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MATHEMATICS IN VIETNAM

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I spent January 1986 as a guest of the Institute of Mathematics in Hanoi, S.R. VietNam, giving a series of lectures there and at the University of Hanoi. The trip was full of impressions, and numerous contacts were made. The purpose of this article is to describe some aspects of the trip and of mathematical life in VietNam.

The initial contacts making the trip possible occurred in 1984. At the special semester on topology held at the Stefan Banach Center in Warsaw, Poland I met a group of four topologists from VietNam as well as a couple of Vietnamese studying in Poland. We became friends and they mentioned the possibility of my visiting VietNam. They mentioned that Neal Koblitz of the University of Washington had recently visited Hanoi and that he was a member of the U.S. Committee for Scientific Cooperation with VietNam.

After returning to the U.S. I got in touch with Neal Koblitz about his experiences in VietNam and the possibility of my visiting. I learned that, in addition to contacts with the Vietnamese and a desire on both sides for a visit, the only essentials for a visit were a willingness to absorb the cost of airfare, an ability to be flexible in scheduling, and a certain adventuresomeness.

Though there was a minor delay in receiving confirmation of my visa and other arrangements, when I arrived in Bangkok and went by the Vietnamese embassy they already

had record of the approval of my visa. The Air VietNam representative in Bangkok was quite courteous, and my only criticism of in flight service is that seat spacing does not adequately consider the space and leg room needed by many westerners.

I was met at the Hanoi airport by Nguyen Viet Dũng and Nguyen To Nhu, two of the Vietnamese whom I had met in Warsaw, and by a driver from the Institute.

While in Hanoi I gave a series of five lectures in topology at the Institute of Mathematics, a lecture in the geometry and topology seminar at the University of Hanoi, and general expository lectures at the Institute of Mathematics and the Institute of Educational Science. Lectures in VietNam are generally of two to three hours in length, with a break near the middle. An overhead projector is available, but electricity is unreliable. Thus, I used the blackboards for most of my talks. Depending on the audience, some of my talks were given in English with simultaneous translation into Vietnamese. Others were given in English without translation.

The lectures I gave at the Institute of Mathematics in Hanoi were on the following subjects:

Universal Continua,

The Pseudo-Arc,

Classification of Homogeneous Continua,

Homogeneous Embeddings of Continua in Manifolds, and

Heegaard Splittings of Three-Manifolds.

In addition, I gave an expository talk on the Texas school of topology, and attended the functional analysis seminar and a mini-conference on topology and geometry, as well as having several informal discussions.

At a seminar in geometry and topology held jointly by the Institute of Mathematics and the University of Hanoi I gave a lecture on Wild Embeddings of Spheres in Manifolds, including a discussion of the free surface problem. In addition I attended the topology seminar at the University of Hanoi where Pham Ngoc Thao was presenting results in a paper by Novikov on a multi-valued analog of Morse Theory (from Uspekhi, 1982). I had an additional visit and informal discussion with members of the section on algebra, geometry, and topology.

At the Institute of Educational Science I gave a lecture on Mathematics Secondary Education in the United States to a group of persons from that Institute and secondary educators from the surrounding area. This was followed by an extended question and answer period. Two subjects the Vietnamese educators were especially interested in were the American experience with microcomputers in the classroom and programs for gifted students. At present the interest in microcomputers is almost entirely theoretical, since even at the university level they are quite rare. The interest in gifted students stems from a recognition that a developing country needs to use effectively the talents of its citizens, while desiring to avoid the development of an elite.

The Institute of Mathematics in Hanoi is part of the National Center for Scientific Research (C.N.R.S.). The Center also includes the Institute of Computer Science and Cybernetics, as well as a number of institutes in the biological sciences, chemistry, and physics. The Center is just over ten years old, being organized shortly after liberation. Some individual institutes, however, pre-date the formation of the Center, with the Institute of Mathematics dating from around 1968. The director of the Center indicated that the Institute of Mathematics and the Institute of Theoretical Physics are perhaps their strongest institutes, being less affected by equipment-related problems and shortages.

