecasting – which is a form of divination. Caroline Flint pointed out that although the distinction between acceptable and unacceptable uses of astrology may have been obvious to Augustine, he wouldn’t have needed to write it down if everyone had understood that. Isidore of Seville similarly distinguished between “natural” and “superstitious” astrology. The Bible itself uses celestial imagery, such as the Sun standing still for Joshua (Joshua 10:13), or God moving the Sun ten degrees for Hezekiah (2 Kings 20:8-11).

Thus astrology was partly condemned, but partly acceptable, which – as Campion points out – was bound to lead to confusion.



Computus / Compotus

A knowledge of Sun and Moon cycles was essential to calculate the date of Easter – a topic called “computus” or “compotus”



One area that was not just acceptable but essential for Christianity was the ability to calculate the date of Easter in advance. The Gospels state that Christ was crucified on “the eve of Passover”. Passover is a Jewish festival, and is always celebrated on the fifteenth day of the month of Nisan. Nisan is the first month of spring, and in the Hebrew calendar, months always start with the first visible crescent of the New Moon, so the fifteenth day is always a Full Moon (in theory). Christians wanted to celebrate Christ’s resurrection, which happened on the first Sunday after Passover, so to calculate this date one needs to know when the spring equinox is, and when the first Full Moon after the spring equinox is. This is non-trivial – it involves understanding both lunar and solar cycles, and how they interact.

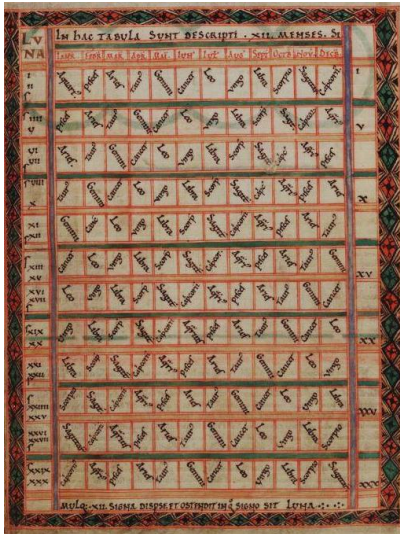
This important task exercised the minds of Christians from the early days of Christianity, and because it involved computation, it was called “computus”. However, many medieval texts call it “compotus” – and this isn’t because medieval scribes were bad at Latin, but is apparently a pun. Computus means computing, and compotus means drinking together – the idea being that computus was so complicated it was best sorted out as a group endeavour over a few jugs of ale in the local tavern!

Computus

Dionysius Exiguus

Dionysius was an early computist

Table of Easter dates from 532 - 627



MS Oxford St. John's College MS 17, f.24r.

One early computist was Dionysius Exiguus in the 6th century. He's most famous as being the inventor of the Anno Domini system of counting years that is still used all over the world today. Incidentally, if you wonder why we insist on "CE" and "BCE" rather than "AD" and "BC", it's because Dionysius got his count wrong when working out the birth of Christ. King Herod is historically attested, and he died in 4 BCE, but the Gospel account says he was king when Jesus was born. He couldn't have died "Before Christ", but he could have died "Before the Common Era" – hence we use CE and BCE as substitutes for AD and BC. Before Dionysius, years were counted from the accession of the Roman emperor Diocletian, who persecuted Christians, which is why Dionysius wanted to change the system. He produced a table in 532 of Easter dates, running for 95 years.

Computus



'The Venerable Bede Translates John'
by James Doyle Penrose (1862-1932)
Public Domain

Bede

Wrote *Reckoning of Time* in 725

Table of Easter dates from 532 – 1063

'His importance for the history of science in the West is seriously underestimated... [his] vision of what computus could encompass allowed [later scholars]... to ponder problems which were purely scientific in character, independent of their applicability to the calendar'

Faith Wallis, in Bede, *Reckoning of Time*, p.300.

Other reference:

C.P.E. Nothaft, *Medieval Latin Christian Texts on the Jewish Calendar* (Leiden: Brill, 2014), p.24.

Bede wrote a major work called *Reckoning of Time* in the year 725, which included a table from 532 to 1063. Bede didn't just produce a table – he explained the techniques, and in one chapter – unrelated to computus – he discusses the number of hours of moonlight which Wallis says demonstrates his critical scientific mind, and whose 'importance for the history of science in the West is seriously underestimated'. She went on to say that 'Bede's vision of what computus could encompass allowed monks like Gerbert and Abbo of Fleury, well before the arrival of Greek and Arabic astronomical texts, at least to pose questions and ponder problems which were purely scientific in character, independent of their applicability to the calendar.'

The complexity of computus wasn't restricted to Christian scholars calculating Easter. Jewish arguments about the calendar also arose - a controversy erupted between two rabbis about the date of Passover in 922, where two competing systems could result in a month's difference, and the calculation of the Hebrew calendar was recorded in Arabic texts too.



10th and 11th Centuries

- Gerbert d'Aurillac became Pope Sylvester II in 999**
- Keen scholar of science and astrology**
- Arabic astrological works transmitted from Andalusia to Catalonia such as *Alchandreana***
- Unique role of Lotharingia and the West Country**

References:

Metlitzki, *Matter of Araby*, p.16

C.P.E. Nothaft, *Walcher of Malvern* (Turnhout: Brepols, 2017), pp.10-11

M. Zuccato, 'Gerbert of Aurillac and a Tenth-Century Jewish Channel for the Transmission of Arabic Science to the West', *Speculum*, 80 (2005), p.743.

D. Juste, *Les Alchandreana Primitifs* (Leiden: Brill, 2007).

Campion, *History of Western Astrology*, p.32.

J. Moreton, 'Before Grosseteste: Roger of Hereford and Calendar Reform in Eleventh and Twelfth-Century England', *Isis*, 86.4 (1995), pp.562-586.

Gerbert d'Aurillac / Pope Sylvester II
Credit: French Ministry of Culture, CC-BY-SA 3.0

If computus opened the door to the permissibility of studying planetary cycles, the study of astrology in Christian Europe took another leap forward with Gerbert d'Aurillac, who became Pope Sylvester II in 999. Legend has it that he studied in Muslim Cordoba – but this is probably not true. He was, though, a keen scholar of astrological and scientific texts. Campion sums him up thus: 'We could not have a clearer instance of a scientifically inquiring mind than in Gerbert'.

The tenth and eleventh centuries saw more Arabic texts transmitted from the Muslim world in al-Andalus (Andalusia) to Christian Spain in Catalonia, with diplomatic contacts between the King of Leon and the caliph in al-Andalus, facilitated by a Jewish intermediary. Gerbert d'Aurillac allegedly requested copies of astrology texts, including the pseudo-astrological *Alchandreana*.

