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Astronomy in Vietnam

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Abstract. In this paper we summarize the history and current state of astronomy in Vietnam. Future plans for the development of astronomy education and research in Vietnam are summarized and some avenues suggested. These include the construction of a planetarium in Hanoi, and the development of a curriculum for an undergraduate major and a Master's degree in astrophysics at some Universities, as well as the development and operation of an observatory in Hanoi.

Keywords. Astronomy, developing countries, education, Vietnam

1. Introduction

Vietnam has a long history of teaching humanities. It is a country with high respect for a culture that is deeply rooted in its traditions. At the time of the Vietnamese feudal dynasty, there were some offices for research in astronomy and the maintenance of a calendar. The first observatory was not built in Vietnam until the 20th century. It was located at Phu Lien, Hai Phong province about 120 km from Hanoi on a beautiful site near the sea. In addition to astronomy, geophysical and meteorological observations were made there. Before 1950, astronomy was officially taught in the last class of secondary school. In war time, however, in order to shorten the education programme, astronomy was no longer a compulsory course for secondary schools. That situation remained unchanged until two years ago.

Since 1975, astronomy has developed in many regions in Vietnam, but it is still rather unconnected. Most Vietnamese astronomers have little opportunity to improve their knowledge and keep up with the field and some have moved on to other fields. After the first visit to Vietnam was made in 1991 by Professor Yoshihide Kozai, the former President of the IAU and a former director of NAO of Japan, the Vietnamese Astronomical Society was created. Since then Vietnamese astronomers have begun to communicate with each other to improve on astronomical research and education. Also since that time, and with the help of support from the IAU, there are now many activities underway to develop astronomy in Vietnam.

2. Support from the IAU and the international community

After visits to Vietnam were made by many foreigner professors of the IAU, the Vietnamese Astronomical Society received a number of facilities from several countries. Vinh University received a 21-cm refractor telescope from the Royal Astronomical Society of Canada with the help of Prof. A. Batten, and three telescopes from Nishi-Harima Astronomical Observatory arrived with the help of Prof. T. Kogure. A planetarium with a capacity of 100 seats and a projector were received as a Cultural Grant-in-Aid from

Japan through the support of Prof. Kitamura. With the help of Prof. Y. Kozai, the Hanoi National University of Education also received a 40-cm Meade Schmidt Cassegrain telescope (computer-controlled with a CCD ST-7) and a 10-cm Takahashi reflector with an H-alpha filter from the Sumimoto Science Foundation of Japan. A small solar radio interferometer was also donated by Prof. Nguyen Quang Rieu. The University of Education in Ho Chi Minh City has also received a 20-cm telescope and a CCD through the support of Prof. Y. Kozai and the Gunma Observatory. In addition, a PC, printer, and slide projector have been received and a number of books and journals have been sent to many universities in Viet Nam.

The main teaching task for astronomy faculty members in the various Vietnamese universities of Education has been to train the teachers for the on-going compulsory astronomy courses. Teachers' workshops have been organized which gradually introduce up-to-date astronomical topics and review the associated physics. Through the TAD programme of IAU Commission 46, some summer schools and workshop from 1997 to 2003 have been organized in Hanoi, Vinh and Thai Nguyen for faculty members and physics students. Annual workshops on the 'Teaching of Astronomy' have been organized. These are intended for astronomy teachers at universities, for graduate students who expect to start a career in astronomy, and for secondary school teachers with experience in teaching astronomy. Besides the support of the IAU, there have been help and collaboration from the University Paris 6, Observatory de Paris, University of Notre Dame and the conference series 'Rencontres du Vietnam' to organize some courses on astrophysics for school teachers and students. These were held at the Hanoi National University and the Hanoi National University of Education in 2004 and 2006. These activities were very useful for both the university lecturers and school teachers. They have provided a chance for these teachers to update their knowledge on astrophysics and to communicate with foreign faculty. Through these astrophysics courses a few students have the chance to study astronomy at a more advanced level. Especially important is that through these activities Vietnamese astronomers have been able to select the best students and send them abroad into MSc and PhD programmes in astronomy. At the present time there are five students who have completed their PhD in astrophysics, but some of them are still doing postdoctoral research in the USA, France and Taiwan. There are also other students who are still doing their PhD work in the USA and France.

The Vietnamese Astronomical Society has highly valued the assistance of the IAU for the development of astronomy in Viet Nam via TAD and other programmes. Thanks to these programs, some astronomers and teachers have had the opportunity to study and to improve their knowledge. Universities have also received telescopes along with many books and journals. Through this generosity the quality of astronomy teaching at Vietnamese universities has significantly improved and some of our best students are being inspired to careers in this fascinating subject.

