

In this issue

Astronomy

Astrophysics has witnessed tremendous growth in the last few decades all over the world, thanks to several factors including the technological innovations which have allowed us to probe the skies better and deeper. India has participated in many of these developments and we now have a vibrant group of young astronomers and astrophysicists in this country. This special section concentrates on this topic.

An additional impetus for such a special section has been provided by the fact that the year 2009 has been declared as the International year of Astronomy by the United Nations. India is participating in the IYA-09 activities with different programmes. While most of the IYA-09 activities are aimed towards the public outreach and students, one cannot have meaningful science popularization without a strong indigenous research component contributing to the relevant areas.

The articles in this special section will also be useful in sharing the information about the progress made in Astronomy with people working in other areas of science through the readership of *Current Science*.

With this background in mind, I have put together a set of nine articles written by Indian astronomers covering a spread of topics in Astronomy and Astrophysics. These articles are broad-based reviews describing the recent developments and highlighting our country's contributions to the same. They range from description of observational facilities to purely theoretical areas at the forefront of research today.

The two articles by Dipankar Bhattacharya (**page 785**) and Jayaram Chengalur (**page 793**) cover the frontiers of Space Astronomy and Radio Astronomy, bracketing the two extreme ends of the electromagnetic spectrum. In Radio Astronomy

we can boast of one of the largest radio telescopes in the form of GMRT and Jayaram Chengalur has concentrated on the low frequency observations which form a significant research area in GMRT. In Space Astronomy, India is set to launch our own astronomy satellite ASTROSAT very soon and several research institutions are contributing to this effort. A closely related topic in X-ray astronomy is covered by Sudip Bhattacharya (**page 804**). Our understanding of high energy astrophysics, related to ultra compact celestial objects, has gone up significantly in recent years and Sudip describes this, concentrating on low mass X-ray binary stars.

At a larger scale, astronomy transforms into cosmology and the attention shifts to aggregates of stars which we call galaxies. Galaxy surveys give extremely valuable information about the way these structures are distributed in the universe. It is sometimes said that galaxies are the basic units in cosmology just as atoms are the basic units in solid state physics. From this point of view, one can think of galaxy surveys as cosmic crystallography. Somnath Bharadwaj describes the role of recent galaxy surveys and their findings (**page 821**). Another article in the extra galactic domain, by Tirthankar Roy Choudhury (**page 841**), discusses the inter galactic medium and its state of ionization which is providing us with valuable information about the processes in the high-redshift universe.

The three articles by T. R. Seshadri (**page 858**), L. Sriramkumar (**page 868**) and M. Sami (**page 887**) describe the leading research areas in cosmology and their current status. The cosmic microwave background radiation (CMBR) has taken the centre-stage in determining the evolution and parametrization of our universe since 1992 and lot more is expected in this front in the coming

years. Seshadri presents a comprehensive review of what we could learn from CMBR. The pattern of temperature fluctuations which we see in CMBR today is thought to be the relic of what happened very early in the evolution of the universe. If our models are correct, then the quantum fluctuations at very small scales have got transformed into classical density perturbations during an inflationary phase in the early universe, and have left their imprint in CMBR. Sriramkumar reviews the ideas behind cosmic inflation and how this transformation from microscopic physics to macroscopic physics takes place. Finally, Sami's article covers what many of us consider to be the greatest mystery about current universe – namely its weird composition in which nearly 70% of the energy density that drives the expansion exhibits negative pressure.

In this cosmic saga, one cannot forget our closest stellar companion, the Sun, which still offers intriguing new insights. H. M. Antia (**page 911**) covers our efforts to understand solar interior and how precise observations and exquisite modeling go hand-in-hand.

I have again tried to keep the average age of the contributors as low as possible! (It turns out to be about 43 years.) It is heartening to note that there is a very vibrant young community of astrophysicists in this country whose research work spans nearly every important area in which progress is being made. I should also add that this is just the tip of the iceberg and, in a special section like this, one could only hope to get a small representative sample of the activities which are going on in the country. I thank all the contributors for their effort in producing these articles.

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Special section on Astronomy