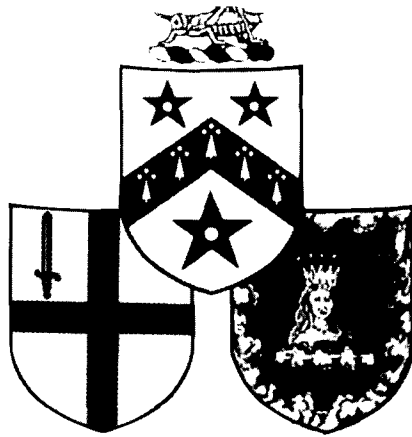


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A Lecture by

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Gresham Professor of Astronomy
(with guest speaker Dr David Hughes)

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The Star of Bethlehem

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The Star of Bethlehem was probably a triple conjunction of Saturn and Jupiter in the constellation of Pisces, the significance of which was only obvious to the Magi of Babylonia. This occurred in 7 BC and events indicate that Jesus Christ was probably born in the Autumn of that year, around October, 7 BC.

THE Messianic star which heralded the birth of Jesus Christ and shone in the skies over Bethlehem, Judaea has been a phenomenon of considerable interest and much mystification for centuries. Almost every Christmas the star is pondered over and discussed. Invariably the same conclusions are drawn—the cause and form of the star are still uncertain. The astrologically significant triple conjunction of Saturn and Jupiter in Pisces is the most likely candidate but the two comets of March, 5 BC and April, 4 BC cannot be dismissed. Neither can the possibility that the star was simply legendary.

Biblical background

The principal account of the star is found in the gospel of St Matthew. It begins (Matthew II, 1–2):

“Now when Jesus was born in Bethlehem of Judaea in the days of Herod the King, behold, there came wise men from the east to Jerusalem, saying, where is he that is born King of the Jews? For we have seen his star in the east, and are come to worship him.”

The term “in the east” in the second verse is incorrect in this Authorised Version translation^{1,2}. Originally it was written *en té anatolé* (Greek singular) whereas “the east” is usually *anatolai* (Greek plural). *Anatolé* has a special astronomical significance, indicating the earliest visible rising of a star at day break (the helical rising), and so the second verse should read “for we have seen his star appear in the first rays of dawn”. These first two verses also indicate that Jesus was born and the visit of the wise men took place some time between 39 and 4 BC when King Herod was on the throne. Learning of the prophecy (Micah V, 2), “But thou, Bethlehem Ephratah, though thou be little among the thousands of Judah, yet out of thee shall he come forth unto me that is to be ruler in Israel.”, Herod told the wise men that this is where Christ would be.

“Then Herod, when he had privily called the wise men, enquired of them diligently what time the star appeared. And he sent them to Bethlehem and said, Go and search diligently for the young child; and when ye have found him bring me word again, that I may come and worship him also. When they had heard the king, they departed; and lo, the star, which they saw in the east went before them, till it came and stood over where the young child was. When they saw the star, they rejoiced with exceeding great joy. And when they were come into the house, they saw the young child with Mary his mother and fell down, and worshipped him; and when they opened their treasures they presented unto him gifts; gold and frankincense and myrrh.”

This second passage contains many interesting points. Very few people saw the star. Although the wise men saw it, Herod and

all Jerusalem did not, so the Christmas card image of a huge brilliant star illuminating all Bethlehem cannot be correct. It seems also that there were two separate appearances of the star. The first induced the wise men to leave the east and set out for Judaea; they then lost sight of it for a time. The second occurred when they were in Jerusalem and here it pointed out to them the place at Bethlehem where the object of their search was to be found. Not only did it point out Bethlehem, but it “went before them” and finally “stood over” Bethlehem. The star must have then been in the zenith. This ties in with the legend recounted by Maunder³. Apparently the star had been lost in the daylight by the time the wise men reached Jerusalem (indicating that it was an evening star during their journey). On reaching Bethlehem, apparently nearly at midday, one of them went to the well of the inn to draw water and, on looking down the well, saw the star reflected in the surface of the water—again indicating that it was in the zenith and that they had arrived at the right place. (For a discussion of seeing stars in wells during the day time, see refs 4 and 5.) It must be noted, however, that if a star is in the zenith it will appear to be equally over every object in the neighbourhood.

A star had been mentally associated with the coming of the Messiah for a long time. The oracle of Balaam (Numbers XXIV, 17) said,

“I see him, but not now;

I behold him, but not nigh:

a star shall come forth out of Jacob and a sceptre shall rise out of Israel.”