3. Some activities for astronomy development

3.1. *Education and outreach*

After more than ten years of offering this opportunity to the Ministry of Education, secondary school students now have a chance to know and understand astrophysics – a field that is still very new for everyone in Vietnam. Vietnamese astronomers have written an astronomy textbook appropriate for the course on the astrophysics to be required in the natural sciences branch of secondary schools. A 10th grade course on Kepler's laws and a 12th grade course on the introduction to the Solar System, Galaxies and Cosmology

has been approved for the natural science branch of secondary schools. Also, there are three specialized subjects for the 10th, 11th, and 12th grade on the celestial sphere, telescopes, and astrophysics.

Almost all of the Universities of Education in Vietnam have a curriculum of astrophysics courses for undergraduate students in physics who plan to start a career in astronomy and become teachers. There is a course on fundamental astrophysics with 60 class-hours on theory and 15 class-hours for observation with small telescopes for the 3rdh year students. Especially in the Hanoi National University of Education which has the 40-cm telescope, there are two courses on astrophysics, one is on fundamental astronomy for the 3rd year students with 60 class-hours and the other is astrophysics for the 4th year students with 60 class-hours plus a lab for observations. Every year, each of the universities selects about 5 to 10 senior students to do research and write their theses in astrophysics. Although these students are very interested in astrophysics, they cannot study for an advanced MSc or PhD degree because Vietnam still has no graduate degree programme in astrophysics. Since the 1970s to 1980s there was only one graduate student with a major in astrophysics and another twenty PhDs who were trained in Russia and Eastern Europe. By now, however, they have moved on to different fields and different regions in Vietnam. In the following decade, no one could get a PhD in astrophysics or astronomy. The number of PhDs since 2000 is very small. Therefore, no university can attract enough students and faculty to create a graduate degree programme in astrophysics.

The task of developing astronomy research and education in Vietnam is still very difficult. We really very much need more support from the IAU and other countries to train professional astronomers. At present, Vietnamese universities train future school astronomy teachers and provide small telescopes for observations, carefully selected books, journals for their libraries, and effective materials for audio-visual and hands-on presentations. Universities also provide access the internet, so as to optimize this facility for aiding Vietnamese astronomy. Many universities have a website in astronomy, Astronomical dictionary and a popular Astronomy Bulletin have also been published. The activities of the Vinh Planetarium has been much improved by the addition of two shows which were donated by the Davis Planetarium (Baltimore, USA) as well as many DVD videos. A new text book 'Astrophysics', was printed in 2000 and re-published 2002 and 2003, in Vietnamese and English on facing pages. That, together with books, journals, and educational software are the main resources for the teachers.

A national professional workshop on 'Astronomy and Culture' was held in Hanoi in 2003 in order to disseminate astronomical knowledge and dissipate mysticism among the Vietnamese people. The Vietnamese Astronomical Society collaborated with VTV3 of Vietnamese Television to carry out TV programmes on astronomy in order bring astronomy to everyone and everywhere in Vietnam. The telescopes in Hanoi and Ho Chi Minh City universities provide an opportunity to impart knowledge to science students on the nature of science, the role of measurement, and the need for judgement regarding the quality of data and reliability of their interpretation. When there is any event such as an eclipse, or a transit of the Sun by Venus or Mercury, the observatory at the Hanoi National University of Education always organizes observations for students and anyone who has a passion for astronomy. The 40-cm Meade Schmidt Cassegrain telescope is large enough that students can experience the excitement of scientific inquiry by participating in observational research projects. But the observatory is located in the centre of Hanoi city and a CCD is the image detector, so it is still limited as a resource to observe and analyze data. On the other hand TAD sent one staff member to the Gunma Observatory, Japan for a few months. That was very instructive,

but it was still not enough time for him to obtain advanced knowledge on observing techniques.

Nowadays the Vietnamese young people are very interested in astronomy and astrophysics. So there are some amateur Clubs of Astronomy in Vietnam. The members of these organizations are comprised of not only physics and astronomy students. They are from almost all universities and high schools in Vietnam. They organize annual activities such as seminars, and field trips for outdoor observations with small telescopes. They have created a website with fundamental knowledge on astronomy for college and high school students.

The project of the building of a planetarium in Hanoi was started a few years ago with the support of the French government, but is not yet completed. Hanoi is the capital of Vietnam with three million people, so the planetarium will be very important and as a means to bring astronomical knowledge and excitement to the public.

