

Liu Shao-Xue

On the occasion of the 75th birthday of Professor Liu Shao-Xue, Beijing Normal University is publishing a volume containing a collection of his papers. In this preface, I want to focus the attention to his initiative to study problems in representation theory. I will outline the development of a very fruitful cooperation between China and the West concerning the representation theory of finite-dimensional algebras, along the line of our mutual contacts. During the years, we became true friends, and I will add some personal comments about my introduction to China and the Chinese culture. Professor Liu Shao-Xue has to be considered as the Nestor of algebra in China and we are very happy that he shifted the interest of many of his students and collaborators to algebras and their representations. Indeed, he is the founder of a large and very successful Chinese school in representation theory of finite-dimensional algebras which covers a broad range of topics and deals with many different applications. This school has its origin at BNU and now has strong outlets at many other scientific institutions not only in Beijing (one has to mention at least Qinghua University and the Academy of Science), but also Shanghai, Chengdu, Hefei, Xiamen, Changsha, and there are many more places.

It does not seem to be necessary to comment on the individual papers in this collection, but one should look also at Liu's book on *Rings and Algebras* which had and still has a tremendous influence. As the title indicates, it is the structure theory for rings and algebras which is the central theme, questions concerning representations are considered only marginal (still, it deals with semisimple modules and the corresponding double centralizer property). In particular, the Wedderburn-Malcev theory, as developed in the book, has to be considered also as starting point for dealing with representations of algebras. The book has served as a basic reference not only for his own students, but seems to have been used throughout China. I tried to persuade Springer to publish a translation into English because it could have been an important and very useful addition to the Western market, but the publishing company did not want to get competition to its other books addressed to the same audience.

1985.

In 1985, Professor Liu visited several European universities, including Bielefeld — this was our first contact. The aim of his travel was to get in touch with some of the active research centers in the West dealing with rings and modules. He had carefully analyzed the present state of research in algebra. Apparently, he was impressed by the stormy development of the representation theory of finite-dimensional algebras and he had decided that China should get involved in such investigations. He wanted to start to cooperate with all the relevant schools, hoping that after some time the Chinese algebraists would be able to participate in the worldwide research competition. It was obvious that he had a clear vision of

the role China should play in the future: to become a leading contributor to the research.

It was August, the typical holiday time in Germany, so not many mathematicians were around, and usually no lectures are scheduled at this time. Still I felt that I should ask Professor Liu whether he would like to present some results, but with the warning that the audience should be rather small. Yes, he said, he would be happy to give a lecture, or better: to give four short lectures, on four different topics, each one of 15 minutes. I was uncertain that this could work, but what could I do? The lecture given by him was a real surprise and it was very well arranged. In any one of the four parts, he first outlined in detail the context, with all the necessary definitions, specified a problem and finally showed the solution (or a partial solution) which had been obtained by him and his students during the last years. In this way we obtained an impressive insight on the scientific interests and the research power of his working group. I still remember the broad range of topics: T-ideals, nilpotency of radicals, pure semisimplicity, and non-associative rings (Jordan algebras). At that time, Skowroński (from Torun, Poland) was also in Bielefeld, and the part which was of most interest to Skowroński and me was the third part, dealing with pure semisimplicity (this concerns rings for which every module is a direct sum of finitely presented ones). There was a large overlap with recent results by mathematicians from Torun, but the corresponding manuscripts had not been available in China. We raised the question about left-right symmetry (a problem which still has to be resolved), since there had been several attempts to provide a solution, but all these announcements were later withdrawn. Liu was well aware about the problem: they had worked hard on it, but had also no success. So the lecture ended in a fruitful discussion and the wish to exchange the corresponding papers. It was the precision of his thinking, the perfect presentation and the well-chosen motivation which impressed us most.

This was his plan: he wanted to send students to all the relevant universities in the world in order to obtain there a Ph.D., and conversely to invite some of the experts for a stay at BNU in order to give series of lectures. As first measure, Deng was sent to Zürich where Gabriel was working, Luo to Carleton University (Dlab), Shiping Liu to Liverpool (Brenner and Butler), and Changchang Xi to Bielefeld. At that time, M. Auslander who was also approached saw problems to accept a student, but later Luo moved to Brandeis University. After my visit to China in 1987, Yingbo Zhang came as second Ph.D. student to Bielefeld and then later Yanan Lin as a third one. Furthermore, Guo obtained a Humboldt fellowship for working with me. Later several other Humboldt fellowships were awarded to members of the Chinese representation theory group (to Pu Zhang, LianGang Peng and to Bangming Deng). This, of course, increased the mutual contacts between Germany and China considerably.