This idea is, in fact, attributed to a man whose home was near the river (Numbers XXII, 5), that is in Mesopotamia, where there was great interest in astrology and astronomical objects and where the Old Testament would be well known and substantively the same as it is now. Some present-day scholars⁴ however think the term “star” in Numbers (XXIV, 17) applies to the Messiah himself and not to the sidereal phenomenon heralding His appearance.

The third reference to the star is not in the Authorised Version of the *Bible* but in one of the infancy gospels that were omitted when the *Bible* was compiled. The Protoevangelium of James (XXI, 2) states⁷:

“And he (Herod) questioned the wise men and said to them: ‘What sign did you see concerning the new born King?’

And the wise men said: ‘We saw how an undescribably great star shone among these stars and dimmed them, so that they no longer shone, and so we knew that a King was born for Israel. And we have come to worship him’, and Herod said: ‘Go and seek and when you have found him, tell me, that I may also come to worship him’. And the wise men went forth. And behold, the star which they had seen in the east went before them, until they came to the cave. And it stood over the head of the child.”

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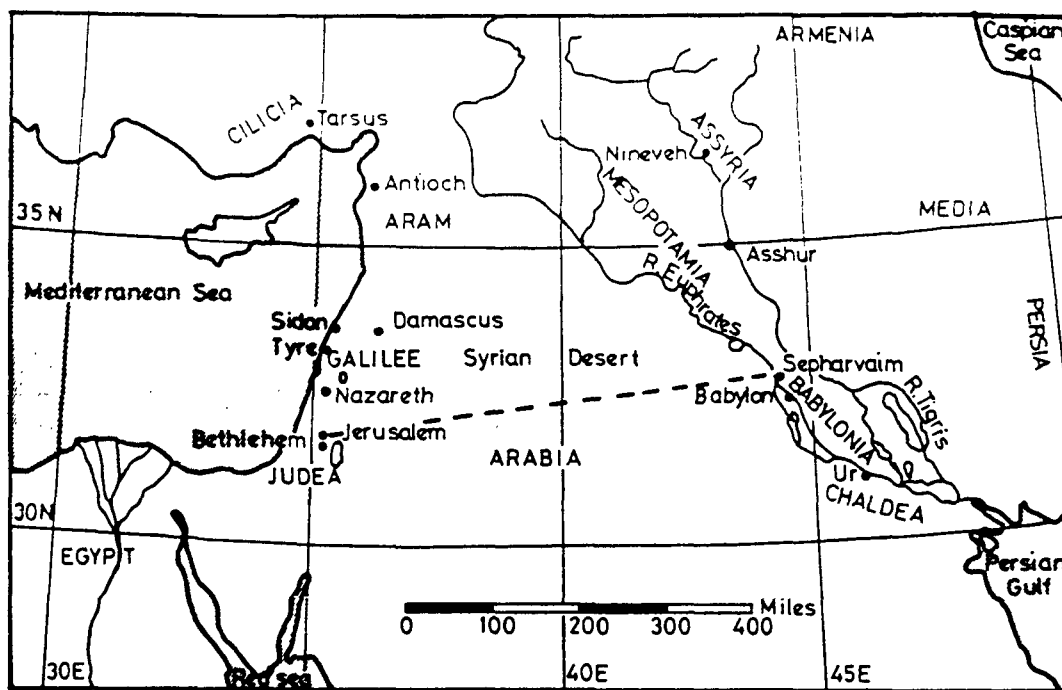


Fig. 1 The Middle East indicating one of the many possible routes of the Magi's journey from the east to Jerusalem and Bethlehem.

Here clues are given as to the star's brightness. To dim the other stars requires it to have a brightness comparable with or even brighter than the full Moon. But if this was so why didn't Herod and all Jerusalem know of it?

The wise men

The word Magi comes from the greek (μαγοι) which the Authorised Version translated as "wise men" and the *New English Bible* as "astrologers". They were probably Median priests of Zoroastrianism who, apart from performing the duties of national priesthood, used to occupy themselves with the interpretation of dreams. Babylon, Assyria and Chaldea have been put forward as their place of origin (Fig. 1). It has also been suggested that Magi does not refer to a specific race at all but is just a general name for a priestly cast of "magical" tendencies. In the earliest carvings and pictures they are shown in Persian dress, wearing trousers. It is said that such a carving saved the Church of the Nativity of Ravenna from the general havoc of the Persian onslaught in AD 614. Astrology, the prediction of future events from the positional relationship between the Sun, Moon and planets and the stellar background, was definitely one of their practices.

