

## VATLY NEWSLETTER

*Whenever objectivity, truth and justice are at stake, a scientist has the duty to form an opinion and defend it*  
*Jacques Monod*

### PLEASE NOTE OUR NEW COORDINATES

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### NEWS FROM THE LABORATORY

*Under this heading we review briefly the progress of the work of the team and the main events in its life.*

For now seven months we have been the Department of Astrophysics of the Vietnam National Satellite Centre (VNSC) in the Vietnam Academy of Science and Technology (VAST). We are pleased with this move, which offers us an environment much better adapted to our work and dreams.

Diep is now officially the head of the team, which means for him new responsibilities. They include taking part in the life of the Centre together with other department leaders, attending meetings and other tasks of this type as well taking care of the smooth running of the team. One of the first problems that faced us was related with the participation of Vietnam in the International Astronomical Union (IAU). We had discovered that the official Vietnamese contact with IAU was the Vietnamese Astronomy Society, which had been inactive for years and had failed to pay its yearly fee for four successive years. As a result, IAU, which has been helping us a lot with support to attend schools and conferences, was threatening to exclude Vietnam from its membership (Vietnam was not a full member, just

a kind of associate member). We then took the opportunity of joining VAST to ask Pham Anh Tuan, head of VNSC, to make VAST the new IAU contact and make sure that the fee would be paid each year. This stirred up a hornet's nest, with the Astronomy Society suddenly waking up, his new chair Dinh Van Trung recruiting new members around (including all of us, who were previously excluded) in order to collect enough money to pay the fee and keeping its status as IAU contact. What matters is that the fee has now been paid and the Astronomy Society will hopefully become an active and visible body, useful to our community. Not much has happened yet, but we are pushing in this direction, in particular asking for the organization of regular information meetings, the creation of a website (for which we offer our help), etc. A second task that fell on Diep's shoulders was the production of a report on a possible future national radio astronomy facility, which was asked from us by the VNSC Directorate. He reports about it later in the issue. We are impatient to hear the response to our recommendations, some of which mean a change of style in traditional Vietnamese practice. A third major task that Diep had to face, was our involvement in existing framework cooperation agreements, in particular with Japan, South Korea, France and Belgium. Nhung reports about it later in the issue. In this context, we had the visit of the director of the National Astronomical Observatory of Japan (NAOJ), Pr Masahiko Hayashi, which Diep organized. He also maintains close contacts with Young Chol Minh, from South Korea, who is active in helping us with support to attend schools or conferences and to pay short visits to Korean research teams. Yet, in spite of such administrative and executive load, Diep manages to find the time to do research. Together with Pierre, Phuong and a USTH student (Hoang Thanh Dat) on internship with us, they are working on a general article addressing in a systematic way the subtleties and intricacies of reconstructing the space properties (density, temperature and wind velocity) of the gas envelope of evolved stars from the observation of their radio emission at millimetre wavelengths. Hoai says more about this below.

Nhung, sharing with Diep the responsibilities that lie with being a senior team member, spends much of her time helping him as

well as guiding and advising the younger members in their research work. Having triggered our interest in the study of an AGB star, EP Aqr, she played a leading role in the analysis we made of its CO observations and she put together the final article, of which she is the first author, which has been accepted for publication in A&A. This is an interesting star, which seems to display spherical symmetry and had been described as such by previous authors. We revisited their analysis by showing that the star could as well be described as featuring a bipolar outflow while being seen pole on. In the context of broadening our understanding of evolved stars, Nhung has been making an inventory of relevant observations archived by ALMA under their open access policy, a policy highly valued as giving us access to data of unprecedented quality in millimetre and sub-millimetre radio astronomy. Such is not the case of IRAM, unfortunately. We repeatedly asked their governing body for access to archived Plateau de Bure observations, but did not receive any answer from them. Our interest in analysing archived ALMA data has been given a strong support by Tuan Anh, who organized a series of lectures teaching us how to reduce ALMA data to a form amenable to physics analysis.

Indeed, Tuan Anh kept a strong interest in the study of high redshift galaxies and looked into new ALMA data of relevance. He is currently exploring the possibility of spending a year or so in Japan, in a team of astrophysicists working in this field and using ALMA data. He paid a short visit to them in early July and applied for a fellowship. Recently, a new opportunity arose with the participation in a Flanders-NAFOSTED cooperation agreement. A team from Gent University, interested in the study of high redshift gravitationally lensed galaxies, offered us to collaborate. They are using Herschel data, in the far infrared. We are seizing the opportunity, with Tuan Anh on the front line. While having obtained his PhD degree from France at the end of last year, he still had to give a final presentation of it in order to obtain his Vietnamese degree, which he did at the end of July, with much success.

Thao took the responsibility of the reinstallation of our small radio telescope on the USTH roof. It is now completed. The idea is to use it to train students. We keep close contact with

USTH and in particular with the Master *Space and Applications* and its head, Yannick Giraud-Héraud. Yannick paid a visit to us in early June, which gave us an opportunity to exchange views on the issues facing this master. Yannick is rightly concerned with giving the master an identity that serves best the Vietnamese interests. We are, also rightly we think, concerned with making USTH become a Vietnamese university rather than the annex of French universities with Vietnamese administration. Both concerns are serious and the recent appointment of a new rector will hopefully help in addressing them successfully. We currently have a USTH third year (meaning last year at USTH) bachelor student in internship with us, Hoang Thanh Dat, working with Diep, Phuong and Pierre on simulations of the reconstruction in space of gas envelopes of evolved stars from radio observations. Another student, Truong Tuan Ngoc, is working with Thao on evaluating new pointing corrections for the exploitation of our small radio telescope. Together with Hoang Anh, a geographer who recently joined our department, Thao is looking into matters related with the future acquisition of two 50 cm diameter optical telescopes, meant to be installed one in the future Space Centre at Hoa Lac, the other in a new observatory in Nha Trang. The aim is to conceive a possible observation and training programme, given the constraints imposed by the high tropical humidity of the atmosphere. Useful experience could be gained by using the 40 cm optical telescope of the Hanoi University of Education, just a very few kilometres away from VAST, which is virtually unused. Thao and Hoang Anh are preparing to do so.



*DAP members with USTH students after installing the telescope dish.*

Hoai is now finalizing the writing of her thesis, which she has been working on during the past six months. She will defend it in Hanoi in December, which will be for us an opportunity to welcome Thibaut Le Bertre and his wife Patricia, which we are impatiently looking forward to. The jury will also include astronomers Stéphane Guilloteau and his wife Anne Dutrey, who will give us lectures. They have a Vietnamese six year old daughter, whom we are impatient to meet. Daniel Rouan, former director of the doctoral school of the Observatoire de Paris, will be another jury member. Together with Diep, Hoai attended a symposium in nearby China at the end of July, in relation with the construction of a gigantic radio antenna in the mountain, FAST. Diep presented some of our results on evolved stars and commented on the possible use of FAST to study the HI emission of their circumstellar envelopes. The message was well received and we were invited to take part in observation shifts, first light being expected for the Autumn 2016.

Phuong must attend many master courses at Hanoi University of Sciences, unfortunately learning mostly techniques that she would much better learn on the job, rather than basic physics, where she really needs to increase her knowledge. To Bac Pierre's utter despair, she will not be able to defend her thesis, which she has already written, before the middle of next year. In her free time, she takes an active part in the work related with the analysis of radio observations of AGB stars with Diep, Pierre and Dat.