The relationship between computus and astrology was reinforced by the fact that it was the same scholars working in both fields. In particular, Lotharingia – the area of Europe that now comprises Alsace and Lorraine on the French-German border – seemed to have a particular interest in astrological texts, and there were many links between this region and the West Country of England. These contacts, according to Jennifer Moreton, 'began before the Norman Conquest and reinforced interest in computus.'

Arabic Science



Credit: Wikimedia Commons,
User Saraguilera, CC-BY-SA 4.0

Computus: ‘the door through which ancient and Arabic astronomy and mathematics entered the West’

F. Wallis, ‘Medicine in Medieval Calendar Manuscripts’ in M.R. Schleissner (ed.), *Manuscript Sources of Medieval Medicine: A Book of Essays*, (Abingdon: Routledge, 2014), p.109.

Arabic science now respectable: ‘One of the most spectacular rescues in the history of magic’s rise in the early Middle Ages is the rescue of astrology’

Flint, *Rise of Magic*, p.128.

Christianity viewed Arabic texts as hidden texts that had been translated: ‘Arabic natural philosophy remained, in some sense, exempted from Islamic culture’

S. Montgomery, *Science in Translation* (Chicago: University of Chicago Press, 2000), p.165.

The study of computus, then, opened the door for other Arabic sciences, including astronomy and astrology. Arabic science had become respectable.

Given the hostility between Christianity and Islam – Spain was contested territory, and the First Crusade was to start around this time – this may seem surprising. However, Montgomery maintains that because Arabic scholars had translated old Greek and Persian texts, these weren’t seen as Islamic, but rather hidden or lost texts that Arabic scholars had safeguarded and translated. Arabic science was somehow “exempt” from Islamic culture.

Astrolabes



Ninth-century astrolabe from Syria
Credit: Museum of the History of Science,
University of Oxford 2006, used with permission.

Walcher of Malvern

- Computist from Lotharingia, who became Prior of Malvern
- Observed a lunar eclipse and used an astrolabe to measure precise details
- Collaborated with Petrus Alfonsi on astronomical tables of Arabic origin

References:

Nothaft, *Walcher of Malvern*.

R.W. Southern, *Medieval Humanism and Other Studies* (Oxford: Blackwell, 1970), pp.166-167.

'The Reception of Arabic Science in England' in C.H. Haskins, *Studies in the History of Mediaeval Science* (Cambridge, MA: Harvard University Press, 1924), pp.114-117.

J.V. Tolan, *Petrus Alfonsi and his Medieval Readers* (Gainesville: University Press of Florida, 1993), pp.10-11.

Mention was made earlier that there was a unique role played by the region of Lotharingia, on the modern-day French/German border, and its link with the West Country of England. We'll now look at two key players in the twelfth century. The first is Walcher, who was born in Lotharingia but became Prior of Malvern. He observed a lunar eclipse while in Italy, and when he returned to England others had seen it, but clearly at a different time.

He seems to have had a keen scientific mind. First, that he realised that the lunar eclipse he witnessed in Italy was the same as the one seen in England, but there was a time difference that intrigued him. A year later, he observed another lunar eclipse and this time made careful measurements of it with an astrolabe.

He also collaborated with a Jewish convert to Christianity, Petrus Alfonsi, and worked with him on astronomical tables developed by the Muslim astronomer al-Khwarizmi (from whose name, incidentally, we get the term "algorithm"). Alfonsi's patron was King Henry I, who according to John Tolan 'took a keen interest in fostering the study of astronomy both in his court and at the Cathedral School in Hereford'. Alfonsi may also have served as Henry's physician.

Astrolabes

Adelard of Bath

- Travelled to Sicily, then to Syria and learned Arabic
- Dedicated a work on the astrolabe to Henry II
- Translated various texts, including Abu Ma'shar's *Abbreviation to the Introduction*
- Produced a set of horoscopes

References:

L. Cochrane, *Adelard of Bath: The First English Scientist* (London: British Museum Press, 1994).
Haskins, *Mediaeval Science*, p.21.

C. Burnett, 'Adelard of Bath and the Arabs' in J. Hamesse and M. Fattori (eds), *Rencontres de Cultures* (Louvain-la-Neuve-Cassino: Institut d'Études Médiévales, 1990), p.105.

J.D. North, *Horoscopes and History* (London: Warburg Institute, 1986), pp.96-107.

Adelard of Bath's translation in Latin in Abu Ma'shar, *The Abbreviation of the Introduction to Astrology*, C. Burnett (trans.) (Leiden: Brill, 1994).



Ninth-century astrolabe from Syria
Credit: Museum of the History of Science,
University of Oxford 2006, used with permission.

The second figure is Adelard of Bath, who was a younger contemporary of Walcher of Malvern, and travelled to Sicily and Syria. Unlike Walcher, he learned Arabic and translated a work of Abu Ma'shar – his *Abbreviation to the Introduction*, which Abu Ma'shar wrote as a summary of his much bigger *Great Introduction*. He dedicated a work on the astrolabe to King Henry II of England, and also left to posterity a set of horoscopes, which were analysed by John North.

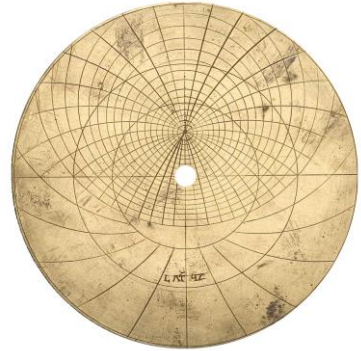
Astrolabes



Ninth-century astrolabe from Syria
Credit: Museum of the History of Science,
University of Oxford 2006, used with permission.



Thirteenth-century astrolabe from Spain, in Latin
Credit: Museum of the History of Science,
University of Oxford 2006, used with permission.

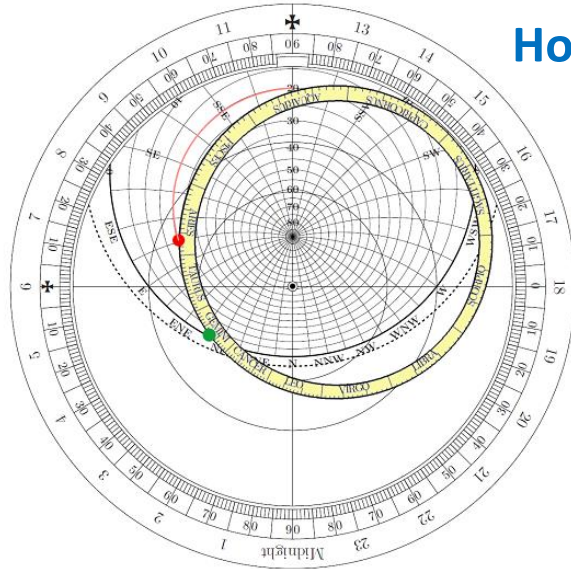


Latitude plate for 52 degrees
Credit: Museum of the History of Science,
University of Oxford 2006, used with permission.

