

Preface

Astronomy

Over the last several years, a number of large projects in astronomy have been approved by various funding agencies in the country and the Government of India. Some of these are national projects, while others are international in character. When ready, the projects will provide Indian astronomers unprecedented access to state-of-the-art facilities which will generate enormous quantities of data. The processing will require advanced data analysis and computing facilities, and many talented young investigators who will convert the numbers to new and exciting science in competition with their peers across the world.

This special section contains a number of papers which describe these mega-projects in a manner which should be accessible to the larger scientific community in the country and abroad. The large projects covered include AstroSat, which is the first Indian satellite fully dedicated to astronomy, the Aditya L1 mission for studying the Sun from space, the Thirty Meter Telescope (TMT), the LIGO-India Gravitational Wave Observatory and the Square Kilometer Array (SKA) radio telescope. Of these, AstroSat and Aditya L1 are Indian missions, with the former having some foreign collaborations; TMT and SKA are international projects located abroad with significant participation from India; while LIGO-India will be a large installation built and located in Maharashtra, with the sensitive laser interferometer being provided by LIGO Laboratories in the USA. The issue also includes papers describing the upgraded Giant Metrewave Radio Telescope (uGMRT), the 3.6 m Devasthal optical telescope, the Multi Application Solar Telescope (MAST), the National Large Solar Telescope (NLST) and the India-based Neutrino Observatory (INO). The first three telescopes have recently been completed and are being used for observations, the NLST is in advanced stages of the approval process, and the INO has been approved, but the construction is yet to begin.

AstroSat, Aditya L1, TMT and LIGO-India are described by several papers each covering the various aspects of the project and the science which will flow from it, while a single paper each covers the other projects. It should be clear from the papers that the projects, especially the larger ones, are industrial-scale undertakings. They necessarily involve close collaboration between astronomers, engineers and technologists, and industries, with the latter producing complex components in quantity and carrying out the major installations. Even where the project is located abroad, India will be contributing significant parts of the hardware and software, all of which

will be on the critical path of the project – unless the contributions are provided to stringent design specification and according to a tight schedule, the whole project will be stalled. This is challenging and requires careful project management, regular flow of funds from various agencies and excellent collaboration between the partner institutions in the country and abroad. Upon successful completion of the projects, the expertise developed in these matters should be an important benefit, not only to astronomy, but to all undertakings which require very advanced technology, extreme precision, and national and international partnerships.

The papers describing the projects do not cover, or do so only scantily, issues related to data management and analysis. Nor do they address the even more important task of human resources development. Without the availability of a large number of expert users, the scientific potential of the instruments will remain unrealized and the great investment in time and money would all be wasted. There are world-class experts in various institutions and some university departments already, but their numbers are relatively small and much needs to be done to ensure a steady stream of young persons into the projects. That can only happen by significantly increasing the involvement of the universities with the projects, and by encouraging IISERs, IITs and similar institutions to increase the number of astronomers in their departments. The young persons involved with the projects need not always remain tied to astronomy; they will have the expertise to be absorbed in many different professions and contribute in different ways to the national effort in science and technology. Perhaps these aspects can be covered in a future issue of *Current Science*.

I thank the authors for accepting my invitation to contribute to this issue and providing manuscripts (mostly) to schedule, referees for responding positively to my impatient demands on their time, and the editor of *Current Science* for cooperation. The idea of a special section in an issue of *Current Science* arose out of a discussion between Professors N. Mukunda and R. Srinivasan soon after the announcement of the first discovery of gravitational waves in February 2015; it was thought that the issue should cover not only the new discovery and LIGO-India, but other exciting new projects in astronomy as well. S. M. Chitre then put the Editor in touch with me. I am glad that I have been able to carry their thoughts forward, though at a much slower pace than they anticipated.

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— Guest Editor