In the language of the Old Testament and probably St Matthew as well the term "the east" was very vague and included countries that lay considerably to the north as well as the east of Palestine. Previous biblical books (Isaiah LX, 6; Psalms LXXII, 10, 15) predicted that the kings would come from Arabia (Sheba, Seba and Tarshish). But other biblical scholars have favoured Persia, Parthia (a country south-east of the Caspian that used to extend from the Indus to the Euphrates) and Babylonia. Wherever they came from they would have been expecting that a King of the Jews was to be born and have probably learnt of this from Jewish sources. (This expectation was widespread, compare Simeon in Luke II, 25.) The nature of the gifts does not present a clue.

It was not until the sixth century that tradition changed the Magi into kings. Their number was fixed at three because of the threefold nature of their gifts (eastern tradition has it that there were twelve).

The date

In AD 525 Dionysius Exiguus, a prominent scholar and Roman monk, fixed the origin of the present calendar so that Jesus was born in December, AD 1 (anno domini, "in the year of the Lord"). AD 1 corresponded to AUC 754 in the Varronian

reckoning (AUC standing for *ab urbe condita*, from the founding of Rome). Unfortunately Exiguus forgot the year zero which should have been inserted between 1 BC and AD 1 (in fact astronomical reckoning has AD 1 = -1, 1 BC = 0, 2 BC = -1 and so on) and also the 4 yr when Emperor Augustus ruled under his own name of Octavian. So Exiguus was at least 5 yr out.

Jesus was born in the days of King Herod. According to the historian Flavius Josephus⁸, Herod died within a few days of an eclipse of the Moon visible from Jericho and a few days preceding the feast of unleavened bread. The eclipse is the only one mentioned by Josephus⁹ and must have been that which occurred during the night of March 12-13, 4 BC. Passover started on April 11, so Herod died between March 12 and April 11, 4 BC. Christ must have been born before this. In fact when Herod died Christ was in Egypt with his parents, the family having taken refuge there after being warned of Herod's impending wrath.

On realising that the Magi had not returned to Jerusalem to tell him where the child was, but had gone back to their country another way, Herod sent men to kill all the children in Bethlehem and its environs who were 2 yr old or less "according to the time which he had diligently enquired after the wise men" (Matthew II, 16), so Christ could have been anything up to 2 yr old at this time.

Luke II provides another clue about the birth date. Joseph and Mary journeyed to Bethlehem from Nazareth because Caesar Augustus decreed that all the world should be taxed. An ancient inscription unearthed in Ankara¹⁰ lists the years in which orders were issued for tax collection. The most feasible date is 8 BC, but slow travel and communications in those days could have delayed the actual collection of taxes by a year or two. Luke also states that this taxing was first made when Cyrenius (Quirinius in Latin) was governor of Syria. Quirinius was a consul in 12 BC and also fought against the Homanadensians in Cilicia before 6 BC. Tertullian¹¹ states that the census at the time of the birth of Jesus was taken by Sentius Saturninus who was governor of Syria between 9 and 6 BC. Quirinius could have been associated with Saturninus in this project some time between 6 and 5 BC, when he was an Emperor's legate in Syria. But he did not become governor of Syria until AD 6 so Luke was mistaken (II, 2). Needless to say if Luke were correct in II, 2, Christ would have been born some time between AD 6 and 7 when Quirinius governed Syria.

Some early Christian writers (Origen and Eusebius, for

constant observers of the sky, would be caught unawares by an appearance of Venus.

Another possibility is that the star was simply the conjunction between two or three planets. Two or more bright planets very close together in the sky provide a most striking sight. Johannes Kepler was fascinated by the conjunction between Jupiter and Saturn on December 17, AD 1603. In the spring of 1604 Mars moved into the vicinity of the other two and in autumn 1604 a supernova (SN 1604 Ophiuchi) appeared nearby. All in all, Jupiter and Saturn came into conjunction three times in 6 months. Jupiter and Saturn have orbital periodicities of 12 and 29 yr, respectively, so Jupiter on average passes Saturn every 20 yr. About every 120 yr, three successive conjunctions take place over about 6 months, this being known as a triple or great conjunction. Such a conjunction will occur every 120 yr and a similar one would have occurred in 7 BC. Pritchard^{14,15} confirmed this fact, and on May 29, September 29 and December 4, 7 BC a conjunction occurred in the constellation of Pisces, which is astrologically associated with the Jewish people. In February, 6 BC Mars moved into the configuration and formed an equilateral triangle with the other two planets, a situation known as a massing of planets¹⁶, but the Sun was too close for this to be observed with the naked eye.