Bac Pierre keeps fighting, as Don Quixote against wind mills, against bureaucracy, apathy, lack of enthusiasm and energy, and other such diseases of today's society. A recent event made him realize that they are not Vietnam's exclusives: a form he had to fill for a European country included a line stating that it had to be produced in "19 copies (of which one unstapled original and 18 two-sided copies, stapled in the upper left-hand corner)". As any old man, he thinks that things were much better before, when secretaries were here to help us instead of telling us what to do and conceiving stupid forms, which we have to fill in order to survive. He took part in several events of the Vietnamese scientific life, such as being a member of the jury of the Ta Quang Buu Prize. This year, to Pierre's satisfaction, the prize

honoured, besides the usual load of mathematicians, a geologist. In the wake of an article he had written for Tia Sang, pleading for a strong effort in promoting more effective professional guidance in the country, he was invited to comment on the issue in several meetings: one organized by Tia Sang, another organized by the Hanoi University of Science and Technology (HUST) and a third on the occasion of STEM day, where he gave an address to parents and teachers. STEM stands for Science, Technology, Engineering and Mathematics and the event, which was a success, was organized by the Ministry of Science and Technology and honoured by the presence of Minister Nguyen Quan and Vice Prime Minister Vu Duc Dam. Many primary school children attended, taking part in practical activities such as building self-supporting bridges and conceiving stories and games on computer. Bac Pierre has been invited to a nuclear physics conference in Da Nang, where he gave a talk entitled *Why should we study nuclear physics?* showing how different the reasons are, compared with nearly 60 years ago, when he studied it. A young student from Hanoi University of Sciences, Nguyen Thanh Luan, in his second year of bachelor, asked to join us for the Summer. As he said that he was interested in studying nuclear physics, Bac Pierre gave him his Da Nang talk to study and asked him to present it to us. A month later, he did so, it was the first time he had a chance to make a presentation to an audience, he did a superb job. But when we asked him whether he was happy to have clearer ideas about why to study nuclear physics, he answered that he had changed his mind and wanted to study astrophysics... The Da Nang conference was an opportunity for Bac Pierre to plead for a more strict and professional safety culture and for the creation of a national nuclear training centre.

Bac Pierre asked to become a member of the Vietnamese Physical Society six months or so ago. After having been asked whether he hold Vietnamese nationality and having answered negatively, he did not hear anything from them any longer and still is not a member.

In July, Hoang Anh, Dat and Ngoc took part in the third Vietnam School of Astrophysics organized by the Rencontres du Vietnam in Quy Nhon. Thao and Hoang Anh also attended the

conference that followed. Both school and conference focused on Planetary Science this year. Support from the Rencontres du Vietnam and from VNSC made this possible.

At the end of July, following the conference in Quy Nhon, Jane Luu, co-discoverer of the Kuiper belt, a US astronomer who was born in Viet Nam and left the country in 1975, paid a visit to Ha Noi. Nhung met her in Hue on her way to the north, helping with the translation of a public talk that she delivered there. She then kept taking care of her during her stay in Ha Noi where she was acclaimed as a Vietnamese heroin, met the Prime Minister and gave a talk on the Kuiper belt at the Ha Noi University of Science and Technology, attended by a densely packed auditorium of students of all ages. Unfortunately, her time was so strictly counted that she had no chance to visit us.



*Bac Pierre giving talk at Da Nang conference*

Finally, an important side event in the life of the laboratory was a week holiday organized by VNSC, which most of us attended. It took place in the South, at Phan Thiet, near the famous sand hills of Mui Ne. We were hosted in a resort on the beach; families were invited, most of the time was free time; two mornings were spent together on visiting around, playing and swimming on the beach, etc... A nice banquet was offered to us in the resort's restaurant on the last day.

### **NEW COLLABORATION OPPORTUNITIES**

*Our recent affiliation with the Viet Nam Academy of Science and Technology (VAST) has given us new collaboration opportunities with foreign institutions,*

*in particular in the context of existing framework cooperation agreements. Nhung comments on such new opportunities in general terms, covering countries such as Japan, Korea, France and Belgium.*

From the beginning, international collaboration has always been essential to the life of the laboratory. Having joined the Vietnam National Satellite Centre (VNSC/VAST) opens a new door to such collaboration as VAST has a long tradition in cooperating with many countries, in particular Russia, Japan, France and many other European countries. We enjoy full support from VNSC to establish new collaboration with foreign institutions, in particular in the context of existing cooperation agreements.

Taking advantage of a strong cooperation programme with Japan in the field of space technology, VNSC has invited Dr Masahiko Hayashi, Director General of the National Astronomical Observatory of Japan (NAOJ), to visit Vietnam and discuss about the possibilities for future collaboration in astronomy between Vietnam and Japan. We spent a day at VNSC to discuss the issue. Attending the meeting were representatives of other astrophysics groups in Hanoi, Dr Dinh Van Trung from the Institute of Physics, Dr Nguyen Quynh Lan from Hanoi University of Education and students interested in astrophysics. Following the introductory talk on NAOJ by Dr Hayashi, each group presented its research work. We expressed our desire to continue working in radio-astronomy using high quality data from the best observatories, in particular from ALMA, and to have closer contacts with Japanese astrophysicists, in the form of possible short visits, common seminars and research collaborations. Dr Hayashi stated that Japan, which owns many large telescopes, can help Vietnam through collaboration with NAOJ research groups. He also suggested that, for the first step, Vietnam can send students and/or young postdocs to join NAOJ research groups. Japan currently has some programmes for sending experts to Vietnam under the endorsement of the Japan International Cooperation Agency (JICA), and NAOJ is also willing to exploit the possibility of sending its experts to Vietnam to cooperate, consult and work with Vietnamese research groups. After the meeting Dr Hayashi encouraged Tuan Anh to contact a NAOJ team led by Dr

Daisuke Iono, active in the study of high redshift galaxies. Tuan Anh has applied for a JSPS (Japanese Society for the Promotion of Science) postdoc fellowship at NAOJ.



*Group photo after the discussion with Dr Masa Hayashi at VNSC*

Collaboration between LERMA/Paris Observatory, with Dr Thibaut Le Bertre, and our team started nearly three years ago in the context of a PhD thesis (Do Thi Hoai) under joint supervision between the two laboratories. Under the guidance of Dr Thibaut Le Bertre, the group became soon interested in the study of evolved stars and acquired some expertise in this field. We would like to pursue this research line in the years to come. However, with the completion of Hoai's thesis by the end of this year, we have to find a new context for our collaboration. To this aim, we took advantage of a cooperation agreement existing between VAST and the French CNRS to propose a project of collaboration between DAP and LERMA. The project, which has been submitted, would essentially cover travel and living expenses for the project members. This collaboration has also been an opportunity for DAP members to work together with collaborators of Dr Thibaut Le Bertre, in particular Dr Jan Martin Winters, and Dr Pierre Lesaffre, both of whom are members of the new collaboration.