Most of the students mentioned had been for some time at BNU, but actually they were selected from all over the country. In fact, it seemed to me that Professor Liu and Professor Cao (from ECNU, the East China Normal University) felt their responsibility to care for all the young Chinese algebraists, at least those studying

at “normal universities” (those devoted to the training of future teachers). The best of these students were invited to come to BNU or to ECNU, to get there their education, so that later they could go back to their home university with a proper training. And some of these were selected to obtain a Ph.D. from abroad, or they were asked to apply for other support such as a Humboldt fellowship.

Liu Shao-Xue had brought several photos with him in order to present a more vivid picture of BNU, and it was clear that he was proud of his university. Most of the pictures were very convincing, so for example I learned that Lu Xun had been a member of BNU (at that time, a nice volume with some of the most famous stories and texts of him had appeared as a volume of *Die Andere Bibliothek*). But there was one picture which irritated us. It showed the gate of BNU: it neither looked old (that would be a convincing argument in the West for presenting it), nor very fancy. Why does someone care about a gate? Are there actually still walls around a university or other institutions (indeed, these are!)? And could it be that the doors are closed in the night, as it was customary in the middle age in European towns? It took me quite a while (and several trips to China) to get some understanding of the importance of the walls around a danwei. A university in China is more than a place to study and to do research. Professors and students, as well as all the subsidiary staff do not only work together but really live together, in a well-defined area, surrounded by a wall. In some sense, such a university also resembles a monastery, well-shielded from the outside, with nice gardens and not too many distractions. These units (which may be a university, or a factory, or some administration, ...) have their own schools, their hospitals, their shops and restaurants, they are nearly self-sustaining, something like small towns in themselves. A city such as Beijing breaks up into thousands of independent units — and the gates symbolize the importance of the units.

During Liu’s stay at Bielefeld, we discussed various topics, ranging from mathematics to culture and politics. It was of interest to see his rating of different mathematical subjects, and his clear assessment of the relevance of notions and results. For example, I remember that he raised the question why I follow the tradition to speak of “torsion theories”? Is this a theory? Or is it not just a typical mathematical object, namely a pair of subcategories, and thus should be named “torsion pair”? And he was right. So, in later publications I changed the terminology.

1987.

My first visit to China was in March and April 1987, being invited by BNU and ECNU. The German research council sponsored the flight and I remember that my application was commented by one of the officials by saying that recently there were many similar applications: *Apparently, it is easier to invite lecturers than to buy books.*

My lectures were scheduled in the morning, usually for three or four hours. Three days lecture were followed by a free day. The graduate students who attended my lectures were Guo, Xiao, Yingbo Zhang and Tang, thus two male and

two female students, and there were around ten undergraduate students, also here the proportion of female students was high. This was quite strange for me, since in Germany mathematics is considered in public as a “male” discipline, and unfortunately female students are often scared away. In later years, it seemed to me that a similar tendency was observed in China — a very unfortunate development. All the students were very active, some came in the afternoon or even late in the evening to ask questions and to discuss with me partial solutions of their home work. And they were very well prepared for my lecture, even showing me copies of original papers related to the content of my teaching. They had seen already quite a lot of the relevant definitions and had read theorems and proofs, however they had not worked through any example at all, so they had severe difficulties to see the relevance of the results.

My lectures followed notes which I had made for a similar series of lectures at Antwerp, however the reaction of the audience was quite different: the atmosphere at BNU was very enthusiastic, but I had to spend much more time on some of the details when dealing with specific applications. So in later lectures, I changed the presentation and shifted all the attention to a better understanding of relevant examples. It was clear that it was important for Chinese students to get personal instructions, not just to obtain books to be read.

One has to recall the hardship at that time: it was very cold, the students were wrapped in heavy coats in order to survive. When giving lectures, I was happy of being able to move around, and I would have been afraid to sit there for three or four hours (also, as lecturer, I had the privilege to obtain all the time hot tea, a very kind gesture). It was end of March, and the official winter period was over (the weather did not care about that), so there was no heating anywhere. An exception was made in the building for foreign experts (where I stayed), and for Professor Tuan whom we visited at Beijing university. He was a student of R.Brauer and it was of interest to listen to his recollection.

