The violet universe

Early 2009 will see the culmination of the ambitious Tel Aviv University Ultraviolet Explorer (Tauvex) project. To be launched on-board the GSAT-4 from Sriharikota by ISRO, the ultraviolet (UV) space telescope is a scientific collaboration between Tel Aviv University and the Indian Institute of Astrophysics (IIA), Bangalore.

Originally initiated in the 1990s as a collaborative project among several countries under the leadership of the former Soviet Union, the project was stalled with the dissolution of the Soviet Union. However, the project was revitalized in 2004 when the Israeli Space Agency (ISA) reached an agreement with ISRO regarding the telescope launch.

Tauvex will observe the universe at wavelengths between 130 and 320 nm.

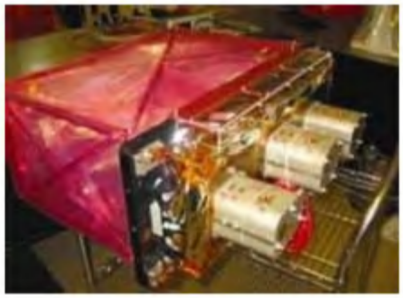

Figure 1. The Tauvex instrument.

These high-energy ultra violet (UV) radiations from outer space cannot be observed from the ground as they are largely absorbed by the atmosphere. With a wide 54 arcmin field-of-view, Tauvex will have a much broader field-of-view than other space UV telescopes like the Hubble. However, compared to the higher resolution that the Hubble telescope is capable of, the spatial resolution of Tauvex will be moderate, and depending on the wavelength will be between 6 and 10 arcsec.

Tauvex will augment our understanding of several important areas of research. One of the main scientific goals of the experiment is the study of the interstellar medium which is the region between stars. The interstellar medium is made up of gas (99%) and dust (1%), and is the birthplace of new stars. These new and young stars are hotter and hence emit more UV radiation. Subsequently, the UV radiation is scattered by the dust in the interstellar medium. By observing and studying the scattered radiation, information can be gleaned about the interstellar medium itself. With its wide field-of-view and two-dimensional imaging capability, Tauvex will be especially capable of detecting diffuse radiation. The wide field-of-view will also uniquely facilitate the study of large nearby galaxies.

Tauvex will be placed in a geosynchronous orbit, i.e. the same areas of the sky will be scanned repeatedly. This will make possible the study of variable stars.

The hardware for the telescope, being built in Israel, consists of the optical module and the electronic module (Figure 1). The optical module has three identical UV telescopes. The telescope will sit on a motor-driven, rotatable platform which will enable observation over the entire celestial sphere. However, there will be a limitation to this as the telescope will also pick up radiation scattered externally by the satellite and internally by the instrument itself, and this could interfere with observations.

The software for the instrument is being largely developed at IIA. According to Jayant Murthy (the IIA Principal Investigator), observing proposals from the Indian community – whether professional or amateur – are welcome. He expects the launch to happen sometime between January and March 2009. For more information, visit http://tauvex.iiap.res.in/

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MEETING REPORT

Seismic hazard in Asia*

A workshop of an international network project on seismic hazard in Asia was organized recently by C-MMACS in Bangalore. Around twenty delegates from ten countries participated in the workshop. This network project had been approved by the Abdus Salam International Centre for Theoretical Physics (AS-ICTP), Trieste, Italy and the Council of Scientific and Industrial Research (CSIR), New Delhi under the leadership of Imtiyaz A. Parvez (C-MMACS, Bangalore) and Giuliano F. Panza (University of Trieste, Italy). K. R. Sreenivasan (AS-ICTP) through the Office of External Activities (OEA) and his own office provided funding for this event.

The project started in late 2006 with its first meeting/workshop held at AS-ICTP, Trieste[1] during 4–8 December 2006. This network project is aimed at pre-disaster planning: prediction of expected earthquake effects in important cities of Southeast Asian countries, in order to reduce the possible impact of large earthquakes. The prediction involved two steps. The first step is to define the most probable earthquake (or in some cases, the great earthquakes) that can affect a particular city, i.e. seismic hazard assessment (neo-deterministic or probabilistic) expressed in values of expected seismic effects for a particular kind of soil at a regional scale. The second step is to evaluate how this regional estimation varies throughout a city that in general is placed in a sedimentary basin, where local incremental effects are commonly present.

The workshop was inaugurated by A. R. Upadhya (National Aerospace Laboratories (NAL), and SIC of C-MMACS, Bangalore). Ramamohan welcomed the

*A report on the second meeting/workshop of an international 'Seismic Hazard in Asia'. The meeting was organized at C-MMACS, Bangalore during 31 March–11 April 2008.

delegates and gave a brief history of C-MMACS. Parvez presented the origin of the network project and the importance and progress of such a network in the Asian region, which is under high seismic threat. The geological system starting from Hindukush to Andaman and Nicobar through the Himalayas is quite complex and covers many political and national boundaries. He also welcomed the three new members in the network, one each from Indonesia, Thailand and Philippines respectively. Upadhya spoke about the seismological complexity of the region, and the past catastrophic events that occurred in the Asian region. He also emphasized on the importance of working together and integrating the findings from all the participating countries in order to mitigate the impact of such catastrophes. Romanelli welcomed the delegates on behalf of Panza and also mentioned about the ongoing network project in North Africa and Latin America.