Pritchard¹⁵ points out that in 66 BC, about two revolutions of Saturn and five of Jupiter before 7 BC, a closer single conjunction of the two planets took place, again in Pisces. In February, 66 BC the planets would set about 45 min after the Sun and would be less than 55 min of arc apart. Whether the astrological significance to the Magi of this single conjunction was the same as the significance of a triple conjunction is unknown. Maybe these previous conjunctions also impelled Magi to journey to Jerusalem, but the Bible only reported the fruitful journey.

Sinnott¹⁷ studied the 200 conjunctions and 20 multiple groupings that occurred between 12 BC and AD 70, these being gleaned from Tuckermann's book¹⁸. Sinnott concentrated on very close groupings, "weeding out" commonplace conjunctions and ones which were widely separated, and lists six conjunctions which could be seen from the Middle East in which the stars were less than 12 min of arc apart and more than 15° from the Sun (so they easily could be seen at night). These are shown in Fig. 2. Unfortunately none occurred between 12 BC and 3 BC, indicating (if the above thoughts about when Christ was born are correct) that Sinnott's selection criteria are too strict. The two conjunctions of the brightest planets, Venus and Jupiter, the first on August 12, 3 BC, visible in the eastern dawn sky from about 0345 h to 0520 h when they were separated by about 12 min of arc (in Leo, near Regulus) and a similar event on June 17, 2 BC when they were less than 4 min of arc apart and close to the western horizon where they would seem to fuse into one star "gleaming like a great beacon over Judaea to the west", would have been most impressive but do occur after Herod's death. The second conjunction again occurred near Regulus, a royal star. (Astrologically it is interesting that Judah, one of the tribes of Israel, has the lion, symbolising the constellation Leo, on its standard. Bethlehem, in the land of Judah, was the predicted birthplace of a "Governor that shall rule my people Israel" (Matthew II, 6). These facts were well known to the Magi.)

Possible sequences of events

It must be remembered that the Magi were skilled astrologers and accomplished star gazers with great knowledge of the sky, backed up by about 4,000 yr of astronomical observations. Many towns in the Middle East have legends retelling how theirs was the town from which the Magi started on their journey (the people of Saveh in Persia told Marco Polo that their town was the starting point). The triple conjunction of 7 BC had been predicted. The calculations and predictions are given in an almanac found on a cuneiform tablet at Sippar (Sefarvaim) in Babylonia, a town noted for its school of

astrology. The conjunction took place in Pisces, a constellation which is astrologically associated with the Jewish people and Israel (compare the writings of Rabbi Arbarband 1437-1508). The Sun moves through Pisces at the boundary between winter and spring and astrologically this indicates the end of an old age and the start of a new one. Jupiter was considered to be a lucky and royal star and in traditional Jewish astrology Saturn protected Israel.

Babylonian astrologers steeped in Jewish tradition would have predicted the triple conjunction in Pisces. Realising its astrological significance (that is, a Jewish king born in Israel) and remembering the prophecy of Balaam (Numbers XXIV, 17) and seeing in the sky their astronomical prediction come true would be ample justification for starting a journey to pay homage to the new king, the herald of a new age.

The journey from Sefarvaim to Jerusalem across the Arabian desert is about 550 miles. Preparing for and taking this journey would take about 4 months. The planetary clustering would have begun about the end of February, 7 BC with Jupiter moving from Aquarius towards Saturn in Pisces. As the Sun was also in Pisces at this time the planets would not be visible. Not until April 12 did both planets rise helically in Pisces (compare Matthew II, 2). The first close encounter (0.98 degrees separation—twice the diameter of the full Moon) took place on May 29 and was visible for about 2 h in the morning sky. The Magi could have set out towards the end of June, 7 BC, the September 29 conjunction confirming their predictions as they were nearing Jerusalem and the December 4 conjunction, occurring after the audience with Herod, pointing the way south to Bethlehem 5 miles away. Pisces rises at about 0200 h, 2200 h, 1900 h and 1200 h during May, July, September and December, indicating that the two planets would be clearly visible during their journey. The planets are due south (and closest to the zenith) about midnight during September and at about 1900 h during early December. (This throws doubt on to the Maunder legend of the midday star in the well.) Jesus could have been born about 2 months before the last conjunction, say in early October, 7 BC. He would have been circumcised at 8 d, then after the 33 d of Mary's purification taken to Jerusalem where a sacrifice was made. After returning to Bethlehem he was visited by the Magi. (The word *το παιδ' εν* in Matthew II, 11 means "a very young child" or infant.) After being warned in a dream about Herod's impending wrath, Joseph fled with Mary and Jesus to Egypt. In early October the shepherds could be moving the sheep from the hills to their winter quarters. Jesus would have been 2.5 yr old when Herod died.

