

Astronomical research in India: I

Astronomy is the oldest of the natural sciences, its beginnings being traceable to the remotest periods of recorded human history. There is ample indication in ancient Sanskrit literature of the interest with which the subject was studied in India from the earliest times, while the later writings of Aryabhata, Varahamihira, Brahmagupta and of Bhaskaracharya, which have come down to us, show that astronomy was actively studied in India at a time when the lamp of learning lighted by the ancient Greeks had burnt out, and Europe was passing through the dark ages. The vicissitudes of Indian history in the later centuries of the present millennium were not favourable to the development and expansion of cultural interests. Some indication that active interest in astronomy nevertheless did not altogether disappear in India is furnished by the astronomical instruments of an earlier era which have been preserved to us, and by the curious structures known as Jaisingh's observatories which are still to be seen at Delhi, Benares and Jaipur.

During the three hundred and odd years which have elapsed since Galileo first directed his little telescope towards the heavens, the progress of astronomical science has been of the most spectacular character. This progress has largely been the result of the success achieved in making bigger and better telescopes. A study of the fascinating autobiography of John A Brashear—the American who loved the stars and made great telescopes for observing them—may be warmly recommended to anyone who is interested in the development of astronomical research in India. It brings home to the reader the extent to which the progress of astronomical science in a country depends on the existence in it of skilled opticians who can grind, polish and figure great lenses and mirrors up to the most exacting requirements. Without telescopes, interest in astronomy must languish, and without an active interest in astronomy, there obviously can be no telescopes in a country. That was the vicious circle which Brashear sought to break in a spirit of genuine altruism. The immense interest in astronomical science and the generous support accorded to it by wealthy men in the United States of America must, to no small extent, be credited to the influence of Brashear's life and work. The making of great lenses and mirrors is practical in optics on an engineering scale, and it is no accident that Brashear was a mechanical engineer before he became a maker of telescopes. The mounting and driving of telescopes is also mechanical engineering of a very exacting nature. In a modern observatory, the ton-loads of material making the telescope and its accessories move with the same accuracy and smoothness as the hands of a wrist-watch go round its dial. Optics and engineering are the handmaids of observational astronomy without whose services she cannot live and flourish.

It may be asked, why trouble about astronomy? Why spend money on making great telescopes and building great observatories? These are pertinent questions to which it is the purpose of this article to return an answer. My reply would be that an interest in astronomy is a part of the cultural heritage of India, and that we would be unworthy recipients of that heritage if we did not cherish that interest and do our utmost to promote the science. As has been truly said, man does not live by bread alone. Astronomy is not only the oldest but the grandest of the sciences. The interest which it evokes in all thinking and cultured minds is instinctive—an expression of man's desire to understand and comprehend the universe he lives in. Modern science is accused—perhaps not unjustly—of allying herself with powers of destruction and helping to make death-dealing weapons of all kinds. I do not know, however, of anyone who has had the hardihood of including the science of astronomy in such an indictment. Like all other sciences, astronomy is not without some practical applications—such as time-keeping and aid to navigation at sea—which have given it claims to support from public funds. But the real purpose of astronomy is very remote from such applications. Broadly, it may be described as the investigation of the nature of the physical universe. Defined in that way, we begin to realize that astronomy occupies the premier position amongst the sciences. Indeed, it may be described as a heaven-born river of knowledge which flows to the earth and fertilizes the fields of learning and culture. That this view of astronomy is fully justified will be evident to anyone who makes a comprehensive survey of the history of modern science during the past three hundred years.

As some of the outstanding results of astronomical research which have influenced the orientation of scientific thought, we may mention the discovery of the finite velocity of light by Romer, of aberration by Bradley, of the laws of planetary motion by Kepler, of the dark lines in stellar spectra by Fraunhofer, of helium in the sun by Lockyer, of the magnetic field in sunspots by Hale, and of the recession of the nebulae by Hubble. When we examine the structures of modern physical and chemical thought, we find that they are laid on foundations built out of the results of observational astronomy. *Vice versa*, observational astronomy calls to its aid all the resources of the experimental physicist, while astronomical thought and speculation have as their basis the well-established laws of experimental physics and chemistry.

It will be evident from what has been said that the organization of scientific research in India must be considered radically defective unless and until adequate provision is made for astronomical study and research of the highest grade in the country.

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