Astrolabes were therefore a topic of great interest in Christian Europe, and they started to be manufactured in the Christian world too. This image shows the same image of the Arabic astrolabe from the ninth century in Syria that was on the previous slides, and a Latin version from Spain from around 1250 – the University of Oxford has both of these in its collection at the Museum of the History of Science, and the Spanish one is understood to be the earliest Western astrolabe in the Oxford collection. The design has been influenced by Muslim precedents, and the similarities are obvious.

One difference, though, would be the latitude plate. Astrolabes are a map of the sky, and the stars that can be seen will vary according to latitude. This is why astrolabes are constructed as a sequence of plates that can be disassembled, so that when travelling a different latitude plate can be used. The figure on the right is a latitude plate for 52 degrees, the latitude of the Midlands in England.

How is an astrolabe used?



- Telling the time
- Navigation
- Calculating the Ascendant, MC and house cusps

References:

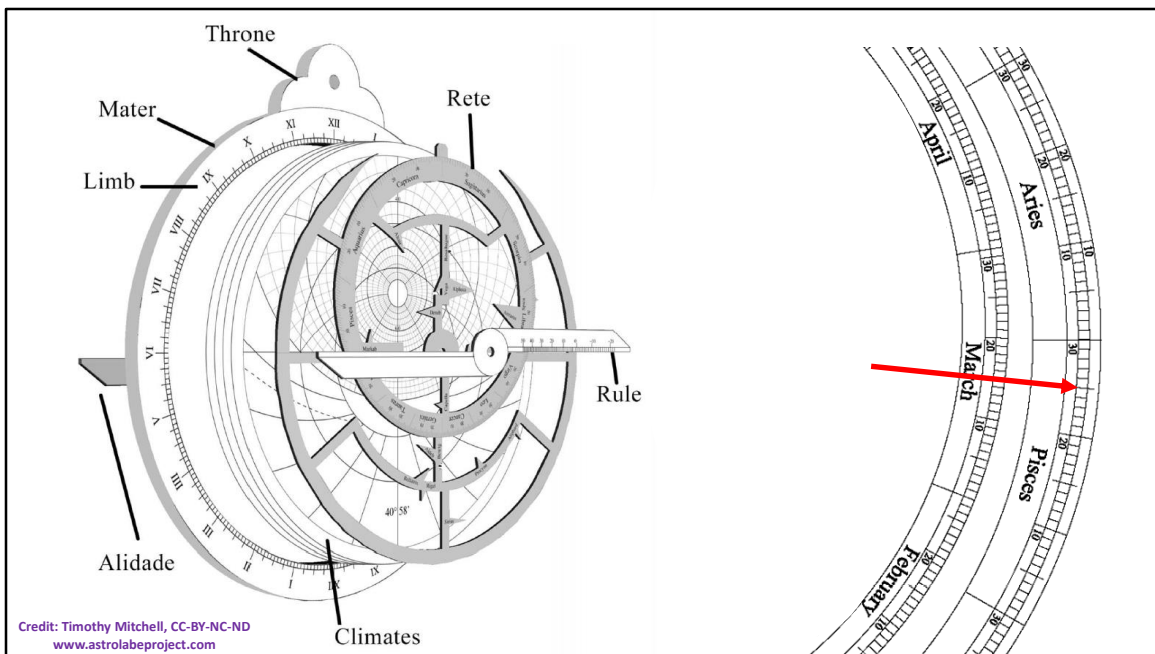
Build your own astrolabe:

<http://www.joh.cam.ac.uk/way-stars-build-your-own-astrolabe>

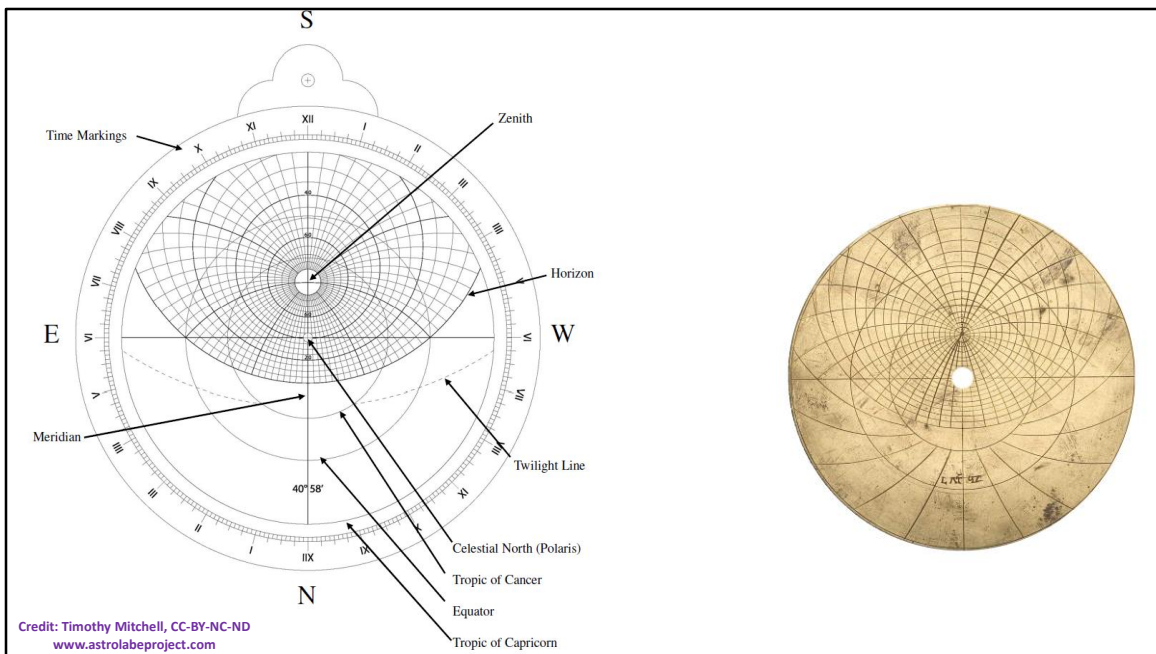
Astrolabe template by St John's College, University of Cambridge, as part of a project to build an astrolabe. Images are used by permission of the Master and Fellows of St John's College, Cambridge.

