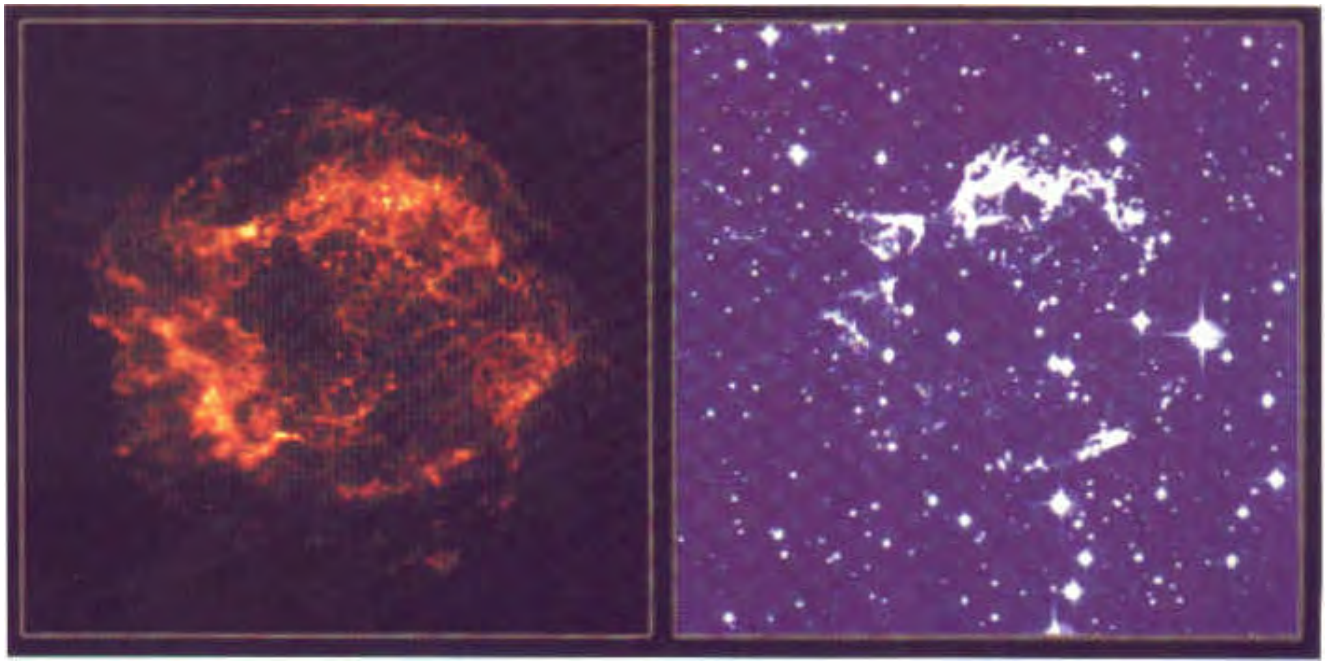

Figure 5. Composite image of X-ray and optical images of the shell-type remnant Cassiopeia A, a star that exploded about 300 years ago. The X-ray image on the left shows an expanding shell of hot gas at a temperature of about 50 million degrees, the shell diameter being about 10 light years. The image on the right is from an optical telescope.

addition to 'showing dramatic details of prodigious production of energetic particles from rapidly rotating magnetized neutron stars', one also sees features like shells
of hot gases produced by the explosions and puzzling structures. Gordon Garmire of Penn State University says, 'it is as though we have a set of Russian dolls, with structures embedded within structures'. These kinds of details 'namely the cores and the shells have never been seen before', according to Patrick Slane of Harvard–Smithsonian Center for Astrophysics.

HST, CGRO and now *Chandra* have been providing rich and new experimental findings. These may lead to an acceptable theoretical model of the universe.

Credits for these images are due to NASA (Marshall Space Flight Centre, Huntsville, Alabama), Smithsonian's Astrophysical Observatory (SAO) and Chandra X-ray Centre (CXC) at Harvard, Massachusetts. Kind permission from Education/Outreach Coordinator, CXC, for using these images is gratefully acknowledged.

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The Indian Astronomical Observatory*

The Indian Institute of Astrophysics (IIA) is developing a high-altitude field station, the Indian Astronomical Observatory (IAO), for optical and infrared astronomy. IAO is located on Mt. Saraswati, Hanle Ladakh, at 32°47′46″N lat., 78°57′51″E long., and 4517 m above mean sea level. The site was selected as a part of the Himalayan Infrared Optical Telescope (HIROT) Project which envisages building a large aperture telescope for the country. Based on a detailed study of meteorological data and satellite imagery, and site reconnaissance trips to six high-altitude sites in the Great Himalayan Ranges, the site at Hanle in the high-altitude cold desert of south-eastern Ladakh was chosen as the most prospective site. Figure 1 shows the Nilamkhul plain area with Mt. Saraswati. Site-characterization studies, being carried out since 1995 January, have proved that this site is among the best high-altitude sites in the world.