To work with Chinese students was usually a pleasure. But sometimes there were surprises. I remember that Changchang Xi, being new at Bielefeld, once contacted me claiming that he did not understand some proof of mine (in the Springer Lecture Notes volume 1099). Without looking at the corresponding pages, I tried to explain him the principles of the methods used; still he insisted that he had problems with the proof. So finally we went through the text, line by line. When I mentioned in by passing that apparently there was a misprint, a t was typed instead of an n , he immediately responded: *yes, if one uses there n instead of t , then the proof works well*. Obviously, he never would have dared to believe that a written text could contain misprints!

And most of the Chinese students had a forceful desire to solve problems, if possible to solve a new problem every month. Such an attitude will not allow any polishing of proofs, no reflection on the best possible way for writing up the results. And I guess that Professor Liu himself, whose writing always was very refined, could not be pleased in this way.

During the first days of my stay, I had a cook for my own. He prepared every

day a kind of Western dish just for me - but I wanted to have Chinese food. Thus, after some days, I took all my courage and copied some Chinese characters from my travel guide, telling him that I would not come back the next day. After that, I learned about the refectory for foreign students, where I enjoyed various kinds of Chinese food. But I was astonished to see the strict separation between Chinese and non-Chinese students (whether from Europe, America or say Vietnam) at that time. The food was fine, but of course it couldn't be compared to the jiao-zi which I tasted when visiting the home of Professor Liu: they were prepared by his wife and were really delicious. Once, also Yingbo Zhang invited me and cooked herself: I was allowed to watch her and to follow all the steps. Clearly, Chinese cooking is an art in itself. And there are many specialities like sea cucumbers, rice field snakes, or also dogs (*"The yellow dogs taste best"* — a sentence which brings every German table conversation to a sudden end), and astonishing variations of classical European ingredients (for example potatoes cut into tiny sticks).

Liu Shao-Xue also introduced me to Beijing operas. At that time, I did not even appreciate the European operas (in contrast to all kinds of other theater plays): They seemed to me too artificial, too far away from any reality (just imagine someone standing there and singing "I run away, I run away" - why doesn't he do what he asserts?), and the Chinese operas obviously looked even worse. The first one I saw was the *White Snake*, and this was a great shock for me. It took me some while to realize the essence of such operas: the perfectness of the presentation and the virtuosity, but also the symbolic reference, the refinement of style, the precise interplay between music and movement. Beijing operas were however popular only for elder people. Indeed, when I mentioned my interest to some of the students, they were surprised and told me: *You are young, why do you care about such things?* There was already concern about the survival of traditional operas, Guo accompanied me to a corresponding meeting. Coming back to Germany, I tried to learn more about operas, both the European and the Chinese ones. Yes, I have to admit that my understanding of the European operas relies on seeing Beijing operas.

After my visit to Beijing, I took a train in order to stay at ECNU for another week. On the way I wanted to stop over in order to climb the mount Tai Shan. Professor Liu accompanied me to Qufu (the home town of Kong Fu Tse, and near the Tai Shan). However, it was not possible to preorder tickets, thus to continue for Shanghai, I had to stay at Qufu for three days. During these days, I gave some lectures at Qufu Normal University, apparently as one of the first visitors after the cultural revolution.

1991 and 1994.

A further visit of me to China was planned for 1989. I had managed to make a booking for the Transsiberian Railway from Novosibirsk to Beijing, which was not easy at all - usually you had to use the Transsib all the way, but there was the Malcev conference at Novosibirsk which I wanted to use as a start. Quite a while after June 4, Yingbo asked me whether I would cancel the trip to China. I

replied: No, I will go. She said: You don't hesitate to go to China this year? I told her: No. She told me: You will not go. But I wanted. However, some weeks later, I obtained a letter from Professor Liu, telling me that he had heard that I had hesitations and that in this case I should not feel obliged to come even having made the promise. I interpreted this as the message to cancel my plan - which I did with quite regret. At Novosibirsk, I met Professor Liu and found out that we both were unhappy about the cancelation of my visit, but it was too late to renew the arrangements.

I was excited to hear that there was the plan to hold a Chinese-Japanese ring theory conference in 1991. I liked the idea very much, because both countries have a long tradition in ring theory and I felt that despite of possible political concerns scientists should always cooperate. By that time I had strong contacts both to Japan and China, and so I was very pleased to be invited (as one of a small number of Westerners) to this conference, which was held at Guilin. The Chinese contributions showed in which way algebra had survived (and even flourished) during the cultural revolution, in complete isolation, without proper access to books or journals. Without much prerequisites, general properties of rings and modules had been studied. Most of the talks focused the attention to properties which hold for the vast majority say of rings, without any discussion of examples. Special properties of those rings which arise in nature, those which are of interest in other parts of mathematics, were not considered as being of greater interest. As a counter balance, I decided to speak on finite-dimensional hereditary algebras, their properties and the relationship of this class of algebras to other parts of mathematics. My aim was to stress the importance of detailed studies of very concrete mathematical objects.