NAFOSTED, from which we currently obtain funding, has bilateral scientific research agreements with some European countries, in particular with Belgium and Germany. In May, on the occasion of a call for new bilateral cooperation projects with Belgium through the Flemish Research Foundation (FWO), we got an invitation to collaborate with Dr Maarten Baes, from Gent, on a project related to Herschel observations in

the infrared. Dr Baes had learned about us from our web site and made contact with us. At the beginning we were hesitating to join since the time for preparation was rather short and we felt that we had already our hands full. However, when Dr Baes told us more about the project, we convinced ourselves that we could both benefit from each other experience and contribute to the success of the project. The goal is to fully exploit the Herschel observations carried out in the frame of the HeViCS project to investigate the extragalactic sky behind the Virgo Cluster. This clearly fits in the long-term research interests of both partners, far-infrared and multi-wavelength surveys at UGent, and high-redshift galaxies and gravitational lensing at DAP. Moreover, it will imply significant cross-fertilization of expertise. The project has been submitted to NAFOSTED for the Vietnamese side and to FWO for the Belgian side. It should cover labour costs, associated materials and research tools and equipment cost, and it must respect a two-year time limit for its completion.

Having moved to a new site does not prevent us from maintaining a friendly contact with Korea, on the contrary! Our close friend, Dr Young Chol Minh, chair of the Korean Astronomical Society, is following our progress. We know him from a Winter School on Radio Astronomy organized by the National Astronomical Research Institute of Thailand (NARIT) in Chiang Mai, where he was lecturing.

Last year, we invited him to attend our workshop on radio astronomy and astrophysics in Vietnam. Whenever we need help or advice from a friend we ask him; when writing our report on a possible national radio telescope in Vietnam, he kindly provided us with most useful information about the Korean experience in developing radio astronomy. Thanks to him, two DAP members got to know about APRIM2014 conference organized in Daejeon and got support from the organizers to attend and present their work; it was for them an opportunity to visit the Korea Astronomy and Space Science Institute (KASI) and to make friends with new colleagues with whom they keep good contact. Recently, Dr Minh introduced us to a new programme supporting young researchers to spend a short visit in KASI and to work on a specific subject. We are presently considering

sending one of our young members to take part in this programme. The help from friends like Dr Minh is invaluable to us. It makes us feel warm and touchy to feel that we can count on close foreign friends like him to continue our cause of promoting basic research in Vietnam. Without international collaboration we would feel lonely and get lost.

### ***A POSSIBLE FUTURE NATIONAL RADIO TELESCOPE***

*Soon after our transfer to VNSC, the Directorate asked us to produce a report on a possible national radio astronomy facility for Vietnam. An interim report presented in April was positively received and we were asked to focus on the short range in the final report, which was handed over at the end of June. Diep reports on the main points.*

In early February, one month after the transfer of the group from INST to VNSC, we had a meeting with the VNSC directorate discussing the future of the newly established Department of Astrophysics (DAP). Besides being given some concrete tasks, we were asked by our directorate board to explore the possibility to build a national facility for astronomy aimed at increasing skills in the field and developing the astronomical community in the country. We accepted the request and agreed to submit the interim report by the end of April and the final one by the end of June.

The interim report started with general considerations on *Astrophysics today, Why a national facility?, Why radio rather than optical?* and *The main challenge: the workforce*. Quoting from it: *“While astrophysics is today the most dynamic field of physics, it is almost absent from the research landscape of Viet Nam and embryonic in the cursus of its universities [...] Modern frontline research in astrophysics is done using major installations, either ground based or aboard satellites, allowing for the exploration of the electromagnetic spectrum from radio to hard gamma ray wavelengths with high sensitivity and excellent resolutions, both spatial and spectral [...] Research in astrophysics is therefore requiring, in priority, resources allowing the community to propose observations and access data collected by such international installations and to take part in their analysis within*

*international scientific collaborations [...] The acquisition of a national facility, while of lower priority, could however play an important role in the development of the field as a training ground for Vietnamese astrophysicists to become familiar with the techniques and methods used in the larger international installations.*” The choice of radio rather than optical is imposed by the humid tropical climate, radio waves being essentially unaffected by the atmosphere up to 10 or so GHz, above which attenuation requires millimetre and sub-millimetre installations to be operated at high altitudes. Hence we limited the scope of our investigation to radio astronomy installations operated on ground above 1 cm wavelength or so (30 GHz) in spite of the scientific advantage of reaching smaller wave lengths where standard molecular lines emit.

The main challenge being the workforce necessary for a responsible and successful exploitation, we underlined that “*it is not just a question of money, but also, may be mainly, a matter of competence. Examples of scientific facilities that are underused, or even unused, by lack of competent staff for their maintenance, operation and exploitation abound everywhere, in Viet Nam as much as abroad.*” The current community of radio astrophysicists in the country does not exceed 10 PhDs, all active in research using international facilities. Diverting a significant fraction of this workforce to the exploitation of a national facility is unrealistic: proper staffing of the proposed installation and securing for it a large enough user community are major issues to be addressed.

Then, the report reviews existing facilities in East and South East Asia. Four countries, China, Japan, South Korea and Taiwan, stand out as operating (on their territories for the first three) installations of international standard. Of the other countries, Thailand is the most advanced while Indonesia and Malaysia are at a level comparable with Viet Nam.

The report went on describing a scenario in which a national radio telescope – typically a 20 m single dish operated between 5 and 30 GHz – could start operation in 2025. By then the community of active astrophysicists and engineers should have increased to fifty or so, large enough to include a small team of scientists and

technicians to maintain and operate the telescope and organize and coordinate the user community and training activities. To obey such a tight schedule, steps need to be taken urgently, in particular defining clearly the scope of the project and making it known, as well as declaring the strong determination of relevant authorities to support it with adequate financial and human resources.

*On a short term, the main actions to be undertaken in priority can therefore be summarized as follows:*

- *centralize resources and coordination at VNSC;*
- *establish close links with universities in a spirit of partnership;*
- *encourage the existing nuclei to grow in size and competence;*
- *draw a clear and realistic plan of the project and advertise it properly;*
- *develop skills in radio detection techniques in the GHz to 100 GHz range;*
- *Consolidate the presence of Vietnamese astrophysics research on the international scene.*

A draft of the interim report was sent to senior astronomers among our friends in China, Japan, Korea and Taiwan and to the Vietnamese astronomical community for comments and advice, which we took in due account. End of April, I presented the report to the VNSC directorate board and interested members of the Centre. The spirit of the report was positively received by the directorate board. However, they felt that such a long term vision of the future, 10 years, exceeded Vietnamese standards and they asked us to focus on the first three to four years in the final report.

We then wrote the final report detailing the plan for the first four years (2017-2020): training of DAP members and increase in size and skills of our team; developing millimetre wave technology at VNSC; setting up an international advisory committee; and equipping a few universities and/or institutes across the country with small 2.6 m diameter radio telescopes tuned on the 21 cm hydrogen line. The latter idea is to create a network of competence in radio astronomy across the country, coached by DAP and fostering

communication and exchange of experience among its members. Preliminary contacts have shown that we can easily find half-a-dozen of interested and responsible partners across the country. This project would give a major boost to the interest for radio astronomy and more generally astrophysics in Viet Nam. The cost implied covers the acquisition of the telescopes and a small running budget for the animation of the network (with a yearly meeting somewhere in the country). The former amounts to ~7'000 USD per telescope, namely 42'000 USD in total. We also explored the possibility to use existing communication antennas for research.