3.2. *Some activities on research*

A National Committee on Space Technology Research and Applications will be established in Viet Nam in the near furture in order to organize, supply concrete guidance, and carry out the strategy of Space Research and Applications until 2020. Together with this National Committee, a National Institute of Space Technology will be established. Training courses for professionals in Space Technology, including telecommunications, and satellite applications, is a main objective of the laboratories on Space Technology etc. The building of an infrastructure for Space Technology involves a center for receiving and analyzing satellite images; a satellite positioning station system, launching and using of the VINASAT geo-static satellite in 2008; the receiving of technology transfer on small satellite technology; completing the design, manufacturing, and launching of a small Earth observing satellite and corresponding control centers on Earth. The centre will also cooperate on research and training with countries having advanced Space Technology; and work on the manufacturing of some hardware and software. The objective is that by 2020, Viet Nam can build advanced Earth stations; have the capacity for small satellite manufacturing technology; can design and manufacture small satellites to observe the Earth; have its own rocket technology, and have a high quality staff. Remote sensing technology had been introduced into Vietnam since the 1980s and has progressed significantly. Application fields at various line agencies are mostly in land use and land cover mapping, environment monitoring, management and assessment, topographic mapping, disaster prevention, and geology, among others. Some projects are being set up at the Ministry of Science and Environment to apply remote sensing for land use, land cover, and mapping of the whole country by 2005. In addition, several research projects at the National Centre of Science and Technology of Vietnam address natural resources management and environment impact assessment.

Recent astronomical research in Vietnam has concentrated on preparing ephemerides, conducting astrometry, studying the motion of artificial satellites, and assisting surveys of the Vietnamese territory. Astronomers have published primarily in Chinese, Russian, and Eastern European journals. Some have written books on astronomy and astrophysics for use at the university and high-school levels; for the dissemination of astronomical knowledge; and for use in practical problems in astronomy. The analytical theory of the motion of Earth's artificial satellites and stellar astrometry are the main themes of research in astrometry in low latitude. They are studied at Vinh University. Some research has been published in Acta Astronomica Sinica (P.R. China) and the Russian Astronomical Journal.

With the facilities at the Hanoi National University of Education we have done some research such as:

- UBV photometry: Using the 16-inch LX 2000 filter with UBV photometry and CCD ST-7, CFW - 8 and RGB to do some research on stars, clusters, galaxies, and proto-planets.
- Solar observation is another possibility. In Vietnam we have places where there are more than 200 days of sunshine yearly and a large number of days when the Sun's latitude at noon is higher than 60 degrees. With the new period of solar maximum starting from 2007, we can use telescopes with an H-alpha filter and a 16-inch LX 2000 solar filter to photograph, analyze and study solar activity.

The theoretical astrophysics group in Hanoi National University of Education has support and collaboration with the Center for Astrophysics and the Joint Institute for Nuclear Astrophysics (JINA) at the University of Notre Dame, USA.

One research topic is on some candidates for self interacting dark matter (SIDM) in unified theories beyond the standard model of particle physics. To test this we are developing calculations of smoothed-particle hydrodynamic simulations of galaxy and large-scale structure formation in the universe. In another project this work also shows promise toward an accurate formulation of the effects of local inhomogeneities on the expanding universe. We also have done research on the possibility that a cosmic bulk viscosity can be produced from dark matter decay which could solve the important dark energy problem of the universe and we have researched possible particle-physics candidates for this decay. Another project involved studies of the possible evidence for white dwarf stars with strange matter interiors (strange dwarfs). Some results on these research topics have been published in Europhys. Lett. and the J. Phys. G; and Astrophysics and Space Science.

The cosmic ray group at the Institute of Nuclear Physics is a part of the international Pierre Auger Project. A lot of papers in this field have been contributed by this group. At the annual International conferences on Astrophysics and Cosmology from 2000 to 2006 of the 'Rencontres du Vietnam', there have been good opportunities for Vietnamese scientists to obtain up-to-date information and to communicate with other scientists around the world.

4. Conclusion

After more than fifteen years of effort to develop astronomy in Vietnam with the support of IAU. Astronomy in Vietnam has step by step made some progress in education and research on Astronomy. But it is still very far behind the developed world. Astrophysics involves fields which are very important for research, study, knowledge and culture. It is a part of modern physics so Vietnam sincerely wishes to have a graduate degree programme in astrophysics at least at the master's level, but we still do not have enough professional people in this field. To develop astronomy in Vietnam we will need more help and donations from the IAU and other organizations to complete the building of the planetarium in Hanoi to help gain popular acceptance an knowledge of astronomy. Also, the further training of professional astrophysicists both here and abroad is very important for us to facilitate the development of research in astrophysics in Vietnam.

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