Chapter 3 - The History of Astronomy

It is advantageous and very beneficial to know a certain amount about the beginning and history of any science. Astronomy is certainly one of the oldest, if not the oldest of all; it has an extensive history that stretches back until it is lost in the mists of the earliest ages. No one person or age is able to claim the development of the science; every one has built upon the foundation of some predecessor. As the author of the article in the *Encyclopedia Britannica* says, some amount of knowledge of the elements of astronomy was indispensible to humanity in its primal state; they could not, had they desired, do any less than organize the trials of their life and work from one day to the next in accordance with the instructions of nature as they would perceive them clearly on every side. They had neither clock nor almanac, and thus the sky had to serve both those purposes for them; it would teach them when to hunt and fish, to sow and to reap. Being illiterate they would see much that was mystical in all this, and the less civilized they were, the more superstitious they would be.

The old Chaldean shepherds of the east studied the sun and the stars under the open sky. The old priests of the Egyptians and Babylonians were busy with the work. The Chinese were also great astronomers. It is possible to trace astronomy much further back in China – to the days of the emperor Yao, 2300 years before Christ. In the book *Sou-Ching*, about the year 2136 BC, there is mention of two royal astronomers of the emperor Chung-K'ang, namely Hi and Ho, who were put to death because a solar eclipse had caught them unprepared. In a word, they were drunk at the time, and able neither to oversee the appropriate religious ceremonies for placating the gods, nor thereby to chase off the curse which fell upon the country as a result. Since the eclipse in question was partial and not total, an old anonymous poet attests in an ancient verse that the punishment was excessive:

> Fan yma gorwedd Hi a Ho
> Drwy dynged anhaeddedig
> Oherwydd iddynt fethu gweld
> 'Diffyg' oedd anweledig!
>
> Here lie Hi and Ho
> By an unmerited fate
> Because they failed to see
> A 'lack'[1] which was invisible

Later, in the old book of the Chun-Tsew, a work of Confucius himself (550-478 BC) and the only book that he wrote, a lot is found of the history of astronomy. A summary of the contents of this work was set before the Royal Astronomical society in 1863 by John Williams, who was assistant secretary of the Society at the time. It should also be added that the Chinese record of the comets stretches back to 2296 BC.

Astronomy was also very early held in great esteem in Babylon – as early as 3800 BC during the reign of Sargon – and it is supposed that many of the constellations were known by around 2800 BC. The Egyptians also worshipped the stars very early on, and it is known that the pyramids were built according to astronomical designs. Sir Norman Lockyer says, incidentally, that the old cromlechs of our country display characteristics similar to those of the temples of Egypt of 2000 to 4000 BC, which indicates that they too

were built according to astronomical designs. And in his *Stonehenge* Sir Norman goes on further to say that he supposes the 'Gorsedd' of the Welsh to be at least four thousand years old.

Thereafter, about the seventh century BC, the Greeks came into possession of much of the knowledge of the men of the east. The most famous among them were Thales of Miletus, Aristotle, Pythagoras, Heraclides (a disciple of Plato), Eudoxus, and Aristarchus. Aristarchus was observing in Alexandria in about 280 BC, and his was the chief impetus in the formation of the 'Alexandria School'. He declared that the sun was 20 times the distance of the moon from us. The correct figure is 400 times, but despite that his ideas about the universe far surpassed in correctness those of anyone before him. Then came Eratosthenes, and after him Hipparchus, who laid the foundation of astronomy as an exact science, and who classified about a thousand stars into six classes of magnitude. Then after a break of about 250 years, and soon after the beginning of the Christian era, came Ptolemy, who based his *Almagest* on the researches of Hipparchus.

Ptolemy had no direct successor, and the next persons of any note to promote astronomy were Theon of Alexandria and his daughter Hypatia, around 400 AD. About the year 800 AD, The Caliph built an excellent observatory in Baghdad. As the centuries rolled on, we find that the Moors carried the study of astronomy to Spain. It blossomed in Cordova and Toledo, and this is the time that the dawn of science broke upon Europe. Soon after this an astronomical revolution broke out in Italy. Novara (1454-1504) was a thinker ahead of his time. Nicolas Copernicus was a student about this time in Bologna and Padua, and in 1543 he published his amazing book *De Revolutionibus Orbium Coelestium*. The great principle of this book was 'relativity of motion' – namely that the observer's location, the Earth, was moving, and not the objects above. The great defect in his system was the idea that the orbit of the earth around the sun was a perfectly round uniform circle.

Then came Tycho Brahe of Denmark, and rapid steps were taken forward. Kepler came to the field, and although he was caught fast for a long time by the old idea of perfectly round circles, after making laborious measurements of seven of the oppositions of Mars he saw at last that nothing would explain the planet's revolutions satisfactorily except the fact that its orbit was an ellipse. Thus he came to publish the laws which have immortalized him, the first two in 1609, and the third in 1619.

After this came Galileo, a most amazing man, who made excellent discoveries that confirmed and extended the ideas of Copernicus. Then came the immortal Sir Isaac Newton to crown it all. With the publication of his *Principia* the truth, the orthodox ideas that have held their ground to the current day, was at last discovered – namely that the sun is the centre of the solar system, that all the planets revolve around it in elliptical orbits, and that all of it is governed by the great law of General Gravity. Those are the essential principles.

Others have done great work after this, people like Flamsteed, Halley, Bradley, Sir William and Sir John Herschel, Sir George Airy, and Adams in England; Bessel and others in Germany; and Le Verrier in France. Then spectrum analysis was discovered by Kirchoff, and its application by Huggins. Then came the application of the camera to the stars, in which field our fellow-countryman Isaac Roberts so distinguished himself. This great work, and all these names (as well as many more), deserve to be mentioned before this chapter will be well and truly complete.

[1] ‘Diffyg haul’, the Welsh term for a solar eclipse, means literally ‘a lack, or deficiency, of sun’.