In this issue

Ocean research

Ocean research, as we know of it today, is generally considered to have begun with the *Challenger Expedition* 1873–76. Carried out using a British naval vessel, the expedition provided the first view of major features of the oceans. However, it completely bypassed the North Indian Ocean, the basin at India's doorstep. The world had to wait for the International Indian Ocean Expedition (IIOE) during the early sixties to learn how special this basin is. IIOE also marked the beginning of organized ocean research in India. During the last four decades this effort has generated new capabilities to observe the ocean and has provided new insights into its working. The special section 'Perspectives on ocean research in India' (**page 268–330**) provides a glimpse of the work that has been carried out. A major capability achieved in the country this year was the successful commissioning of the satellite IRS-P4, also called *Oceansat*, that has been built and launched by the Indian Space Research Organization. Desai, Honne Gowda and Kasturirangan (**page 268**) describe the importance of satellite-based sensors in observing the oceans. Satellites have made it possible to collect data that do justice to the temporal and spatial scales inherent in ocean dynamics. This is particularly important in the North Indian basin, where three factors – proximity to the equator, relatively small size of the basin, and monsoon winds – conspire to ensure an unique seasonal cycle. D. Shankar (**page 279**) discusses the dynamics that underlie this cycle. The dynamics also have implications to chemistry of the basin. One of these is formation of regions that are highly oxygen depleted. S. W. A. Naqvi and D. A. Jayakumar (**page 289**) discuss the implications of the low oxygen environment not only to the oceans, but also to the atmosphere. Chemical processes that occur in the oceans have shaped the climate of the earth. The oceans have been around pretty much in their present state of chemical composition during the last two billion years. There are signatures in the ocean of reactions that take millions of years. The signatures record variability of the ocean environment. B. L. K. Somayajulu (**page 300**) examines the reactions that lead to formation of manganese nodules on the floor of the ocean at depths of about 4 km, and what they tell us about the state of the ocean during the last few million years. Such studies, by revealing how the climate has changed in the past, provide important clues on what shapes the present. This issue is particularly important to India whose population is largely dependent on the monsoon for supply of freshwater. What role do the oceans play in year-to-year fluctuations of the monsoons? This question, that has fascinated both the oceanographer and meteorologist, lies at the cutting edge of global climate studies. S. Gadgil (**page 309**) provides an overview of what is known and what needs to be understood. Critical insights into what needs to be understood come from data. A new ocean observation system using buoys has been put in place recently by the Department of Ocean Development, Govt of India. K. Premkumar *et al.* (**page 323**) present the first results from the system.

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Sonoluminescence

It was a decade ago that Felip Gaitan working on his Ph D thesis at the University of Mississippi discovered the conditions for light emission from a single gas bubble trapped and driven by standing wave acoustic field. The remarkable thing about this phenomenon, which now has come to be known as Single Bubble Sonoluminescence (SBSL) is the fact that a tiny bubble of few microns in size is able to emit light which is visible to naked eye at a distance of million times its own size; for this reason in some quarters SBSL has been termed as 'Star in a jar'. Shortly after its discovery in 1990, Seth Putterman at UCLA taking a challenge from a colleague set out to unravel the mystery behind this phenomenon which now has attracted considerable attention. One of their first findings (*Nature*, 1991, **352**, 318) was that the SBSL flashes are of picosecond duration (more precise duration since then have been established) and the flash to flash synchronicity was also in the range of picoseconds. Shortly thereafter, the UCLA group found the SBSL spectra to be broadband with still increasing intensity at short wavelength at which strong liquid (in this case water) absorption begins. Another fascinating aspect of SBSL which they found (*Science*, 1994, **266**, 248) is that small amount of noble gas doping is essential condition for stable SBSL from gases like nitrogen and oxygen. It is fortuitous that air contains one per cent argon, otherwise the original discovery of Gaitan would not have been possible. Considering all these aspects many wondered whether there is some new exotic physics behind the full explanation for SBSL. However, this has been put to rest from a recent article by Hilgenfeldt, Grossman and Lohse (*Nature*, 1999, **398**, 402; it may be noted that the intended title of this article was 'Sonoluminescence under Occam's Razor', however was eventually published with a more straightforward title) where through ingenious use of existing laws and concepts they are able to predict most features of SBSL. In this issue (**page 238**) Hilgenfeldt and Lohse (H and L) give a lucid description of the SBSL phenomenon and their theoretical basis for predicting its physical characteristics. However, it remains to be reconciled as to how simple doping of H and L and quite exotic theory of Moss *et al.* (*Science*, 1997, **276**, 1398) can predict the experimental observations of SBSL like its spectra and pulse duration to the same degree of accuracy. In addition, another aspect of SBSL which remains to be answered is how a small doping of argon with nitrogen bubbles results in remarkable increase in intensity but the same is not true with hydrogen bubbles.

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