By the end of June, as promised, the final report was handed over to the VNSC directorate board who are now studying how to finance it. However, it seems that our recommendations are of a style that is unusual in Vietnam, making it difficult to follow them: they address a first phase of a long term project, mixing building infrastructure and training; the proposed equipment would be installed in different places and used by different universities/institutions outside the host institution, an unprecedented idea, etc.

In any case, the exercise was interesting and useful, we are very grateful to our friends for their kind comments and advice, which helped us a lot in clarifying our views. Both reports, interim and final, can be found on our website <http://dap.vnsc.org.vn/>.

### **INTERVIEW OF THE HEAD OF NAFOSTED**

*Diep and Nhung have interviewed for us Dr Do Tien Dzung, head of the National Foundation for Science and Technology Development (NAFOSTED), acting as funding agency for fundamental research in Vietnam. As usual, we gave our report to the interviewed person for possible corrections; in the present case we had to suppress many sentences which were considered inappropriate for the written version of what was said.*

**DAP:** Which are the main achievements of NAFOSTED that you are most proud of and the main difficulties that you are facing to progress?

**Do Tien Dzung:** NAFOSTED contributes to creating a more effective research environment in

the country. It has a broad impact and has brought confidence to the research community through a transparent and objective support process. We have been able to attract many more young researchers to become project leaders. We are trying to stick to international standards in allocating funds to scientists. According to statistics from ISIKNOWLEDGE, publications resulting from natural science projects supported by NAFOSTED during the period of 2009-2013 have grown by 20-30%. The number of publications in 2014 covers more than 25% of all publications having Vietnamese authors in their author list and more than 50% of publications sponsored by Vietnamese agencies.

For what concerns the difficulties that we are facing, some are related to the fact that the mode of operation of the Foundation is new in Vietnam and the policy and procedures that we have to obey differ from those in use in other funding institutions. A recent set of regulations meant at improving the management of science and technology issues has recently been published and should provide a better framework for us to be efficient.

**DAP:** Do you consider including foreign members in the panels in order to guarantee better neutrality and a broader scope?

**Do Tien Dzung:** In principle there is no nationality limitation for appointing panel members. For the fiscal year 2013, about 20-30% of all the submitted projects were evaluated by international referees. However, none of the present seven scientific committees for natural sciences includes a foreign member. We are voting to elect new committee members. Foreign scientists have been nominated but not sufficiently known to be elected.

**DAP:** The general NAFOSTED practice is to consider individuals rather than teams, teamwork being notoriously insufficiently encouraged in Vietnam. Do you consider changing this practice and leaving more freedom to the team leader on how he organizes the work in his team?

**Do Tien Dzung:** As a funding agency we always highly appreciate teamwork. However, in the first





*Dr Do Tien Dzung*

years of operation we have met some difficulties. Most of the project proponents being new to us, the evaluation cannot take into account the merits of teams of which we have neither previous assessment nor information about their past scientific achievements. Therefore, applicants may have the feeling that individual merits are more favoured. Yet, the scientific committees do take the strength of a team and the presence of qualified scientists in due consideration. In the future, from the results of past projects, it will be possible to base such judgement on more objective ground. Groups having successfully completed their projects will be given more credit for the next assessments. If a group is working at a higher level, and having better results, it should be given more support in order to encourage teamwork. Moreover, in each project, part of the budget allocated to it is for team activities, such as organizing a conference or symposium, welcoming foreign experts or sending scientists to work abroad. NAFOSTED is allocating a budget based on the amount of work carried by the project members. In the first years of operation we gave priority to supporting as large as possible a number of research teams. This rule causes some big groups to split into smaller groups in order to get more funding. We are aware of the problem and have imposed a new policy meant to overcome this obstacle. Clear rules should now allow for better support of large groups, more appropriate to their ability and size. The better the group, the more support it will be given. Concerning giving more freedom to PIs, they already enjoy some flexibility and can adjust the

distribution of money earmarked for different items.

**DAP:** Could you comment on the conflict between imposing strict rules in order to be as objective as possible (number of publications, publications in journals having a high index, etc.) and being flexible in order to take particular situations in due consideration (encouraging a young team, fostering collaborations, etc.)

**Do Tien Dzung:** We are aware of this conflict. In the first years we have allocated funds to a broad spectrum of fields, supporting as many research groups as possible, of course with some criteria such as requiring publications in Institute for Scientific Information (ISI) journals. Concerning the support to different branches of a field and to young research groups, there exist other possibilities to support young research groups. For example, a young researcher who has not accumulated enough experience to build his own research group can join a graduate programme supporting postdocs (we considered creating a separate programme for young researchers but we decided that direct support to postdocs was better). The programme allows for postdocs to have some buffer time by joining a project as a member and gain experience before becoming PIs later on. Concerning some branches of science that need support to develop, this is an issue for each scientific committee of the Foundation to deal with. It is fully based on their decisions. Moreover, we currently have better statistics on the overall picture of science in the country. It will help to steer funding in a more appropriate way. In general, the quality of the support offered by NAFOSTED will increase. In fact, the criteria to get support are not very stringent; the requirement of having an ISI paper is but a small administrative barrier to get over. We have a separate set of rules for supporting young researchers who want to build a research team, we call these exploratory projects and accept that they imply some risk. The criteria for this type of projects are different, usually easier to fulfil than the normal ones.

**DAP:** More generally, one may hope that someday NAFOSTED will not only distribute

funds but also help shaping a scientific policy of Vietnamese research, which is presently lacking. What are your view

**Do Tien Dzung:** In the first present phase, the support given to the Foundation is meant to have a positive impact on science and technology in the country. However, we must acknowledge that we are only one of many funding agencies for science and technology. The amount of resources under our control is but a very small fraction of those allocated to science and technology. Therefore, I think that we cannot play an important role in steering the scientific policy of the country. Our ambition is more modest: we simply to do our best to optimize our efficiency within the limits imposed to our operation. Our main priority for the time being is to contribute to the improvement of the research environment in the country and to the growth of the scientific community.

We need to distinguish between basic research and national key programmes. Funding the former aims at contributing to the progress of knowledge in the country and at increasing the size and skills of the scientific community. It covers a broad spectrum of fields and implies a clear vision of the far future. Yet, we must keep in mind the importance of supporting sectors that are national priorities, such as information technology and nuclear energy. Funding the latter addresses concrete applications of science and technology to important national issues. We, in NAFOSTED, work bottom up on the former exclusively: we only consider research projects that have been submitted to us by a scientist or a team of scientists and our decision is based solely on their ability to complete the proposed project successfully. National programmes are handled by the Ministry of Science and Technology directly. While not being in a position of steering the national research effort, we have at least some freedom of movement that enables us, for instance, to promote projects displaying creativity and opening new directions.