Considering that the site was remote and had minimal infrastructure facilities, it was decided to develop this site and, initially,

*A report of the workshop held during 15–16 April 1999 at the Indian Institute of Astrophysics, Bangalore.

install a smaller-sized telescope with remote operation facilities so as to gain experience before embarking on the project for installation of a large national telescope. It is proposed that by the summer of 2000, IAO will house a 2-m aperture optical near-infrared telescope with remote operational facilities, and a 0.5-m aperture robotic telescope. In the first phase, the 2-m telescope will be equipped with instruments for optical imaging and spectroscopy, as well as with near-infrared imaging. A 0.3-m aperture site-survey telescope already exists at the site. This field station has excellent potential for conducting optical, infrared and sub-mm-related astronomical studies.

A two-day workshop was held at IIA, Bangalore, on 15 and 16 April 1999, with the objective to catalyse development of some seminal ideas for possible research endeavours around the IAO, with special focus on the unique characteristics of the site: excellent astronomical seeing (Figure 2), low temperature and humidity (Figure 3) leading to a low infra-red background and high UV-transmission, the proximity of the 30° lat. of the solar quiet day magnetic variations field concentration and the descending hadley cell. All these conditions together with the relatively clean environment at Hanle –uncluttered by optical, chemical, and electromagnetic noise – render the site potentially advantageous for studying a host of significant natural processes and phenomena in areas of astronomy as well as in other areas, notably upper atmosphere, aeronomy, geomagnetism, geodynamics, and environmental sciences.

The workshop was preceded by advance dissemination of the characteristics of the site based on four years of continual monitoring, and first-order brainstorming sessions held at a number of institutions in the country, at the instigation of IIA. Thus, a number of ideas which had already been explored by various groups of scientists were already available for structuring the workshop in a purposive manner.

The meeting was well attended by scientists from various institutions all over the country: IIA, RRI, IUCAA, TIFR/NCRA, PRL, UPSO, Osmania University, NPL, VSSC and IIG.

The first session of the workshop, held on 15 April, was devoted to discussions of the site characteristics and infrastructure facilities already established there by IIA as well as facilities being made available in the near-future. The second session was devoted to overview presentations of the science programmes in the areas of galactic and extragalactic astronomy, with emphasis on multiwavelength studies. The purpose of these presentations, based on scientific interests at IIA, was to arouse

Figure 1. Mt. Saraswati at the centre of Nilamkhul Plain with distant mountain ranges in the background.