There are three things that an astrolabe can be used for: telling the time, navigation and calculating astrological charts.

To a Christian cleric suspicious of astrology, two of these uses are perfectly acceptable – telling the time, and navigation. The other one – calculating horoscopes – is more suspect.



An astrolabe consists of various parts. The front of the astrolabe has a base, called the mater. The edge is a 360 degree circle marked with either hours, degrees, or both. If marked in hours, the circle is divided into 15 degree segments – one per hour. The back of the astrolabe is also marked by a circle, usually with zodiac signs and dates on – this is just an easy way of seeing that, for example, 15 March corresponds to the Sun being at 25 degrees of Pisces. The top of the astrolabe – the Throne – represents due South.

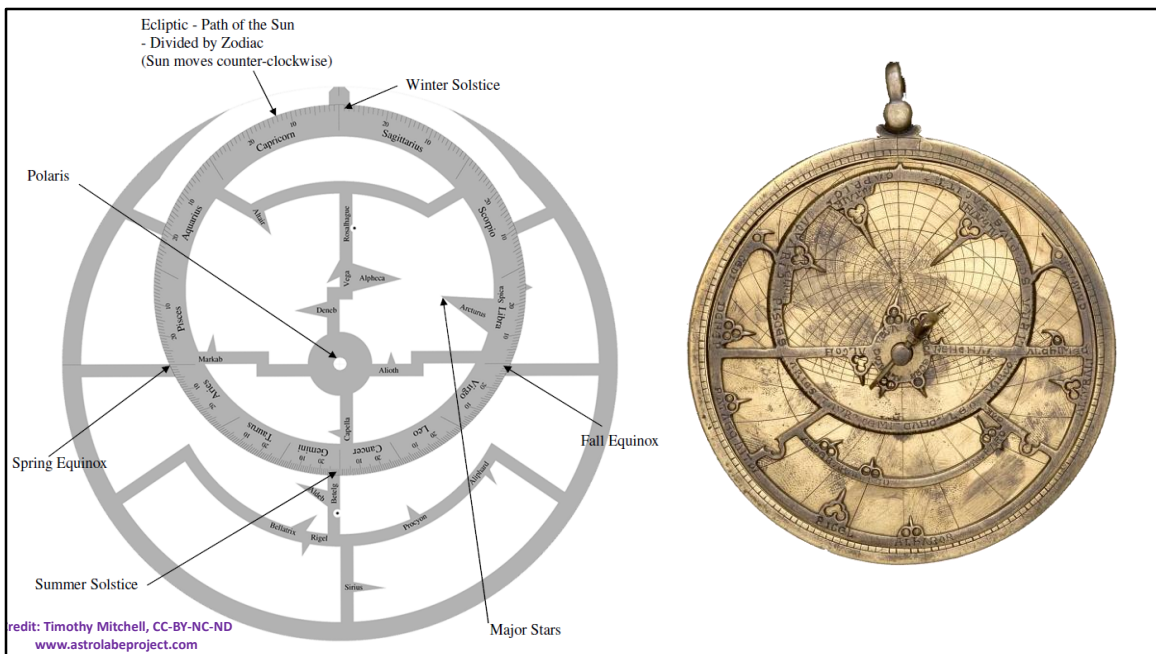


The next layer is the plate. An astrolabe would normally come with several sets of plates, but only one would be used at a time, corresponding to the latitude you are at. This diagram shows an actual plate (on the right) set for 52 degrees North, the latitude of London, Oxford, Hereford, and Lampeter.

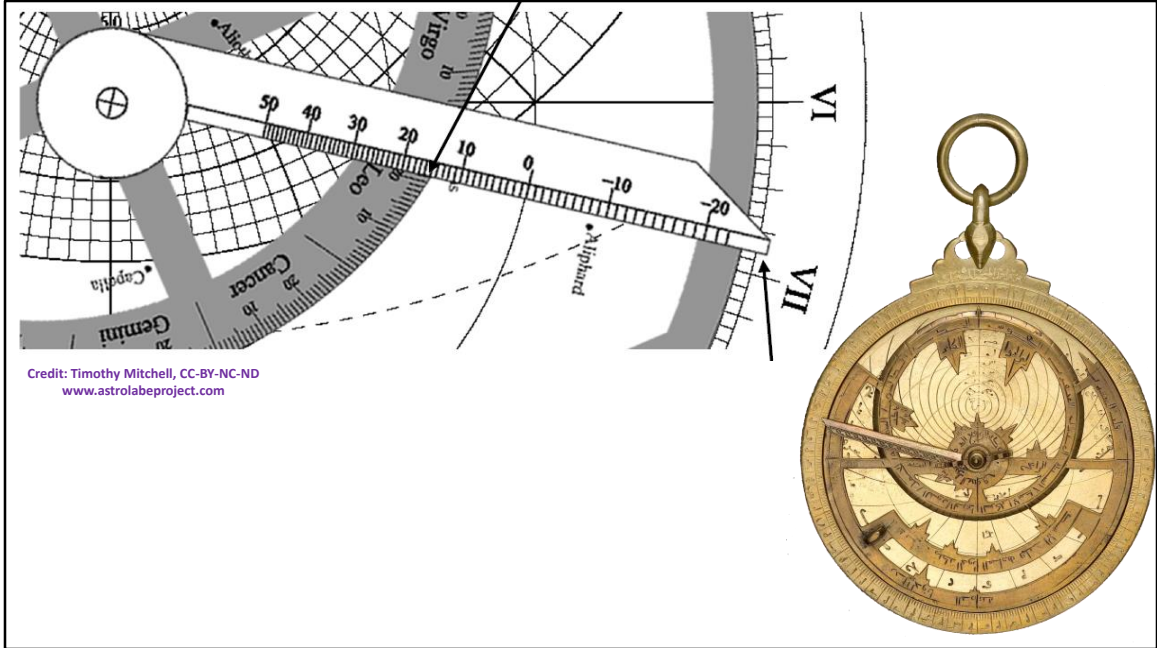
Question: if you were stranded on a desert island on a clear night, how would you work out your latitude?

Answer: if you're in the Northern hemisphere, look for the North Star (Polaris). If you're on the North Pole, it will be directly above you. If you're on the equator, it will be on the horizon. If you're in Lampeter, it will be 52 degrees above the horizon. The altitude of the North Star is your latitude on Earth.

In an astrolabe, the centre of the plate is always the North Star. The zenith – the point directly over your head – is where the lines all converge on the plate. The bottom one of all the circles represents the horizon. The lines going up from the horizon and mostly parallel to it are the lines of altitude (usually every 5 degrees) – known by the Arabic name ALMUCANTAR. The ones crossing these lines are the AZIMUTH (the direction east or west), also in 5 degree increments.