### **RADIO EMISSION OF THE GAS ENVELOPE OF EVOLVED STARS**

*After RS Cnc and the Red Rectangle, we have pursued our studies of evolved stars with another*

*AGB star, EP Aqr, which has the particularity of being seen pole on. Hoai comments on general features of such studies that we are currently investigating systematically.*

Under the guidance of Thibaut Le Bertre, in Observatoire de Paris, I was introduced to the study of evolved stars in the Autumn of 2012. I was spending my first four months there in the context of my PhD work, under a joint (cotutelle) agreement between the Paris and Ha Noi doctoral schools, Thibaut and Pierre being my co-supervisors. When back in Ha Noi, I transferred my newly acquired knowledge to the team, and particularly to Nhung and Pierre who helped me with the job that Thibaut had assigned to me: modelling the gas envelope of an Asymptotic Giant Branch (AGB) star, called RS Cnc. AGB stars are stars having moderate masses (our Sun will become one in some five billion years) with a very dense core made of a carbon-rich fully ionized plasma, the electrons having become completely disconnected from the nuclei to which they were attached and forming a Fermi gas – astronomers speak of a degenerate core. On the contrary, the gas envelope (called circumstellar envelope, CSE) has blown up in size by a large factor, reaching several orders of magnitude, and runs through successive cycles, burning alternately hydrogen and helium, and producing carbon, oxygen and heavier elements, typically up to iron. Thibaut is a world expert in the study of such stars, with experience both in the infrared, which allows for observing the dust content of the CSE and the continuum emission of the gas, and in decimetre and millimetre radio emission. The latter has the advantage of hosting spectral lines that can be used to measure the Doppler velocity of the gas. The main tracers are neutral hydrogen atoms (HI) at 21 cm wavelength and molecules in the millimetre and sub-millimetre ranges, in particular the rotational lines of carbon monoxide. Such were the data that I had to model for RS Cnc, including two lines corresponding to the 1→0 and 2→1 transitions. From past experience with the analysis of large quantities of cosmic ray data, our team had the tools, experience and know-how for the modelling that Thibaut was expecting from me and, when I returned to Paris in the Autumn of 2013, he was very pleased with

the results. Nhung had come with me this time and we spent together, with Thibaut and some of his collaborators, a most profitable time, learning a lot of new stuff.

The model we had conceived in Ha Noi follows the general guidelines that Thibaut had given me, including the way to account for both emission and absorption of the observed wavelength, although, in practice, absorption was very small in the cases that we studied (sufficiently far from the star for the temperature to have dropped to a few hundred K). The difficulty in making such models is that one claims to reconstruct in three dimensions something, the radio emission of the gas molecules, that is observed in only two – the projection on the sky – and to reconstruct the three components of the gas velocity when only one, the Doppler velocity along the line of sight, is measured. Hence, much arbitrariness in the modelling, which needs to rest on additional hypotheses based on preconceptions about the morphology and kinematics of the CSE. The main such hypothesis is that the star departs from its original spherical symmetry by acquiring a new axial symmetry, with approximate rotational invariance around its axis, possibly accommodating a bipolar outflow along the axis and rotation about the axis in the equatorial region. Many observations are in support of such an hypothesis, the reason most frequently invoked being the presence of a companion accreting material from the AGB star; however, such morphologies are also observed for stars having no known companion, in which case the way in which magnetic field and angular momentum are shared between the degenerate core and the CSE is expected to play a role.

When Nhung and I returned to Paris last autumn, we had applied our model to other stars, also observed in CO using the IRAM telescopes: the 30 metre single dish at Pico Veleta and the Plateau de Bure interferometer array. In particular, Nhung studied closely a star, EP Aqr, which the model was describing as having a bipolar outflow directed toward the Earth, while an earlier analysis by Thibaut and his close collaborator Jan Martin Winters was describing it as spherically symmetric, with winds of different velocities at different distances from the star. Encouraged by

them, Nhung pursued this study when back in Ha Noi, together with Pierre and I, trying to make statements as independent as possible from the model used, a work which has now been accepted for publication in A&A. On my side, I dedicated full time to the study of HI emission during my third Paris time. Thibaut is first, together with his collaborator Eric Gérard, to have clearly demonstrated the presence of neutral hydrogen in the CSE of AGB stars using the Nançay radio telescope. The difficulty there is that neutral hydrogen is ubiquitous in the Galaxy, both in the foreground and background of the observed star. The advantage of using HI as a tracer rather than CO is that it probes larger distances from the star, where CO molecules are dissociated by the interstellar UV radiation, and where the interaction between the CSE and the interstellar medium produces important observable effects, such as the presence of a tail in the wake of the star, with a velocity gradient along it. This work was for me an opportunity to use data from the Very Large Array and to meet another of Thibaut's collaborators, Lynn Matthews from the Haystack Observatory in Boston.

Meanwhile, the Ha Noi team had analysed on their own ALMA observations of a post-AGB star, the Red Rectangle. ALMA (Atacama Large Millimetre/sub-millimetre Array) is a new interferometer array located at high altitude in Chile and offering unprecedented sensitivity and resolution, both spectral and spatial. Contrary to IRAM observations, ALMA data are made available to the public one year after collection, an invaluable opportunity for a team such as ours. While AGB stars spend most of their time losing mass to the interstellar medium at a low rate, typically  $10^{-7}$  solar masses per year, the mass-loss process accelerates at the end, the star becoming a planetary nebula with its CSE fully diluting in the interstellar medium and the degenerate core remaining alone as a white dwarf. The Red Rectangle is a star at the border between the AGB and planetary nebula phases. Tuan Anh, who had acquired much expertise in reducing interferometer data from his PhD work, contrary to Nhung and I who always worked on already reduced data, played a major role in this analysis. Later, he gave us very useful lectures on how to proceed with the reduction of ALMA data.

We are now looking forward to the pursuit of this very fruitful line of research. Under Thibaut's direction, we have submitted two proposals for new observations, one, already accepted, using the Plateau de Bure interferometer to refine our observations of RS Cnc, the other using ALMA, to observe EP Aqr with much better sensitivity and resolution.

In December, on the occasion of the presentation of my PhD thesis, Thibaut will spend two weeks with us and Stéphane Guilloteau and his wife Anne Dutrey will give us lectures. Meanwhile, with help of both Nhung and I, Pierre, Diep, Phuong, and Dat have undertaken a systematic study of both real and simulated gas envelopes with the ambition of making general statements on the uniqueness of the models that are commonly made, their reliability and the accuracy attached to their parameters. In addition to the stars that we have already studied, they also consider open access ALMA observations, which Nhung and I have selected and at which we had a first look.

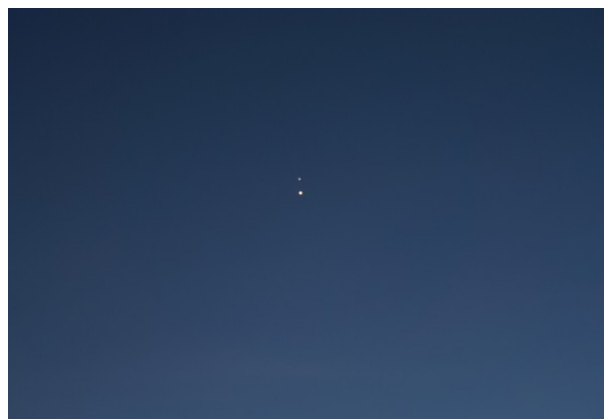
In less than three years, the study of evolved stars has become one of our main lines of research and nearly all team members have taken part in it. We are also looking forward contributing, in the same effective way, to the analysis of ALMA observations of far away galaxies, a line which Tuan Anh is currently actively pursuing.