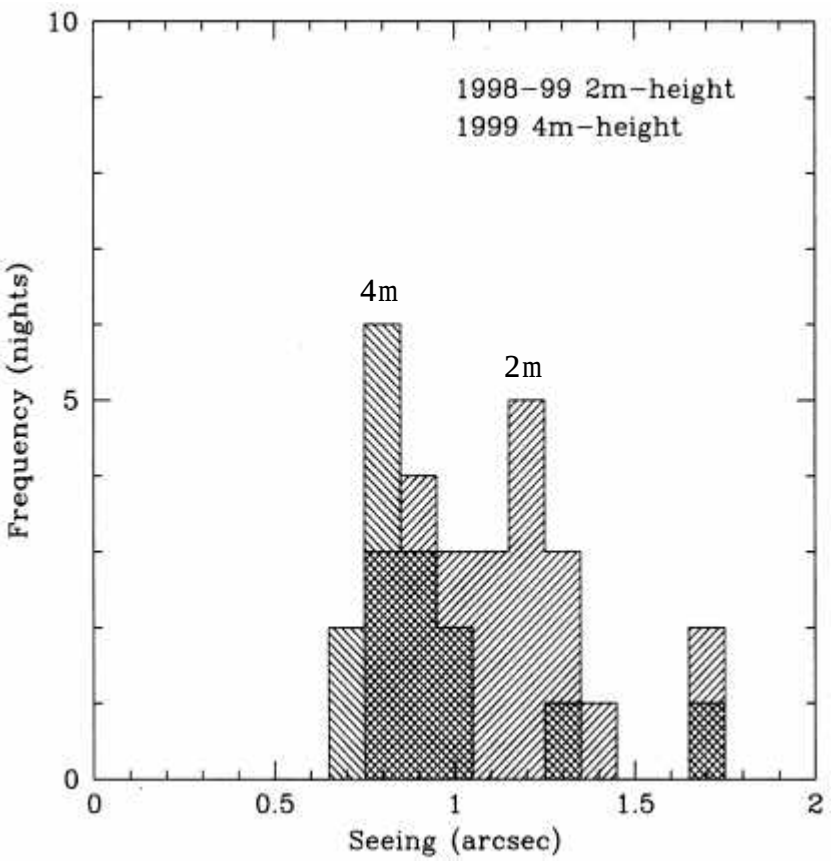

Figure 2. Histogram of nightly median seeing, measured at 2 m and 4 m above ground.

the interest of the larger astronomical community gathered at the meeting so as to further complement and add new dimensions to these programmes through wider participation of astronomers and astrophysicists around the country.

In the third session were the presentations and expression of views by scientists, from various institutions, who had been invited to help energize the workshop. This was followed by a concluding session of the day on 15 April, chaired by G. Srinivasan, and devoted to further exploration of the ideas/programmes discussed during the day. While summarizing the day's proceedings, G. Srinivasan made a number of points which need to be pursued and further encouraged to provide the nourishment required for sustaining expansive, multi-institutional programmes. In particular, he observed, 'this meeting represents an important watershed in our quest for more modern observational facilities for astronomy. Ten years ago there were several brainstorming sessions to arrive at a consensus to project a few major facilities as National Facilities –but consensus has eluded us. In my personal opinion, the astronomical community in