It is customary that during a mathematical conference one half day or even one day is reserved for some excursion. The organizers of the Guilin conference had planned even two such occasions: the visit of a marvellous stalactite cave and a boat trip on the river Li. The landscape around the river is very special, with mountains which look like sugar loafs. Some of these mountains are plain rocks, and looking at the stone one may envision hidden pictures. Liu challenged the participants to use their imagination and to explain what they see. For example, one of these peaks is famous for its "nine horses". It was interesting to observe the different reactions to this game. One of the mathematicians from Japan proposed instead to evaluate the phallic shape of the peaks, but Liu condemned this as too obvious and blatant.

Europeans are less enthusiastic about stones and the miracles they hide. Of course, the so-called precious stones are admired and are used for jewellery, and one finds stones like marble in entrance halls, as floor covering or table tops, but never you will take an individual stone as a decoration like a painting or a sculpture. I learned from Liu to follow the flow of lines and to interpret the colors in order to see the inherent pictures. Such a perception yields a transfer from nature to art.

The Nankai Institute in Tianjin devoted the academic year 1993/4 to Representation Theory and it was a pleasure for me to stay there for several weeks.

For the same period, also Auslander and Reiten had been invited, and later Puig arrived. The discussions with all the participants were very fruitful. I presented the idea of adding infinite-dimensional indecomposables to the Auslander-Reiten quiver (which is made from the finite-dimensional indecomposables) in order to sew together different components. What one obtains in this way may be called an Auslander-Reiten quilt.

I was happy to have again a bicycle at my disposal and I used much of the free time to cycle around. Once Auslander was asking me where I had been. I told him of all the temples I had visited, the old traditional houses I had seen and so on. He was amazed to hear about temples and pagodas — he had asked Guo about the city and was told there would not be any attraction. So when he spoke to Guo again, Guo replied: *There is nothing special, it is just like any other Chinese city.* What seems to be the usual thing for the local people may be of great interest, even surprising, for foreigners: I remember, when I went with Professor Liu to one of the cellars in Antwerp which serve a big variety of beer, with wooden tables and candle light (Antwerp is very proud of these places), he told me that it is very difficult for him to understand why it should be nice to have candle light, when one could have a proper electric illumination!

During the visit to Guilin, the Humboldt applications for Pu Zhang and Lian-Gang Peng were planned, both were successful and strengthened the ties between China and Germany. We also arranged a visit of Jie Xiao to come to the Bielefeld Sonderforschungsbereich (SFB). In addition, Changchang Xi (after finishing his Ph.D.) continued to stay at Bielefeld for some time (also as a member of the SFB). 1995 saw the start of the official cooperation between BNU and the Faculty of Mathematics at Bielefeld University. And there was an Oberwolfach meeting at the end of July 1995 where Changchang Xi, Jie Xiao and Pu Zhang were able to participate.

The Volkswagen Cooperation.

During Xi's time at Bielefeld he had cooperated with Steffen König. In order to continue the joint investigations, König contacted the Volkswagen Foundation trying to find out whether they would provide travel support as well as means for computer equipment and literature. The Volkswagen Foundation had supported scientific contacts between Germany and China before, however this program was suspended after 1989. But it was clear that they had the intention to start again, with projects on a broader scale. They asked us to outline such a proposal, including several research groups in China as well as in Germany, aiming not only at the exchange of scientists and the improvement of the working conditions in China, but allowing also Chinese Ph.D. students to come for a year to Germany. We got very helpful comments on our first draft, with an indication to include further items, for example means for German language courses (and the provision that the final application should not comprise more than the double amount of the first draft). The project was coordinated on the Chinese side by Professor Liu, on the German side by myself, it included universities in Beijing, Changsha, Chengdu,

Hefei, Xiamen as well as the Academia Sinica, and the German universities at Bielefeld, Chemnitz, Düsseldorf and Paderborn.