The institutes are housed in new buildings to the northwest of Hanoi. A significant amount of resources is invested in the institutes, especially considering the generally low economic level of VietNam and the need to put resources into development. From informal discussions with various individuals at the Institute of Mathematics as well as a meeting and luncheon with the director of the Center, it appears that members of the various institutes do have influence with the policymakers, are listened to, and are highly respected. Many people expressed a desire for further and stronger international contacts with the West, with other socialist countries, and with other developing countries. The international recognition which the institutes bring to VietNam is highly regarded. However, it was also pointed out to me that members of the institutes

and university faculty frequently earn lower salaries than some workers in the basic manufacturing industries who are without any engineering or formal technical training.

The Institute of Mathematics currently consists of approximately 70 researchers and 15 students. (A student is normally someone who has completed all formal course work at the university and is at the Institute to do work on a dissertation.) At present there are only two female researchers at the Institute, though the percentage of female students at the university is somewhat greater. One of the women researchers at the Institute had several questions about women mathematicians in the U.S.--their relative numbers, their positions and level of recognition, who were some of the more notable individuals, and especially questions about the degree to which they could coordinate a career with a family. She pointed out that the latter causes many problems for a woman in VietNam, especially considering the time and effort involved in raising a family and the lack of conveniences common in developed countries.

One of the biggest problems facing the mathematicians at the Institute is inadequate library resources. The Institute's library is quite small. Many journals have incomplete runs. Some Western journals, for example Proceedings of the A.M.S., are available. However, even some journals from other socialist countries are difficult to obtain. The intermittent electricity sometimes makes searching through the stacks an awkward process. A photocopying machine is available though there are sometimes problems with availability of supplies.

When I first saw the size of the library, I thought that perhaps better facilities were to be found at the university. However, I was assured that the Institute's library was the best mathematics library in the country. Later, when I saw the library at the University of Hanoi, this was quite believable. The Vietnamese mathematicians do appear to make very good use of the facilities they have, and discussions indicated that they are in general up to date in their area, are aware of what people elsewhere are doing, the questions they are looking at, though sometimes lacking in specifics about techniques used and details of proofs. They benefit significantly from items that visitors are able to bring them, and on my visit I left several items with them--some specifically requested beforehand and some duplicates or items I thought they would be interested in. I also returned with a list of several items which they requested. One of the journals currently on the Institute's most wanted list is the Transactions of the A.M.S.

The Institute publishes the journal *Acta Mathematica Vietnamica* in Western languages. Most articles are in English, with a few being in either French or Russian. At present the journal is published in one volume of two numbers per year. It publishes papers in both pure and applied mathematics. In addition to subscriptions, the journal is exchanged with several other journals and universities, making it possible for the Vietnamese thus to acquire further journals. The address for the journal is:

Acta Mathematica Vietnamica
Institute of Mathematics
P.O. Box 631, Bo Ho
Hanoi, VietNam

The Institute of Mathematics and the Institute of Computer Science and Cybernetics also jointly publish a preprint series. This is also published in Western languages, primarily English, and appears irregularly.

There are universities with research mathematics departments in Hanoi, Hue, Ho Chi Minh City, and Dalat. In addition there are research mathematicians at the Pedagogical Institute and the Polytechnic Institute in Hanoi, but several Vietnamese indicated that these are less desirable places mathematically to work. There are a few other facilities that are not active in mathematical research. For example, Can Tho University in the Mekong delta is primarily involved in agronomy training and research.

At the University of Hanoi, mathematics is included in the department of mathematics, mechanics, and informatics. There are currently approximately 40 mathematics faculty. There are approximately 100 students in mathematics with an additional 70 secondary students taking mathematics courses at the University of Hanoi. The faculty is further divided into groups according to their interests. For example, the topologists are included in the division of algebra, geometry, and topology.