### **TRAINING STUDENTS USING RADIO AND OPTICAL TELESCOPES**

*Thao is now taking care of the transfer of our radio telescope to the roof of USTH, the University for Science and Technology of Hanoi, located on the VAST site. Together with Hoang Anh, a geographer who recently joined our department, she is also preparing for the future exploitation of an optical telescope which VNSC will soon acquire. She briefly reports on these activities.*

Our small radio telescope has now been installed successfully on the roof of the building of the University of Science and Technology of Hanoi (USTH). It took us a month, including repairs to some damage of the support, calibration of the

arm movement and cleaning and greasing mechanical parts. The telescope is connected to a PC in a room one floor below and ready for data acquisition. A third year USTH student, Truong Tuan Ngoc, was very much implied with the work and has shown a strong interest for astrophysics. The telescope has already been used by USTH master students in the past years for practical work. Its use will be extended to bachelor students and staffs from other institutions from now on.



*Venus-Jupiter conjunction (the lower brighter object is Venus).*



*The early comers seen here were later followed by many other students.*

At the beginning of July, along with a group of USTH students and some young astronomy amateurs, we had the opportunity to observe a conjunction between Venus and Jupiter not only by naked eye but also through a small optical telescope left at USTH's lab by a former student. We also looked at the four larger moons of Jupiter symmetrically lined up around the planet. We also had a chance to see very clearly by naked eye the reflected light from solar panels of a satellite

flying across the sky in the sunset light. Unfortunately we had no adapter to connect the camera, we can only show images of poor quality.

### **SCHOOLS, CONFERENCES AND SHORT VISITS ABROAD**

*Diep and Tuan Anh have attended a conference in Taiwan, Diep and Hoai a conference in nearby China, Phuong a school in Korea and Hoang Anh a school in Thailand. Tuan Anh has paid a short visit to a Japanese team working on ALMA data. Brief reports on these events follow.*

#### ***FAST symposium in nearby China*** (D T Hoai)

China is currently constructing in Guizhou province, some six hundred kilometres away from Ha Noi a Five-hundred-meter Aperture Spherical Telescope (FAST) made of a gigantic fixed antenna resting on ground and a receiver hanging on cables at its focus. The design is similar to that of the Arecibo telescope in Porto Rico. The project was initiated in the early nineties and officially approved in 2008. The construction started in 2011 and first light is expected in September 2016. It consists of some 4500 moveable triangular mirrors, over 10 m<sup>2</sup> each in area, forming a single spherical dish of 500 m diameter. Each panel, made of aluminium, weighs some 500 kilograms. They can be adjusted to form a parabolic dish pointing to adjustable directions, with an effective diameter of 300 m. FAST is able this way to cover 40° from zenith. Its working frequency will be 0.3-3.0 GHz with a pointing accuracy of 8 arcseconds. A multi-beam receiver (19 beams) will be eventually available, allowing for broad sky coverage, but, in the early science phase (until the end of 2017), a single beam will be used.

At the end of July, the symposium “Frontiers in Radio Astronomy and FAST early sciences 2015” was organized in Guiyang, capital of the Guizhou province. The symposium focused on most recent developments in radio astronomy and explored the promises of FAST. There were participants from many countries around the world including the United States, Canada, Mexico, Holland, England, Korea and Japan. Thanks to Di Li (FAST principle investigator), we

were invited and got financial support to attend the symposium. We also had a chance to visit the FAST site, about 4 hours away by bus south of Guiyang. FAST is making nice progress with its construction. We could see the telescope supporting ring which is also a railway for the crane installing the heavy mirror panels; a cable net to keep the panels in position, feed cables connected to six 150 m high towers to hang the FAST receivers and actuators to control the panel movements have been completely installed. The first panels were supposed to be installed in the next few days after our visit. The expected installing rate is about 20 panels per day. Therefore, it will take more than 200 days just to install all panels. We met some engineers and technicians there and talked to them. Many of them are very young, friendly and full of energy.



*Diep and Mingchang Wu, who is in charge of designing and installing FAST actuators for controlling its panels. The FAST ring and a cable tower are seen behind them.*

The symposium covered three days gathering scientists from many fields related to FAST: pulsars, external galaxies, fast radio bursts, interstellar medium, stars, etc. FAST is expected to discover many new pulsars in the Milky Way and extragalactic pulsars which are not detectable with the sensitivity of current telescopes. In addition, FAST should provide new information on the detection of gravitational waves from their interaction with pulsar timing arrays and help the study and localization of fast radio bursts (a hot topic in present radio astronomy). Diep gave a presentation on evolved stars which summarizes our work on RS Cnc, EP Aqr and the Red Rectangle using CO emission lines; he also

discussed HI observation of AGB stars using FAST. Di Li was interested in our work and welcomed us to use FAST for our future studies. He also mentioned a possibility for us to come and take shift at FAST site for the early science phase. In the last afternoon of the symposium, we had a discussion session about the early science with FAST and synergy with other competing future instruments.



*Diep giving his talk at FRA 2015.*

This symposium was a good opportunity for us to make new friends and establish collaboration with Chinese colleagues. It was rainy during the time when we were in Guiyang. I found the food too spicy for me. However, thanks to Di Li's young students who guided us around the city and taught us how to say “not spicy” in Chinese, I could manage. We had memorable time in Guiyang.

### *A training workshop in Thailand (Hoang Anh)*

I recently joined the VNSC Department of Astrophysics and I am preparing for the exploitation of an optical telescope that VNSC will soon acquire and install at the future Space Centre in Hoa Lac. In this context, I took part in the 1<sup>st</sup> NARIT International Astronomical Training Workshop (NIATW) that took place in Thailand from March 24 to April 1, 2015. The theme was “Time Variability in Modern Astrophysics”. It was organized by the National Astronomical Research Institute of Thailand (NARIT) and co-sponsored by NARIT and by the Office of Astronomy for Development (OAD) of the International

Astronomical Union. There were participants from Taiwan, China, Cambodia, Indonesia, Philippine, Malaysia, India, Thailand and Vietnam.



*Hoang Anh and participants of NIATW.*

We started with two days in Chiang Mai, learning about AGN variability and all-sky surveys, before moving to Doi Inthanon, the highest mountain in Thailand, host of the 2.4 m diameter optical telescope. We observed, for five consecutive nights, events such as occultation of a star by the Moon, and objects such as pulsars, clusters and variable stars. We also learned about ULTRASPEC, a high-speed imaging photometer installed on the telescope. We then worked on data reduction and the results of our lunar occultation observations will provide material for writing a paper.



*Learning about data reduction at NIATW.*

The workshop was very useful to me. First, it gave me valuable experience in research and in observation using optical telescopes.

Second, it gave me an opportunity to meet researchers in the field of optical astronomy. It helped me to create links in Asia with people working in this domain, which will be useful for the future exploitation of the VNSC telescope.

*A conference in Taiwan and a visit to Japan*  
(Pham Tuan Anh)

The East Asian Young Astronomers Meeting (EAYAM) was first organized in 2003 to promote interaction and collaboration between young astronomers in East Asia. The success of the initial meeting in Taiwan was followed by EAYAM 2006 in Japan, EAYAM 2008 in China, and EAYAM 2011 in Korea. The conference is for postdocs and graduate students working in the East Asia region, whether or not nationals of East Asian countries. EAYAM 2015 was organized in Taiwan for the second time, from February 9<sup>th</sup> to 12<sup>th</sup>, at the Institute of Astronomy and Astrophysics of Academia Sinica (ASIAA) in Taipei. Diep and I were happy to attend. As our financial request to Nafosted had been rejected because the conference was considered by them as “not prestigious enough”, we had given up any hope to attend and cancelled our participation; we then got an answer from the chair of the local organizing committee saying that the National Astronomical Observatory of Japan (NAOJ) was willing to cover travel tickets and accommodation for both of us. Clearly the notion of prestige must be different in Japan and in Vietnam...

