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Ancient Chinese Astronomy

Chinese astronomy is fascinating in that it developed largely clear of the Indo-European sphere and developed its own particular methods and nuances. The Chinese were meticulous in keeping astronomical records, enabling modern historians to establish that Chinese astronomy remained largely unchanged from 1800 BCE onwards.

Astronomy was very much a royal preserve, and emperors directly employed astronomers to chart the heavens and record phenomena, their main purpose being to record time accurately, something that they started to do with great accuracy.



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The Split Between Astronomy and Astrology

Unlike other cultures charting the stars at this period, astrologers were separate from astronomers and their job was to interpret occurrences and omens portended in the sky. As the astronomers began to chart regular events, such as lunar eclipses, these were removed from the realm of astrologers, who Emperors consulted before every major decision.

As a result, the Chinese developed an extensive system of the zodiac designed to help guide the life of people on Earth. Their version of the zodiac was called the 'yellow path', a reference to the sun traveling along the ecliptic. As is the case with Western astrology, the Chinese had twelve houses along the yellow path, although the names they gave were different.

The Chinese followed a calendar of twelve lunar months, and calculated the year to be 365.25 days long. They translated this 'magic' number into a unit of degrees, by setting the number of degrees in a circle equal to 365.25 (as compared to our use of 360 degrees). They also divided the sky into four quarters, with seven mansions in each, making 28 in total, and these were used to chart the position of the moon as it crossed the sky.

Ancient Chinese Astronomy 28 Mansions of the Chinese Astronomy (Creative Commons [1])

The first Chinese records of astronomy are from about 3000 BC, and they used the circumpolar stars [2] as their reference point for the heavens, unlike the Indo-Europeans who used observations based upon the rising and setting of celestial bodies on the ecliptic and the horizon.

A tomb dating from about 4000 BCE contained bones and shells inscribed with the Plough and symbols for the Azure Dragon and White Tiger, two of the four regions, the black tortoise and the Vermillion bird being the others. A lacquered box, dating from before 433 BCE had the names of the 28 Mansions inscribed on the lid, showing that this system was in use for a long time.

The main job of the Chinese astronomers was to chart time, announce the first day of every month and predict lunar eclipses. If they were wrong in their predictions, then they were often beheaded! To measure time, the Chinese divided the sky into 12 branches and 10 stems arranged around the ecliptic, to give a 60-year cycle. This particular system is believed to have been implemented by Emperor Huang Ti, whose reign began in about 2607 BCE. It is also stated that he built a great observatory and planetarium to help with accurate observations, although this is largely built upon tradition rather than hard evidence. In order to mark the passage of time and the seasons, the Chinese primarily used the orientation of the Big Dipper constellation relative to the pole star in early evening.

The Chinese were meticulous in recording other astronomical phenomena, such as comets, sunspots, novas, and solar flares, long before any other culture made any such observations. They attempted to catalog every single star, defining their constellations by one major star, called the king, and surrounding it with princes.

The astronomer Shi-Shen (4th Century BCE) is believed to have cataloged 809 stars in 122 constellations, although he took little interest in the planets, unlike the Greeks [3] and Mesopotamians [4]. He also made the earliest known observation of sunspots. Alongside his contemporary, Kan-Te, he is one of the most notable of the Chinese astronomers. To make such accurate measurements of position in the sky, the Chinese must have used an armillary sphere, a metal sphere consisting of intersecting scaled circles, which allowed the observer to give each star a coordinate. The first human record of an eclipse was made in 2136 B.C., and over hundreds of years of advanced sky watching, the Chinese became very adept at predicting lunar eclipses.

One of the famous observations made by Chinese astronomers was that of a supernova in

the year 1054. They referred to this phenomenon in records as a 'guest star', and mention that it remained bright for about a year before again becoming invisible. This supernova created what we see today as the Crab Nebula. The explosion itself in 1054 was also recorded by the Anasazi Indians of the American Southwest, but for some reason, there is no known record of this occurrence in European or any other cultures.

Chinese Astronomy and the Tang Dynasty

The most important stage in the development of Chinese astronomy was between the 3rd and 6th centuries, when Chinese scholars and polymaths made many wonderful contributions to mathematics and astronomy, creating accurate measuring instruments. One of the leading astronomers of this particular period was Zu Chongzhi (429-500), a notable polymath. Using self-designed instruments, he proposed that the year was 365.24281481 days long, a measurement that is less than a minute different from modern measurements.

He used this to design the Daming calendar, the most accurate lunisolar calendar available at that time. Other measurements included measuring the number of times that the sun and moon overlap, proposing 27.21223 times, which is very close to 27.21222 as we know today; using this number he successfully predicted an eclipse four times during 23 years (from 436 to 459).

Dunhuang Star Map, from the Tang Dynasty (Public Domain)

Yi Xing (683-727) was a monk who studied many of the methods and beliefs of Indian astronomy and mathematics, under the auspices of the Tang Dynasty [5]. He was the first known astronomer to try to plot the length of a degree of the meridian line, stating that it was 123.7km, not far off the modern measurement of 111km. Yi Xing was the prime mover behind building an armillary sphere that moved in conjunction with the heavens.

The Chinese Astronomers of the Song Dynasty

The Song Dynasty [6], 960-1279 saw the Chinese build a number of huge observatories, based upon a series of accurate star-maps, one of which was used to build a planetarium containing 1,434 stars and 28 constellations. At the end of this period emerged one of the greatest of Chinese astronomers, Guo Shoujing (1231-1316), responsible for creating a huge sundial, allowing him to calculate the length of a year to within less than 30 seconds, a monumental achievement. He also improved upon the armillary sphere, making it less complex but also more accurate.

Chinese Astronomy – The Legacy

The Chinese astronomers have often been looked over in favor of the Greek, Indian [7], and Islamic contributions to the field, mainly because they use such different methods from the Eurocentric world. Their work tended to be more concerned with refining their observations and making ever more accurate measurements than developing theories but, in that respect, they were one of the leading ancient cultures.

The Chinese astronomers generated fantastically accurate measurements of time and charted unusual cosmological phenomena, such as novae, comets and meteor showers. This makes their work important to the development of the history of astronomy, and their ideas filtered down the Silk Road into the Middle East and Europe.

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[1] <http://en.wikipedia.org/wiki/User:Mysid>, [2] http://en.wikipedia.org/wiki/Circumpolar_star, [3] <https://explorable.com/greek-astronomy>, [4] <https://explorable.com/mesopotamian-astronomy>, [5] http://en.wikipedia.org/wiki/Tang_Dynasty, [6] http://en.wikipedia.org/wiki/Song_dynasty, [7] <https://explorable.com/indian-astronomy>, [8] <https://explorable.com/users/martyn>, [9] <https://explorable.com/chinese-astronomy>