Let me mention the eight topics which were outlined in the application:

- Structure of the module category of a finite-dimensional algebra, combinatorial invariants, generic modules.
- Homological investigations, tilting theory, functor categories, derived categories.
- Vector space categories, matrix problems, reduction algorithms.
- CREP (computer algebra programs for dealing with combinatorial problems in representation theory).
- Hall algebras and quantum groups, canonical bases.
- Cellular algebras, quasi-hereditary algebras.
- Cohomology of Schur algebras and of symmetric groups, Hecke algebras.
- Kazhdan-Lusztig theory.

This list shows the wide variety of joint research themes; not all the open problems mentioned in the application had been solved by the end of the program, but the final report documented essential advances for nearly all of the topic, and in some cases the results obtained exceeded by far the envisioned aims.

For the preparation of the Volkswagen project I traveled to China in 1997 and visited Beijing, Hefei, Xian, Chengdu, Xiamen. After this visit, I felt it would be necessary to learn both to speak and to write Chinese. However I did not succeed at all.

The project allowed five Ph.D. students and one postdoc to come to Germany and actually all of them stayed most of the time at Bielefeld. The first two, Yang Han and Bin Zhu actually obtained their Ph.D. there (this was not the intention of the project, but it turned out that the essential part of the research work leading to their Ph.D. theses was achieved during their time at Bielefeld, so we arranged that their stay could be slightly extended).

The exchange program comprised of mutual visits (up to two months): candidates from China were Jie Xiao, Changchang Xi, Jinyun Guo, LianGang Peng, Pu Zhang, Yingbo Zhang, Bangming Deng and Yanan Lin. Those from Germany were Dräxler, Kerner, König, Lenzing, Happel and Unger. In addition, the Volkswagen Foundation provided means to buy some computer equipment for Sichuan and Xiamen University and books for BNU and Hefei.

The project also included the support of a scientific conference to be held at Beijing; the planning of this conference was done quite early and it turned out that it was possible to organize the conference (ICRA 9) in 2000 in the frame of the ICRA-conferences, thus as a truly international conference. This will be discussed later.

A kind of intermediate ICRA-conference (ICRA 8.5) was held at Bielefeld in 1998. Through the Volkswagen fund, but also many other supporting measures from China as well as from Germany, fourteen Chinese mathematicians were able to participate (Changchang Xi, Jie Xiao, Yang Han, Bin Zhu, Bangming Deng, LianGang Peng, Shao-Xue Liu, Yanan Lin, Xianneng Du, Jin Yun Guo, Hailou

Yao, Pu Zhang, Shunhua Zhang and Yingbo Zhang). All of them reported on recent investigations and Jie Xiao was asked to give a plenary lecture. We were very happy that Professor Liu himself was able to come. This was his second visit to Bielefeld. For that travel, as well as a third one in 2000, his wife could accompany him.

As a by-program to the conference, an excursion to the old city of Lübeck was arranged, with a concert devoted to Mahler's second symphony (it is rather rare that this symphony is played since it requires a lot of resources). After the concert, Liu started a discussion on the meaning of the tunes, on the images delivered by the various sounds and phrases. It was important for him that art should have a meaning, that it is necessary to understand the internal structure as well as the hidden pictures.

When Professor Liu retired there was a great danger that his integration power would be lost. The representation theory seminar of BNU split off in several distinct seminars, with only sporadic joint sessions. Of course, such developments are difficult to control (and a similar development occurred in Bielefeld soon after). On the other hand, by that time his efforts to build a large representation theory group in all of China were bearing fruits and the topic was no longer restrained to Beijing. Now, obviously there is a very fertile cooperation between the different groups across the country. A first survey on the development of representation theory of finite-dimensional algebras in China was written by him and Pu Zhang already in 1996 and has appeared in a volume on *Rings, Groups and Algebras in China* published by Marcel Dekker, which is also included in this volume.

ICRA 9.

ICRA stands for *International Conference on Representations of Algebras*, these conferences had been held before in Canada and in Mexico, in Japan and in Norway, the first one was organized by V. Dlab in 1974 at Carleton University in Ottawa, Canada. ICRA 9 was tentatively scheduled to take place in Torun (Poland), however during the Norway conference in 1996 it became clear that there also would be the possibility to hold the conference in China. At that time, it was not yet specified whether this should mean Beijing, or Hefei and Chengdu: Usually, ICRA's have been accompanied by a corresponding workshop, and sometimes conference and workshop were held at different places. The scientific committee unanimously adopted the proposal to hold the 2000 conference in China (leaving open the precise location) and Professor Liu was asked to join the committee.