The conference covered a wide range of topics, both theoretic and observational, from distant galaxies to nearby stars. Invited talks were delivered by distinguished astrophysicists: Luis Ho, Director of the Kavli Institute for Astronomy and Astrophysics, Peking University, on black holes and their impact on galaxy formation; You-Hua Chu, Director of ASIAA, on bubbles and their impact on galaxy evolution; Sung-Chul Yoon, Seoul National University, on pre-supernova evolution of massive stars. Diep gave a talk on the Red Rectangle using ALMA archive data and I on RX J0911 using Plateau de Bure Interferometer data. Both were well received and appreciated. As the conference was meant for young people, organizers did their best for participants to interact both with each other and

with senior researchers by having lunch together, visiting ASIAA labs, etc. They organized several discussion panels, so-called career development panels, with distinguished conveners answering questions and sharing their experience with us. All invited speakers actively joined these events, including Paul Ho, founding father of ASIAA. The main message to young participants was to build their own skills and expertise in the field, to learn and collaborate with experts, to be aware of opportunities offered by the East Asian Core Observatory... and to keep a good balance between research and life.



*Diep, Kaz and Tuan Anh at EAYAM 2015.*

We enjoyed meeting again Dr Kaz Sekiguchi who supported us from NAOJ, for which we thanked him wholeheartedly. We had a nice discussion with Pr Paul Ho sharing with us his feelings when he started building ASIAA from scratch. Luis Ho was showing his interested in promoting astronomy and astrophysics in developing countries in East Asia and will attend a conference in Vietnam next year.

The meeting was for us an opportunity to make a lot of new friends, mainly from China and Korea. We often joined a group of Korean participants, spending time downtown, visiting night markets, having a try on Taiwan noodles, sharing a hotpot, etc. We also spent half a day visiting the National Palace Museum. All together, the time spent there has been a very nice experience. We met again Dr Satoki Matsushita, whom we had first met in Korea at APRIM Daejeon last year. He joined us very late in a Belgium beer bar.



*Tuan Anh, Paul Ho, Kaz and Diep at EAYAM 2015.*

After finishing my PhD, the Hanoi team encouraged me to continue to pursue the study of high-redshift galaxies. Since our lab is part of the Vietnam National Satellite Centre having a strong collaboration with Japan for developing space technology in Vietnam, and since Japan is playing a leading role in East Asia, in particular with ALMA, we would like to establish a close collaboration with a Japanese team using ALMA data. We enjoyed the visit of Pr Masahiko Hayashi, head of National Astronomical Observatory of Japan (NAOJ) in April and he encouraged us in this direction. I then contacted Professors Kenichi Tatematsu and Daisuke Iono from the East Asia ALMA Regional Centre (ALMA ARC) on a video meeting to explore possibilities to have a postdoc position at NAOJ and, on the long term, to possibly collaborate. Pr Daisuke expressed his support and offered to be my host researcher in applying for a postdoctoral fellowship from the Japanese Society for the Promotion of Science (JSPS).

At the end of July I joined a school organized by Tokyo University about “New era of the cosmic distance scale”. I took this opportunity to pay a short one-week visit to the team of Pr Daisuke at NAOJ. He booked for me a slot so I could present there my PhD work on RX J0911 and the work on the Red Rectangle using ALMA public data. There are about 15 researchers at the ALMA ARC, they do research mainly in two domains: nearby and distant galaxies and star formation. They welcomed me for the visit.

During my stay, I spent some time discussing with Dr Bunyo Hatsukade and Dr

Yuichi Matsuda. Both showed me their current research; Dr Buyno is strongly involved in the ALMA survey of sub-millimetre galaxies. We discussed a possibility to collaborate on a sub-millimetre gravitationally lensed galaxy at  $z \sim 3$ , SDP.81, observed by ALMA. The data show a beautiful Einstein ring both in CO lines and in continuum, with spatial resolution reaching down to a few tens milliarcseconds. The Japanese team has published two papers using these data, one for modelling the mass distribution of the lens and the other about molecular clump properties of the lensed galaxy. There is still material for more work, such as the study of CO line ratios providing invaluable information on the gas temperature, independently from the gas density. Such information would contribute important new elements to previous analyses and, hopefully, allow for drawing new conclusions.



*Tuan Anh visiting the ALMA Regional Cluster (ARC) at NAOJ.*

Another possibility to collaborate with the Japanese team is to submit an ALMA Cycle 4 proposal to observe the CO emission of RX J0911. Using Plateau de Bure Interferometer we could only measure the size and shape of the molecular gas volume. The much better spatial resolution and sensitivity of ALMA would reveal the inner structure of the galaxy and hopefully solve the puzzle posed by the narrow line width.

I made many new friends during my visit. Patricio, a young postdoc working on star formation, who is in charge of organizing ALMA ARC seminars, friendly helped me on some of ALMA calibration/imaging stuff. Kana Morokuma-Matsui, also a young postdoc, spent a



late afternoon explaining her study of mid redshift galaxies. I discussed a lot with Dr Takeo Minezaki from Tokyo University, who has his office on NAOJ campus, about his AGN work. A third year USTH student, Nguyen Duy Thanh, who spends an internship at NAOJ under the guidance of Dr Nguyen Luong Quang, very kindly helped me and took me on a tour around downtown Tokyo. Finally, I paid a visit to Dr Kaz Sekiguchi, thanking him warmly for his constant support to us and it was a pleasure to meet him again.

*A winter school in Korea  
(Nguyen Thi Phuong)*

Last February, from 10<sup>th</sup> to 13<sup>th</sup>, I attended the UST-GUAS Radio astronomy winter school 2015 in Jeju Island, South Korea. I enjoyed listening to many useful lectures from experienced lecturers and sharing pleasant days with young, active and talented students from Asian countries.



*At the KVN Tanma Station.*

The school was organized jointly by National Astronomical Observatory of Japan (NAOJ) and Korea Astronomy and Space Science Institute (KASI); the aim was to provide introductory courses of radio astronomy to undergraduate and master students interested in conducting future radio astronomy research in Asian countries. It brought together 60 students from Japan, Korea, China, Taiwan, Vietnam, Thailand, Indonesia and Malaysia, as well as students from other countries such as Nigeria and England. Apart from me, two other Vietnamese students attended the school, Hoang Hong Van from the Institute of Physics in Hanoi and Dang

Duc Cuong from the International University in Ho Chi Minh City.