The first two days of the workshop were devoted to presentation and review of the work done under the project. Participants from each country presented their findings and the problems to be tackled in the network. The rest of the ten days resulted in preparation of the inputs for each region and extensive computations of hazard parameters. The following problems were tackled during the workshop:

(1) Neodeterministic seismic-hazard assessment.
(2) Microzonation studies in megacities of Asian countries.
(3) Intermediate-term earthquake prediction using CN and M8 algorithms.
(4) Identification of earthquake-prone areas with morphostructural zoning and pattern recognition.

The first-order neodeterministic seismic hazard map and seismic inputs of China, Bangladesh, Nepal, Indonesia and Bangladesh were prepared during this workshop. Such a map for India and the adjacent areas has been already published in 2003. The participants from India, Vietnam and China also worked on site-specific seismic hazard of cities like Delhi, Beijing, Dalian, Hanoi, etc. The participants from Indonesia, Nepal and Vietnam also worked on intermediate-term earthquake prediction using CN and M8 algorithms and pattern recognition.

For the Indian scenarios, the first-order high resolution neo-deterministic seismic hazard map has been prepared for the Uttaranchal region using the updated knowledge of crustal structure, seismogenic zone and newly compiled earthquake catalogue. The bedrock-level ground motions have also been simulated for Delhi city using size-scaled point source (SSPS), space and time-scaled point source (STSPS) and extended source (ES) models from the Himalayan and regional earthquakes. Site-specific hazard study along the north-south geological cross-section of Kolkata city was carried out to be used for microzonation. A similar study has been carried out for the Silchar basin.

For China, the first-order neo-deterministic seismic hazard map to the northwest part of the Chinese territory has been prepared. The earthquake bulletin of the whole of China was collected. The bulletin includes the earthquake events from the year AD 43 till March 2008, with magnitude equal to or greater than 5. The final map shows the maximum designed ground acceleration of 0.569 g, maximum velocity 120 cm/s and maximum displacement of 60 cm. Seismic zoning of Dalian city, China was taken up during this meeting and computations have been done at regional and local scale using different earthquake scenarios. Based on these results, the maximum displacement was about 3.4 cm, velocity 5.3 cm/s, and acceleration 0.107 g using regional potential seismic areas with 10 Hz limitation and 0.2×0.2 grid. These estimated parameters are consistent with the parameters used in China now. Hence, these results prove that the present design parameters are reliable for structural aseismic design.

For Vietnam, the first-order neo-deterministic seismic hazard map has already been prepared and has been improved further using updated knowledge of crustal structures. For the first time, the modelling approach was applied for estimating the local site-effects in Hanoi city, Vietnam. The results obtained for downtown Hanoi from the simulation of synthetic seismograms using 2D model show the value of maximum acceleration to be around 53.28 cm/s^2 for the vertical component and 50.11 cm/s^2 for the transverse component, which is about two times higher than the PGA value calculated for the same area using the probabilistic method. The determination of the spectral amplification at a certain site plays a significant role in seismic engineering, as the amplification factors indicated in building code are usually limited for a fixed range of ground-motion values and for certain soil types.

For Nepal, the seismic hazard from the Himalayan region is relatively high due to frequently occurring moderate to large-sized earthquakes. The preliminary seismic hazard of Nepal has been estimated using neo-deterministic method in terms of peak ground motion values such as displacement, velocity, and designed ground acceleration for shallow focus earthquakes. Computation of synthesis seismogram from six delineated seismogenic source zones and two structural zones has been done. This study is still under refinement as the great earthquakes ($M > 8.0$) will be used independently for computation and the results will be superimposed on the existing hazard map.

For Bangladesh, Indonesia, Philippines and Thailand, seismic inputs have been prepared. There are issues with the crustal structure, seismogenic zones and earthquake catalogues, which have been discussed. The members of these countries have tried to generate some inputs readily available and will prepare the rest before the next workshop. However, they were given training with the existing sample dataset, computer codes and tutorials. The participants were also given training on intermediate-term earthquake prediction using CN and M8 algorithms and identification of earthquake-prone areas with morphostructural zoning and pattern recognition by a series of lectures and tutorials from Igor Kuznetsov (Russia).

The workshop ended on 11 April 2008 with a valedictory function organized at C-MMACS.

1. Parvez, I. A. and Panza, G. F., *Curr. Sci.*, 2007, **92**, 715–716.

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