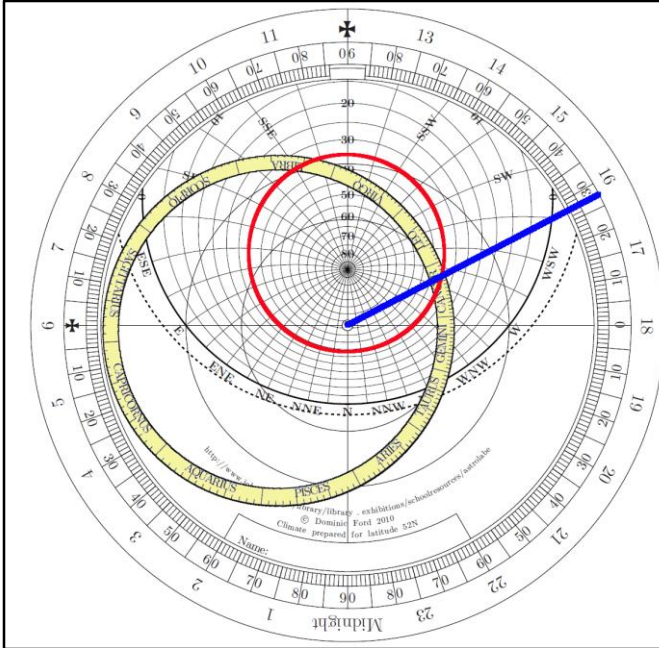


The rete is the next one out, which shows major stars and a ring with zodiac signs on. The rete can be rotated.



Finally, there is a rotatable ruler, called the ALIDADE.

Telling the time: daytime



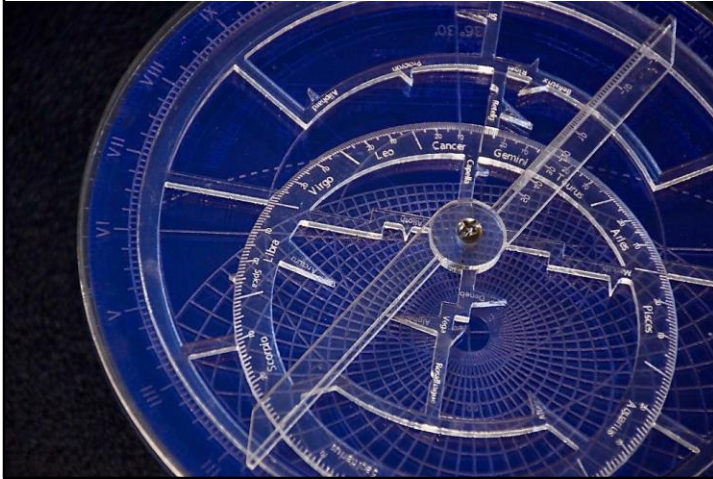
First, what is the “zodiac date”? Assume that today is 16 July, in Lampeter, and the Sun is at 24 Cancer. You might know this from a table, or you can look it up on the scale on the back of the astrolabe. It’s daylight, so we can’t look for any stars – but we can measure the altitude of the Sun above the horizon visually, by moving the ruler on the astrolabe while standing up until it aligns with the Sun – be careful doing this, though, as it’s dangerous to look directly at the Sun. Let us say that it’s 34 degrees above the horizon.

We rotate the rete until 24 Cancer is on the 34 degree altitude line, and use the alidade to read the time: just after 16:00. That’s local time, of course. Lampeter is about 15 minutes behind London time, which would make it 15:45. That’s GMT, so the real time is 16:45 BST.

At night, we’d find the latitude of a bright star instead, and use the rete to line up instead of the zodiac wheel.

Telling the time: night time

Credit: JohnW539,
www.instructables.com, CC-BY-NC-SA



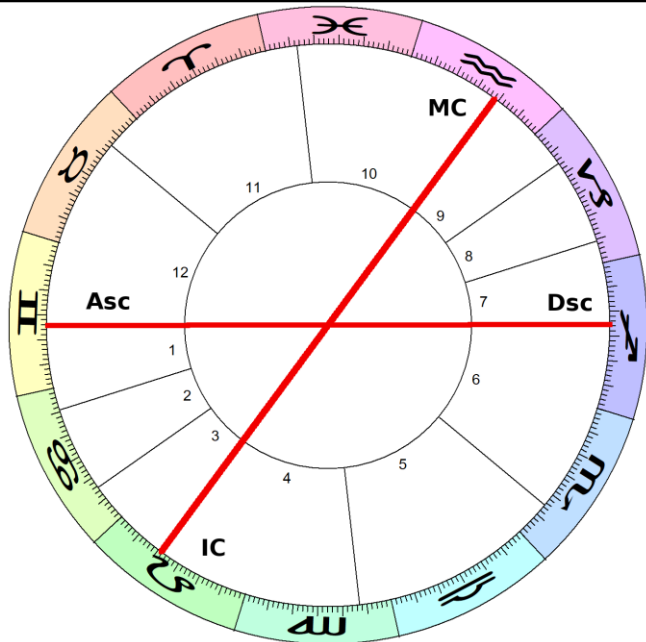
At night, we'd find the latitude of a bright star instead, and use the rete to line up instead of the zodiac wheel.