*With Dr Young Chol Minh in the class room.*

During the four days that the school lasted, I learned a lot about both fundamental and current research topics in radio astronomy such as star formation, the Milky Way, pulsars, black holes, AGNs, extra-galaxies and cosmology; the lecturers were from NAOJ, KASI and some Korean universities. The lectures also covered interferometry and on-going and future radio astronomy projects like ALMA, VERA, EAVN and SKA. Time was devoted to the practice of analysis tools AIPS and CASA to calibrate KVN and ALMA data. Dr Phrudth Jaroenjittichai from NARIT-Thailand presented the TVN project (Thailand Very Long Baseline Network) that will include three 20 m radio telescopes operated up to 100 GHz to study star-forming regions, AGNs, radio galaxies and pulsars. It will be the first interferometer ever built in Southeast Asia and it might join the EAVN in the future. Dr Hiroaki Nishioka from ASIAA-Taiwan presented AMiBA – a thirteen 120 cm dishes array packed on a 6 m hexagonal platform and operated around 3 mm wavelength (94 to 102 GHz); it will study anisotropies of the cosmic microwave background and the Sunyaev-Zel'dovich effect.

On the third day, we went to KVN Tamna station, an antenna of the Korea Very Long Baseline Network (KVN), a network of three identical 21-m radio telescopes located in Seoul, Ulsan and Jeju island. The baseline lengths range from 305 to 476 km. The antennas are equipped with a system allowing for simultaneous observations at 22, 43, 86, and 129 GHz. We were

distributed in three groups under supervision of Mareki Honma, Bong Won Sohn and Taehyun Jung, and learned about the KVN construction progress, the operation of the antenna and principles of data taking. We were shown the antenna back-end system and the control room.

After the visit to Tamna, we went to Sungsan Ichulbong – one of the UNESCO World Nature Heritage created entirely from volcanic eruptions. We climbed the mountain and enjoyed the beautiful view on the frozen landscape of Jeju island from the top where a strong wind was blowing. It has been a wonderful and exciting experience; I have been as much impressed by the big and fast moving antenna as by the beauty of the mountain around.

I shared a room with four other students: Samantha Chen from Taiwan, Moe Yoda from Japan, Stephanie Tumamos from Philippine and Umeh Maureen from Nigeria, all young, active and talented students; we shared each other knowledge, culture, hobbies and dreams. Together with other students we went to visit Manjangul

Lava Tube, a wonderful cave 23 m in breadth and 30 m in height; it stretches over some nine kilometres, of which one is open to tourists.

I helped with the organization of a great birthday party in honour of a Malaysian student, Ishyhara Rio. It was a memorable event and we had lots of fun.

The school offered many important assets for my future: improved knowledge of radio astronomy, analysis skills and, most importantly, an opportunity of making new friends among excellent East and South-east Asian students with whom I will keep in touch. I am very grateful to the organizers for the excellent organization. I would like to thank particularly Dr Young Chol Minh, who first introduced the school to me, for his invaluable support. I also express my gratitude to Dr Bong Won Sohn for his patience in listening to my visa problems and helping me with solving them. Last, I am deeply indebted to my winter school friends for having shared so many things with me.

**Distribution:** Elie Aslanides, Patrick Aurenche, Maarten Baes, Jim Beatty, Cristoforo Benvenuti, Jean Pierre Bibring, Pierre Billoir, Frederic Boone, Bui Duy Cam, Ludwik Celnikier, Catherine Cesarsky, Ngo Bao Chau, Nguyen Duc Chien, Nguyen Mau Chung, Françoise Combes, Alain Cordier, Jim W. Cronin, Manoel Dialinas, Luigi Di Lella, Giap Van Duong, John Ellis, Pierre Encrenaz, Alberto Etchegoyen, Roger Eychenne, Jerome Friedmann, Daniel Froidevaux, Yoshitaka Fujita, Jose Gabriel Funes, Michèle Gerbaldi, Nguyen Van Giai, Sheldon Glashow, Yannick Giraud-Héraud, Stéphane Guilloteau, Edward Guinan, Jacques Haïssinski, Chu Hao, Masahiko Hayashi, John Hearnshaw, Pham Duy Hien, Nguyen Van Hieu, Emmanuel Hinglais, Nguyen Dai Hung, Fadi Ibrahim, Antonio Insolia, Stavros Katsanevas, Le Hong Khiem, Dao Tien Khoa, Marc Lachièze-Rey, Nguyen Quynh Lan, Pham Tran Le, Thibaut Le Bertre, Pierre Lesaffre, Di Li, Nguyen Van Lien, Alain Maestrini, Grant Mathews, Giorgio Matthiae, Jean-Christophe Mauduit, Michel Mayor, Peter Mazur, Young Chol Minh, Phan Bao Ngoc, Wayne Orchiston, Etienne Parizot, Denis Perret-Gallix, Minh Ha Pham-Delègue, Tran Viet Phuong, Vu Viêt Phuong, Philippe Quentin, Burton Richter, Nguyen Quang Rieu, Jean-Michel Rieubland, Carlo Rubbia, Pierre Sebban, Sally Seidel, Kaz Sekiguchi, Rogel Mari Sese, Greg Snow, Paul Sommers, Do Hoang Son, Phan Hong Son, Michel Spiro, Jack Steinberger, Christine Sutton, Annick Suzor-Weiner, Tran Minh Tam, Charling Tao, Dick Taylor, Tran Chi Thanh, Samuel C.C. Ting, Tran The Trung, Dinh Van Trung, Hiroshi Tsunemi, Nguyen Van Tuan, Pham Anh Tuan, Hoang Tuy, Marcel Urban, Odon Vallet, Jean Tran Thanh Van, Suzy Vascotto, Sylvie Vauclair, Tini Veltman, Nguyen Ai Viet, Dang Van Viêt, Alan Watson, Joël Weisberg, Atsushi Yoshida, Antonino Zichichi.

–PHOTO ALBUM–



*Assembling the telescope dish on the roof of USTH building.*



*Vu Viet Phuong, VNCS vice director, welcoming Pr Masa Hayashi.*



*Truong Tuan Ngoc standing between radio and optical telescopes.*



*Pr Masa Hayashi and Tuan Anh at Hanoi ethnology museum.*



*Hoai on the FAST site.*



*Phuong and friends at the banquet.*



*Students of VSOA visiting ICISE.*



*Children enjoying the first STEM festival in Hanoi.*



*After Tuan Anh's thesis defence.*



*VATLY members playing with Diep's son, Khoi, on Mui Ne sand dune.*



*Diep at the FRA 2015 conference dinner.*



*Thao sliding down Mui Ne sand dune.*



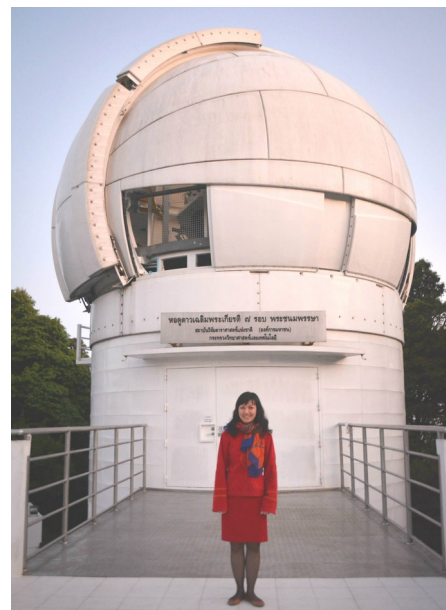
*UST-GUAS school participants visiting Sungsan Ichulbong with Dr Bong Won Sohn.*



*On the way to Tay Thien pagoda near Hanoi with VNSC friends.*



*Diep, Phuong, Tuan Anh and Hoang Anh on the beach with VNSC staff in Phan Thiet.*



*Hoang Anh in front of NARIT 2.4 m optical telescope.*