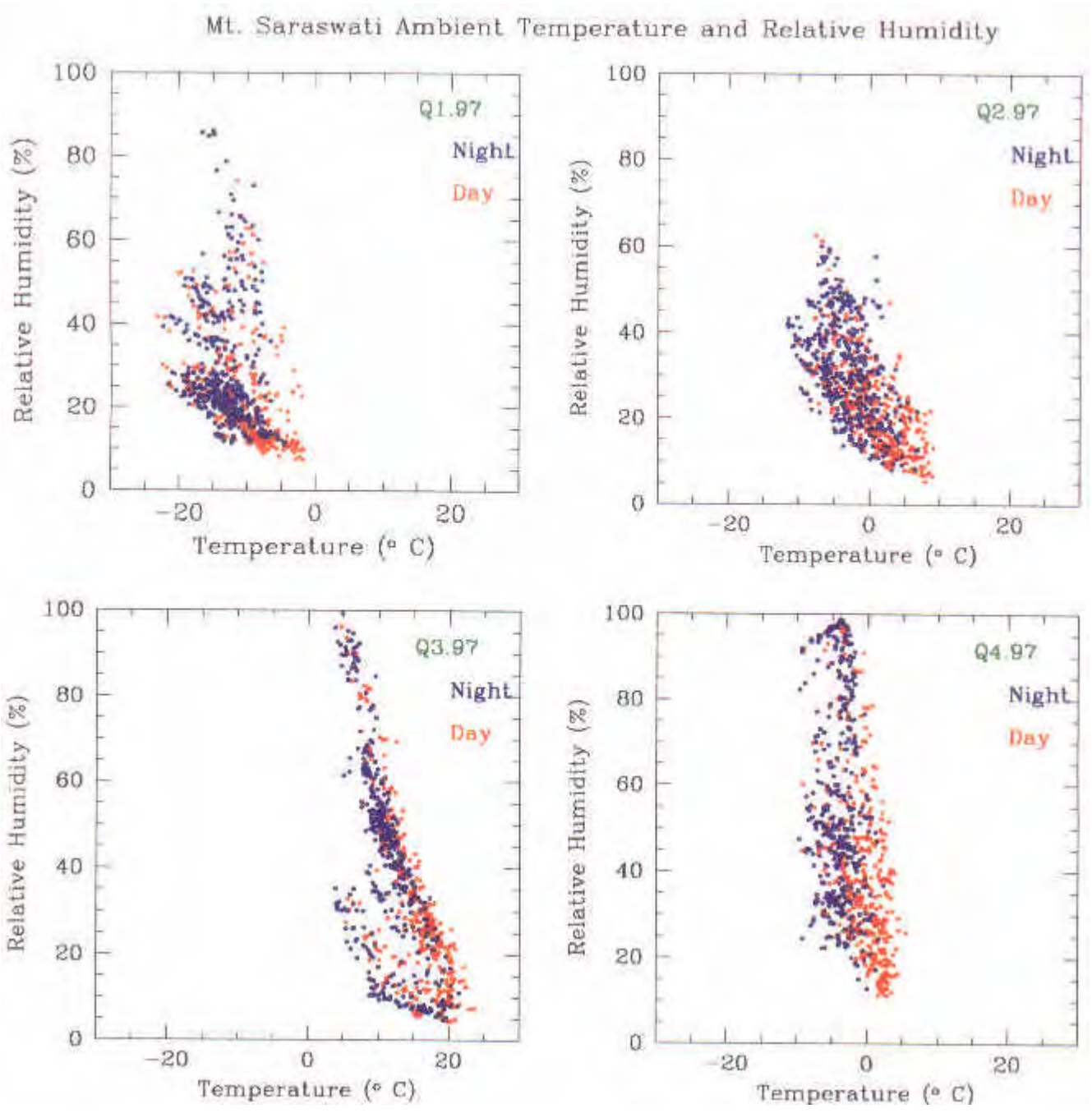

Figure 3. Plot of the ambient temperature and relative humidity during daytime (red points) and during night hours (blue points).

India continues to be fragmented and polarized. It is time to dissolve institutional boundaries, abandon wavelength-chauvinism and enter the modern era of multiwavelength astronomy!'

On 16 April, the workshop conducted programmes in areas other than astronomy and astrophysics discussed the previous day, which had been specifically conceived and designed to take advantage of the special attributes of the Hanle site. After a thorough going discussion of the proposed programmes it was felt that while some of these programmes, requiring substantial additional new inputs, will need to be projectised for a longer term funding, a few of these could be taken up straightaway for the first-stage implementation in the summer of 1999. These programmes include: solar studies—exploratory attempts; development of a multiwavelength solar radiometer; studies on atmospheric transparency at 220 GHz; optical imaging of mesospheric gravity waves; environmental monitoring of O_3, H_2O, OH, aerosols, solar UV; magneto-telluric studies and broad-band seismology for delineating the deep structure of the region; and GPS geodesy to understand the kinematics and dynamics of continental deformation zones.

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PM asks IAEA to 'return to fundamentals'

In his Statement* to the 43rd General Conference of the International Atomic Energy Agency (IAEA) at the end of September, R. Chidambaram, Chairman, AEC read a message from Prime Minister Atal Bihari Vajpayee which asked the Agency to 'ensure that we leave behind a legacy, not a liability, for future generations . . . by returning to the fundamentals, shorn of all rhetoric and verbiage and by acknowledging that the primary function of the Agency is to encourage and assist research, development and practical applications of atomic energy for peaceful purposes throughout the world'.

Chidambaram castigated the IAEA for becoming 'diffident on nuclear power related matters, perhaps influenced by the environment in which it is located, where power generation, having reached a point of saturation, finds it difficult to find support for new nuclear plants. However, while nuclear power may be stagnating in Europe and North America, it is growing fast in Asia and some other parts of the world where it is being looked upon as an inevitable option to satisfy future energy needs.'

'Nuclear power becomes even more relevant in the context of global environment considerations. Presently, it accounts for the avoidance of 8% of global carbon dioxide emissions. It is unfortunate that the Kyoto Conference on the Convention on Climate Change did not explicitly mention "nuclear" among the cleanest sources of energy despite the Agency's efforts in recent years in projecting nuclear energy as one of the means for mitigating carbon dioxide emissions under the Clean Development Mechanism (CDM) evolved under the Kyoto Protocol of the UN Convention on Climate Change.'

Pointing out that spent fuel is 'a resource, and not a waste', Chidambaram added, 'Mature technologies for reprocessing, waste management and recycle of plutonium have been demonstrated and are available. Progress is under way (in India) on the thorium–uranium 233 cycle also. In this context, it is worth mentioning that because of our great interest in the closed nuclear fuel cycle, we have always considered spent fuel as a vital resource material. This was emphasized by us during the negotiations on the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The closed fuel cycle, adopting a "reprocess to recycle Pu" approach after extended period of spent fuel storage, has several advantages. It renders reprocessing and nuclear waste management a more viable and safe technology, with reduced Man–Rem expenditures, since it minimizes the complication due to the presence of Americium-241 in the recycled fuel fabrication process. The planning of reprocessing capacity should be such that the needs of the fast reactors/advanced PHWR, etc. which facilitate the utilization of plutonium and thorium, while reducing the input of natural uranium (in the process realizing the much higher energy potential of uranium) can be met on "just in time" basis, which is a very important concept in materials management. Americium is not of any proliferation concern and this has also been borne out by the Board's recent decision in this regard.'

*The full text of Chidambaram's Statement is available at http://www.dae.gov.in/gc.htm