A second scenario could be as follows. The conjunctions of 7 BC could simply have attracted the wise men's attention towards Palestine, the comet of March, 5 BC starting them on their journey. They would have arrived well before Herod's death (which occurred between March 12 and April 11, 4 BC) and being told that Jesus was born in Bethlehem, arrived there about April, 4 BC when the nova was shining. Before Herod died he ordered that all children under 2 yr old be killed, and with this scenario the order would have gone out just before he died, giving Joseph, Mary and Jesus time to flee to Egypt.

Jesus would have been about 2 yr old when this order went out and when seen by the wise men. This ties in with Epiphanius* who stated that the star shone in the east 2 yr before the Magi arrived in Jerusalem. So Jesus would have been born in the spring of 6 BC, Epiphanius's star could have been the conjunction and the shepherds would have been in the fields at lambing time.

But why should Joseph and Mary stay in Bethlehem for 2 yr when they had only gone there to be taxed? And why had not Herod and the Jews connected the comet of 5 BC with the coming of Christ? It is possible that Herod missed the triple conjunction when the planets only just came within 1° of each other. The Protoevangelium of James supports this latter picture.

Non-astronomical possibilities

One easy way out of the dilemma introduced by the Star of Bethlehem is to regard it as another miracle, as the direct intervention of the hand of God and thus as a phenomenon not requiring a scientific explanation.

It could also just be a legend. No king worth his salt in those days was born without some celestial manifestation. A star greeted the birth of Mithridates (131–63 bc) and Alexander Severus¹⁹. The temple of Diana at Ephesus was burned down the night that Alexander the Great was born, Magi announcing that the plague and bane of Asia had been born that night. The magos Tiridates and some followers came to Rome to acknowledge the divinity of Nero in AD 66.

Matthew, who wrote his gospel for a Jewish audience and who frequently cited passages of the Old Testament to prove points to his readers, probably felt that a star was necessary to fulfil the prophecy of Balaam. The Essenes, who studied the prophets to find interpretations of the contemporary scene, would believe that such a prophecy could not have been without fulfilment. They would go so far as to say: no star, no messiah. The absence of the Matthean clause "that it might be fulfilled" is very worrying and casts doubts as to how far the evangelist regarded the account of the star as historical. Albright and

Mann¹ suggest that the clause might have been "edited out" of Matthew's gospel at a later date to appease Gnostic opposition to the church. (The gospel of St Matthew was probably written some time between AD 65 and AD 85.)

Bearing in mind Herod's surprise on being told of the star by the Magi, the triple conjunction in 7 bc seems to be the most probable candidate. If this is so Christ would have been born in about October of that year.

¹ Albright, W. F., and Mann, C. S., *The Anchor Bible, Matthew* (Doubleday, New York, 1971).

² Keller, W., *The Bible as History* (Hodder and Stoughton, London, 1956).

³ Maunder, E. W., *The Astronomy of the Bible* (Sealey Clarke, London, 1908).

⁴ Minnaert, M., *Light and Colour in the Open Air* (Bell, London, 1940).

⁵ *The Observer*, letters page, November 25, 1973.

⁶ *A Dictionary of the Bible* Hastings, J. (ed.), III, 204 (Clarke, Edinburgh, 1904).

⁷ Hennecke, E., *New Testament Apocrypha*, 1 (Lutterworth, London, 1963).

⁸ Finnegan, J., *Handbook of Biblical Chronology* (Princeton University Press, 1964).

⁹ Josepheus, F., *The Works* (translated by Whiston, W.), (Lockington, London, 1800).

¹⁰ Cole, D. I., *Mon. Not. Astron. Soc. Southern Afric.*, 23, 152 (1944).

¹¹ Finnegan, J., *ibid.*, p 237.

¹² Finnegan, J., *ibid.*, p 256.

¹³ Williams, J., *Observations of Comets from [bc 611 to AD 1640, extracted from the Chinese Annals* (London, 1871).

¹⁴ Pritchard, C., *Mon. Not. R. astron. Soc.*, 16, 215 (1856).

¹⁵ Pritchard, C., *Mem. R. astron. Soc.*, 25, 119; 1856.

¹⁶ *The Christmas Star*, 12 (Morrison Planetarium, San Francisco).

¹⁷ Sinnott, R. W., *Sky and Telescope*, 36, 384 (1968).

¹⁸ Tuckermann, B. J., *Mem. Am. Philos. Soc.*, 56 (1959).

¹⁹ Little, E. S., Leaflet 474, *Astron. Soc. of the Pacific* (December, 1968).

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