An astro-trilogy

Indian Mathematics and Astronomy: Some Landmarks. Jnana Deep Publications, Bangalore, 261 pp.
Indian Astronomy, An Introduction. Universities Press, 3-5-819, Hyderguda, Hyderabad 500 029, ix + 207 pp.
Astrology: Believe it or not? Navakarnataka, 101, Crescent Road, Kumara Park, Bangalore 560 001, 153 pp.

All three books by: S. Balachandra Rao.

Right at the outset I wish to congratulate Balachandra Rao for doing us the signal service of writing the above three books. In different ways these books answer many questions that come to the lay as well as the not-so-lay minds concerning our ancient scientific heritage. We never stop telling ourselves that our ancestors right from the Vedic times were well informed on several scientific fronts. However, when pinned down with the question: 'What exactly did they know and at what epochs in the past?', there are very few of us who can give a satisfactory reply. Balachandra Rao (BR hereafter) provides us with useful information in simple and readable form.

Briefly, the three books cover separate aspects of the above issue and are aimed at different readerships. The first one tells us about the development of astronomy and mathematics from the Vedic to the colonial times. This book will be and should be appreciated by a reader with some understanding of elementary mathematics, although even a more general type of reader can catch the flavour of the march of ideas. The second goes into technical details, rederiving the mathematical results obtained by the ancients. Here knowledge of geometry, plane and spherical trigonometry and algebra will be required. The last book is aimed at general readership and describes the subject of astrology while pointing out why it is not a science. I strongly recommend this book to the general educated layperson, especially one who likes to regulate his/her life by astral considerations.

Indian Mathematics and Astronomy begins with an overview of the whole scenario and then proceeds in a chronological fashion, beginning with the Vedic lore, followed by the Vedanga

Jyotisha. The overview is well worth reading. There, we are told why the ancient geometors did not bother with logical proofs (as in Euclid) but stated results. They did so because their aim was to generate practical results like fixing times of religious rites, construction of altars and buildings, etc. The author bemoans the fact that because of this emphasis on applied aspects, the rigours of mathematics were ignored and later the pseudo-science of astrology coming from Greece and Babylon was 'received with open-arms'.

The author then goes through the works of individual astronomers/mathematicians chronologically, starting with Aryabhata I, and is at pains to point out the scientific as opposed to the pseudo-scientific statements from the ancient works. Like Varaha Mihira's emphasis on observational verification of stated results, although he also dwelt on superstitious beliefs like portents. (Did not Newton also believe in alchemy?) It is also amusing to see the harsh words used by critics from opposing sides. In case today you are smarting under some unkind criticism of your paper by a referee, think of the words used by Brahmagupta about Aryabhata I: 'Since Aryabhata knows nothing of mathematics, celestial sphere or time, I have not separately mentioned his demerits.'

Going through the golden age of Indian mathematics and astronomy starting from Aryabhata I (5th century A.D.) and going to Bhaskara II (12th century A.D.), giving the important contributions of the various astronomers and mathematicians, the author points out those results which preceded the more well-known results of the Western mathematicians. In more than one place BR stresses the work of the Kerala scholars in later years, which is less well known. Again one finds that the emphasis in India was on intuitively knowing the result and its practical

applications and explicit constructions rather than on its proof. It is interesting that he has a brief last chapter on Ramanujan who also 'saw' several results in number theory intuitively, most of which were later proved by other mathematicians.

This otherwise excellent account seems strangely to pass over any discussion of instrumentation used by Indian astronomers. Even in the pre-telescope times there were several instrumental aids for observing and locating stars and planets. Brahmadatta himself is quoted as insisting on observational verification and accuracy of results.

Indian Astronomy, the second of this set, covers a similar range of periods, but deals with more technical problems, like calendars and time measurements using astronomical observations, the true positions of the Sun and the Moon as well as planets, eclipse calculations, and also computer programmes doing the siddhantic calculations with some modern improvements. I have two criticisms to point out. The computer program are not accompanied by any statement of exactly what they are computing. The second point is that the geometrical figures could have been drawn more professionally.

If you were restricted to buying only one of these three books I would recommend the last one. In the ongoing controversy of whether astrology is a science, the astrologers often criticize the scientists for dismissing their subject without understanding it. So here BR presents the essentials of astrology in as systematic a way as possible.

He begins with the mathematical and astronomical works of the Vedic times and distinguishes it from the astrological inputs received later from the Greek and Babylonian traditions. (Thus the recent fuss by the UGC of teaching Vedic astrology is seen to be wrongly motivated as there was no astrological

thinking in the Vedas!) BR then gives the methods of constructing a horoscope which of course vary from North to South India and from India to Europe. Some ancient horoscopes are discussed, and BR shows, for example, that the claimed horoscope of Lord Rama is an astronomical impossibility. For, the angular separation of inner planets can never be as large as shown on the horoscope.

Apart from this shaky starting point, BR emphasizes the shakiness of various predictions especially in the context of Indian politics of recent decades. He has reproduced predictions from well-established astrologers side by side with what actually happened. The lack of predictive power evident from such cases would alone disprove any case astrology might have for being called a science. There are also discussions of sociological and psychological aspects of beliefs in astrology.

The author could have given some more examples of western tests of astrological predictions which have proved to be negative. Since Indian astrologers are quite capable of saying that western astrology is all wrong, there is need for controlled experiments to test the veracity of predictions of Indian astrologers.

Balachandra Rao is Principal and Professor of Mathematics of the well known National College, Bangalore, an institution that has produced a refreshing breeze of scientific temper against the prevailing stagnant air of superstitions and false claims. I hope that these three books will be well patronized.

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