Drawing up the houses of a horoscope

6 April 1175, 07:30 LMT,
Hereford

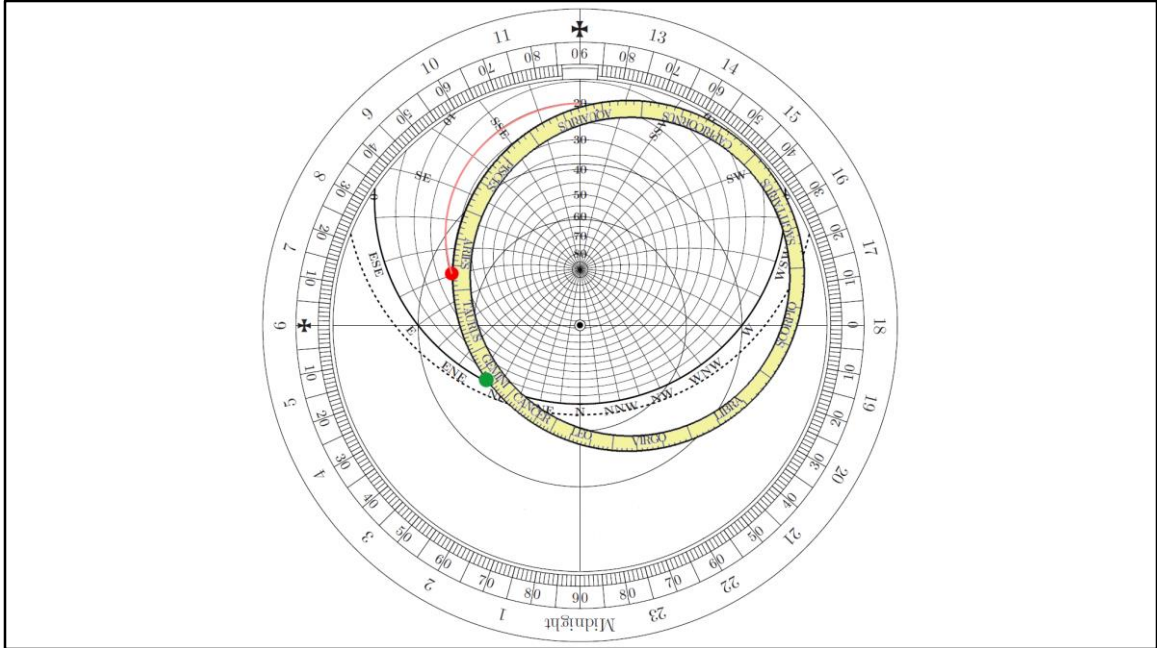
Sun: 22° Aries

Elevation of Sun: 20°

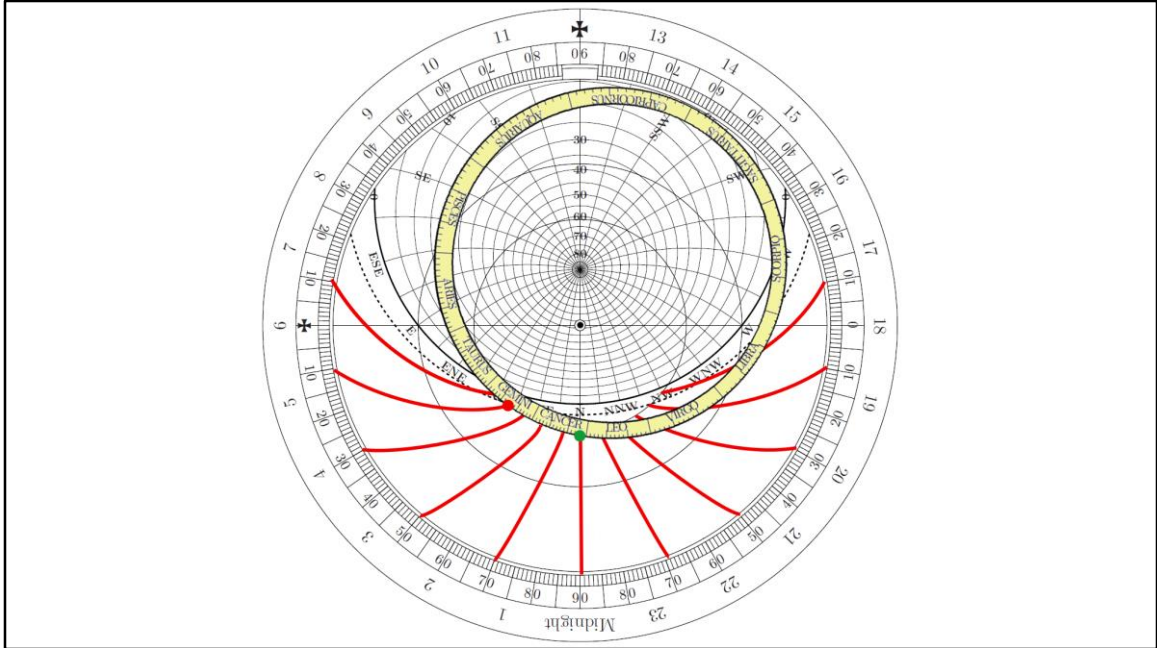


Here's a chart set for 6 April 1175 at 07:30 LMT in Hereford, on the English/Welsh border. The chart is shown here using modern software, using the Alcabitius house system (named after the Arabic astrologer al-Qabisi) – but how would the medieval astrologer have drawn it up?

First, he or she would know the date, and by looking in a table or on the back of the astrolabe would work out that the Sun was at 22 degrees of Aries. Visual observation with the alidade on the astrolabe would show that the Sun was at an elevation of 20 degrees above the horizon.

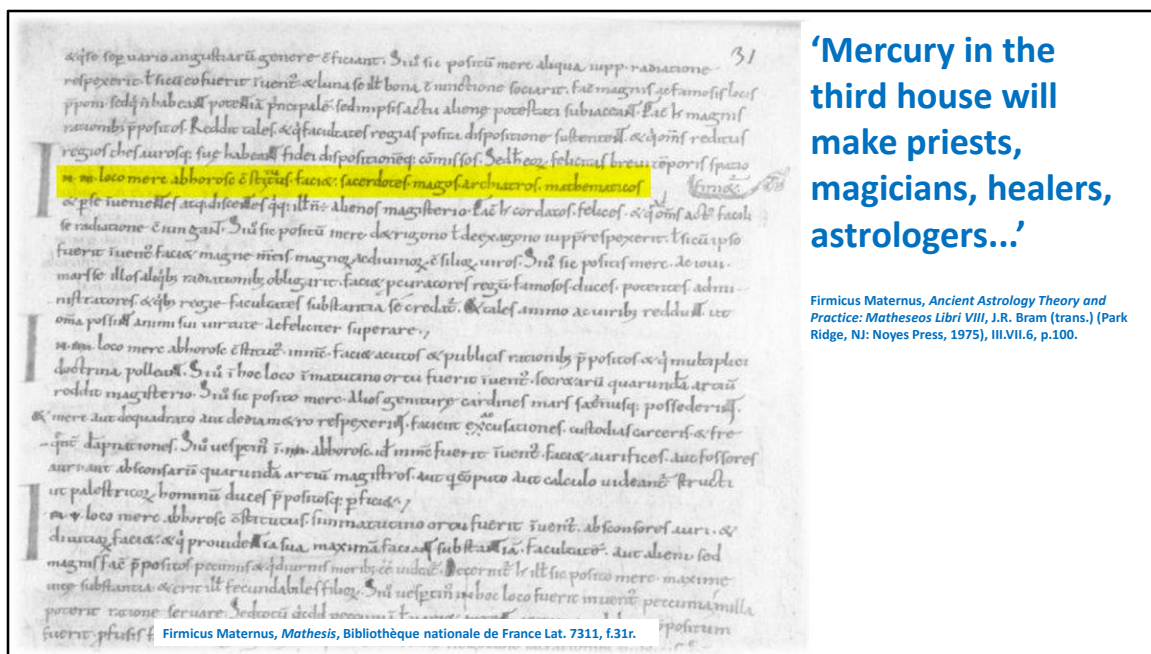


Using the astrolabe, the astrologer moves the point on the rete corresponding to 22 Aries to the altitude circle corresponding to 20 degrees (it's shown as a red arc here). You can now read off the Ascendant – that's where the zodiac wheel crosses the lowest zero degree altitude line – at about 17 Gemini. You can also read off the MC by seeing where that wheel intersects the vertical line – about 14 Aquarius (this is actually a couple of degrees out, but it's not a bad approximation).