There are a few topologists with interests in continuum theory or geometric topology. (Nguyen To Nhu has worked on hyperspaces, and Le Hoang Tri--a student of his--has

worked on fixed point problems.) A couple of persons at the Institute of Computer Science and Cybernetics expressed interest in set-theoretic topology, asking for some basic references. However, most of the topologists work in either algebraic or differential topology--or differential geometry. Huynh Mui of the University of Hanoi is one of the more notable of the algebraic topologists. There are also several young topologists, e.g. Nguyen Viet Dũng, working in homotopy theory.

In addition to training at the Universities and the Institute, many students do graduate or postgraduate work in other socialist countries. A few of the mathematicians have visited Western countries, including a few in the United States. The most significant contacts with the West which I saw were with the French and the Scandinavian countries. Regarding exchanges with the United States, both countries at present adopt the position that they will not inhibit purely scientific visits (which each government defines) for a duration of up to one month.

Probably the largest restraint at present on visits by the Vietnamese is economics. Both Dũng and Nhu assured me in individual discussions that they know of no case when someone with a bona fide invitation to attend a conference or for a scientific visit with their expenses paid by their foreign host has been denied permission by the Vietnamese government. The Vietnamese, however, have very limited funds of their own to support such travel. Available funds also sometimes limit the number of foreign

visitors they can have, though they will sometimes try to work around this.

VietNam is at present a quite poor country, still largely agrarian with little mechanization or industrialization. There are some indications that standards are slowly improving. One saw several signs of Vietnamese participation in United Nations programs (FAO, UNDP, UNESCO, etc.). However, the infrastructure is in very poor shape. Transportation is mainly by bicycle, and traffic is rather chaotic. Electricity and water availability is irregular. Paper is in short supply, causing inconveniences for the bureaucracy. The basics are available in state stores and many other items are available in private shops or sidewalk stands. Such shops are quite common. No queues were evident.

Meat is rationed. However, fresh fruits and vegetables are readily available and of good quality. Bananas or pineapple chunks were served with almost every meal, including breakfast. Rice is a staple. A sizable monthly per capita quantity is guaranteed at subsidized prices at the state stores. Any additional quantity is available at higher prices, and better quality, at private shops.

I had been told beforehand to expect skepticism from the Vietnamese if I indicated I wanted to try Vietnamese foods. I found just the opposite. Such wishes were warmly received and several items were recommended. Pho (Hanoi soup) and cakes of sticky rice are very common for lunch. I also found eel soup very tasty. However, fish sauce is definitely an acquired taste. An inexperience with chopsticks is sometimes an inconvenience.

I was able to visit several interesting sights while in VietNam. The Museum of History has archaeological exhibits of items over 7000 years old. There are several interesting pagodas, many still functioning. While the Mausoleum of Ho Chi Minh is impressive, I found his former home even more interesting. There are several well kept parks and small lakes in Hanoi.

I took one trip about 40 kilometers to the southwest of Hanoi, to visit Tay Phuong and Thay pagodas and to see part of the countryside. January is a poor time of the year for visiting the northern coast, but I was promised that if on a future visit I travel in either the spring or fall a trip to Ha Long Bay will be arranged. It is about 120 kilometers east of Hanoi and, from all reports and photos I have seen, quite lovely. I took a fairly extensive collection of photographs during my trip. Though my cameras attracted curiosity, there were restrictions on photography only inside the Mausoleum of Ho Chi Minh or at military installations.

I found the Vietnamese very friendly, and also very proud of their country. Though I encountered a few reactions of surprise when people first learned I was from the United States, I detected no signs of anti-Americanism. I did detect a general desire for improved relations between the countries, and in some cases what may be an excessive optimism about the prospects for short term improvement.

Overall my visit was quite pleasant and very interesting, and I have already started considering a return

visit. The Vietnamese mathematical community is probably the strongest in Southeast Asia and one of the strongest of any lesser developed country (after China and India). While the Vietnamese would especially like more exchanges in applied areas more directly related to developing their economy, they also would like to maintain and increase the level of such visits as mine.

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