The mater is also marked with “hour lines” (which haven’t been shown on the slides so far).

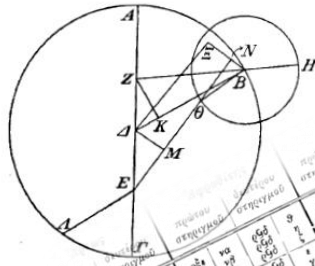
Once we know the Ascendant (17 Gemini), we can move the rete so that 17 Gemini is two “hour lines” along – these hour lines are shown here as red arcs. The point crossing the vertical line at the bottom then corresponds to the third house cusp, using Alcabitius houses. This gives us around 25 degrees of Cancer.



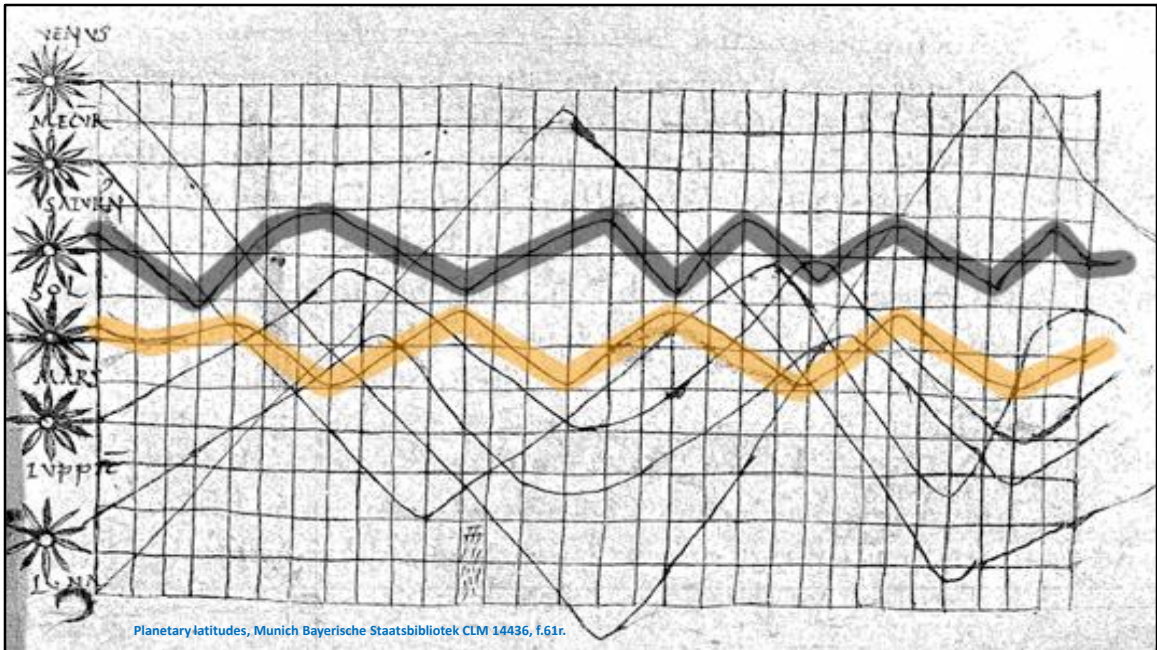
Firmicus Maternus, *Ancient Astrology Theory and Practice: Matheseos Libri VIII*, J.R. Bram (trans.) (Park Ridge, NJ: Noyes Press, 1975), III.VII.6, p.100.

Thus, the astrolabe let astrologers start to create charts. There was still one missing element, though – the planets. By the eleventh century, the *Mathesis* of Firmicus Maternus, the fourth-century Hellenistic astrology, was available in the Christian West. This picture shows an eleventh-century copy in Paris describing the features of a native with Mercury in the third house. This is fairly standard astrology, of course, but in to discover which house your Mercury is in, you need to be able to calculate both the Ascendant of your natal chart, and the position of Mercury – without this, the information is useless. Firmicus Maternus presumably assumed that his readers knew how to do this (though Bram, who provided an English translation of this text, suggested that Firmicus Maternus himself did not fully understand the calculations involved).

Classical texts assumed a knowledge of calculation

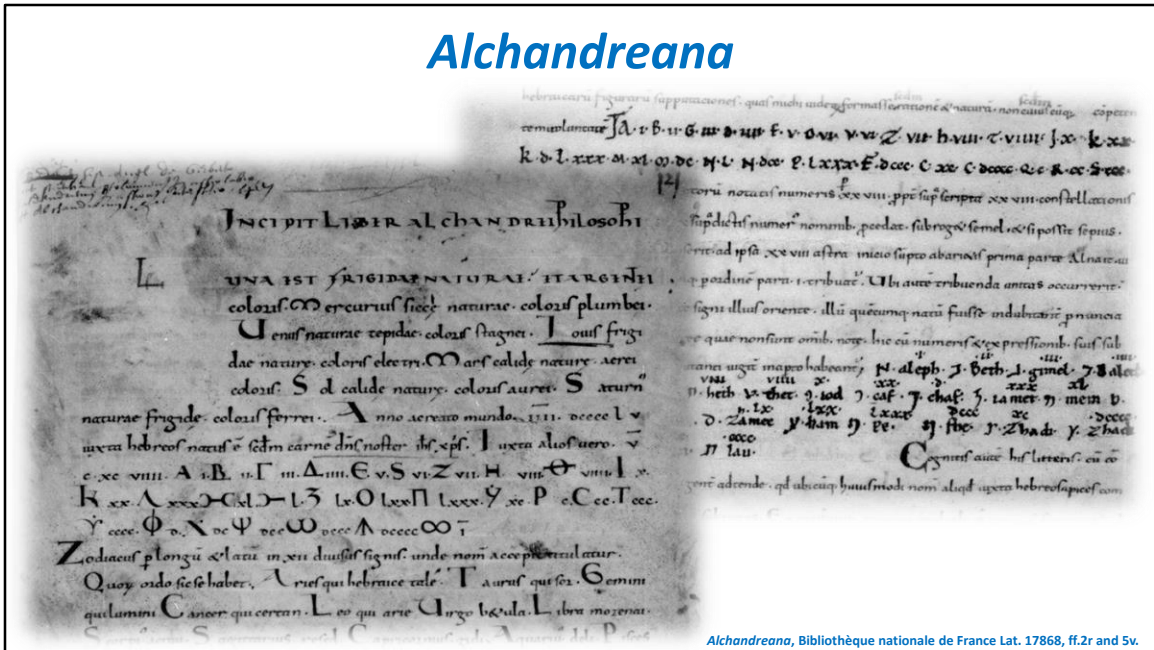


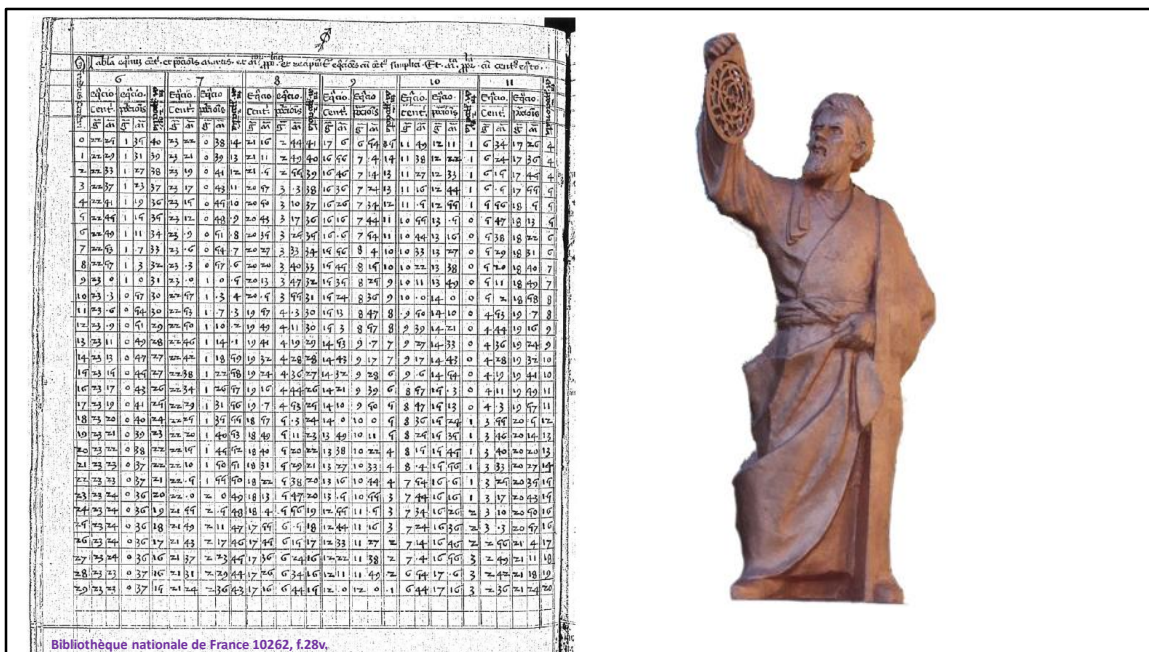
This, then, was a major stumbling block for astrologers before the twelfth century. They had the texts, but without the calculations to work out planetary positions, they couldn't do any practical astrology.



There was, then, some transmission of astrology into the Christian West in the ninth, tenth and eleventh centuries, from classical and Arabic sources. However, the techniques were not fully understood. This slide shows a diagram of planetary latitudes derived from Pliny, showing how the latitudes of planets vary. There is no sense of scale to this diagram, though, it merely illustrates that planets change latitude as they move through the zodiac. Take a look at the lines for the Sun and Saturn. Saturn is shown by the black line, and the Sun by the orange line. They appear to change longitude (the horizontal motion in this diagram) at roughly the same rate, even though Saturn moves about 30 times slower than the Sun.

Alchandreana





The astrolabe opened the door to the permissible study of Arabic science. From an astrologer's point of view, this opened an entire treasure trove. The chap depicted here – holding an astrolabe – is a statue of al-Khwarizmi, a ninth-century Persian scholar and polymath. His great work on mathematics, called *Kitāb al-muḥtaṣar fī ḥisāb al-ğabr wa-l-muqābala*, or the *Compendious Book on Calculation*, solved quadratic equations. The *al-ğabr* part of the title – meaning reunion – is where we get the word algebra from. And his name was transcribed into Latin as *Algorismus*, which is where we get the word algorithm from. One of his many achievements was the creation of planetary tables – that missing link that Western scholars needed to draw up astrology charts.

Twelfth-century scholars – including Walcher, the Prior of Malvern, and Adelard of Bath, produced translations of these tables. This picture shows a 14th-century copy. Now – at long last – the lost art of drawing up real charts could re-commence!

The edifice comes tumbling down



- Hostile attitudes to astrology modified by practical considerations
- Computus needs accurate tables
- Astrolabe helps produce these
- Astrolabes are Arabic, so an acceptance of Arabic science
- Arabic science includes astrology, so the door is opened fully

Those early cracks seen in the edifice of Christian hostility towards astrology – that astrology was only sometimes evil, but had a good use too – therefore ended up letting astrology in. Some astrology was good, or even essential – particularly understanding lunar and solar cycles in the subject of computus.

The tables needed for computus were enhanced by that Arabic instrument, the astrolabe, which led to an acceptance of Arabic science.

This Arabic science included astrology. Glimpses of astrological technique had already been seen in Christian Europe with the introduction of texts like *Alchandreana* and Firmicus Maternus' *Mathesis*, but couldn't be used without the ability to calculate planetary positions. Again, Arabic science came to the rescue – with both the astrolabe allowing positions to be verified, and the mathematical knowledge needed to construct accurate planetary tables, making horoscopic astrology possible.

The edifice had come tumbling down.



Credit: Cambridge St. John's MS E.2.105

Onwards...

- **Computus and astrology taught in cathedral schools from the 12th century**
- **Astrolabes made in Christian cultures**
- **Chaucer's astrolabe and treatise**

Both computus and astrology were taught in cathedral schools from the twelfth century onwards, and in the universities that replaced them. Astrolabes were made in Christian cultures.

Chaucer – the author of the *Canterbury Tales* – wrote a treatise for his son, “little Lewis”, explaining how to use the astrolabe. Arabic science, including the practical use of astrology, had become fully embedded in European scholarship, thanks in no small part to that magnificent instrument, the astrolabe.