I visited Beijing in 1999, in the frame of the Volkswagen project. During this visit, we discussed the organization of the ICRA conference as being part of the cooperation project. I always felt that one should try to hold the opening of such a conference in the old Confucian academy: it still exists, being surrounded by the buildings of the national library, near to the Confucian temple in the north-east of Beijing. The Chinese colleagues tried to get the permission but apparently failed. I also joined the local organizers when they approached the Chinese Research Council for obtaining financial support. (At that time, we were informed that

a Chinese-German science center was going to be established, supported by the Chinese Academy of Science and the German Research Council. The main purpose of this science center is to host binational conferences, and one may hope that it is possible to organize such a conference on Representation Theory of Algebras in a not too far future.)

During the workshop of ICRA 9, the Chinese representation theory group gave two series of lectures presenting their own contribution to the subject. The lectures by LianGang Peng and Pu Zhang outlined the progress on Hall algebras, the title was *Twisted Hopf algebras, Ringel-Hall algebras and IM-Lie algebras*, whereas Bangming Deng and Changchang Xi spoke on *Quasi-hereditary algebras and Δ -good modules*. On the other hand, on the request of Liu I gave a survey with the title *Combinatorial Representation Theory – History and Future*, including a list of open problems and directions for future research.

The focus of conference and workshop was on questions in the representation theory itself, to a lesser part on possible applications. I felt a little unhappy that the interaction with group theory and with topology, but also with some parts of Lie theory remained undiscussed, since some of the invited main speakers who were supposed to outline such relations were not able to come. In addition, a conference with a similar target was held in Rumania just some weeks before and may have distracted several of the possible participants. Despite all these obstacles the conference was clearly a great success. It provided a vivid picture of the subject and stimulated further progress. The two volume proceedings of workshop and conference (edited by Yingbo Zhang and Dieter Happel, and published by BNU press) record the main developments.

At the time of the conference, another convention took place at BNU: a meeting in didactic of mathematics, concerned with the teaching of mathematics in China. It was discussed whether (or not) China should follow more closely the teaching concepts developed in the West. This seems to be a quite curious proposal, since all the comparative studies show the superiority of the traditional teaching used in the East. But it requires that students work hard, without being allowed to blame the environment of the teacher for any failure. Of course, learning by heart alone is not sufficient for a proper understanding, but it is a necessary requirement for building up longer range considerations. And as intensive training in sports, the final success should provide the student with satisfaction.

When I visited Dunhuang, a city in the middle of the desert, I was amazed to see in a bookstore a large number of booklets with mathematical exercises. They looked like school books, but I learned that they are bought to be used by the children after school, and to allow the parents to control what the children have learned. A lot of these booklets were edited by an institute at BNU devoted to the problems of teaching mathematics. I should note that Bielefeld is famous for having a correspondingly named institute (the IDM), but its impetus is of a completely different nature: one of its endeavor was a proposal to reduce teaching of mathematics for those students who do not aim towards mathematically oriented professions: why should they be confronted with quadratic equations, with sine

and cosine, or with mathematical proofs? It is a pity that mathematics often is considered as a burden and not as a source for inspiration and understanding.

For quite a while Professor Liu has now been engaged in mathematical education both at university, as well as high-school level. I remember that already in 1996 he complained to me that students who have studied undergraduate algebra will know the Van der Waerden approach, but will not be aware that groups were actually designed in order to describe symmetries. He took a lot of effort in order to remedy this situation!

2002.

In 2002, the International Congress of Mathematics took place at Beijing. Every four years, such a congress is organized somewhere in the world, and it is considered as the main gathering of mathematicians. During the congress I visited BNU twice. There was a tour around the campus for some of the participants of the ICM, and during the final dinner we praised the official cooperation between BNU and Bielefeld university which has been extended to include analysis and stochastic as well. And I was invited to give a lecture on recent developments and possible future directions in representation theory. I choose to report on ICRA 10 which had been held some weeks before at the Fields Institute in Toronto (Canada), since unfortunately not many Chinese mathematicians had been able to participate in this conference.

The present state: The Chinese group in representation theory is now working on a big variety of topics. Let me give just a few indications: Yingbo Zhang devotes her time to the very delicate representation theory of BOCSEs. Changchang Xi deals with quasi-hereditary algebras, the representation dimension, the finitistic dimension conjecture, with Hecke and Brauer algebras. There is a large group working on the Hall algebra approach to quantum groups, namely Xiao from Qinghua University together with Peng, Deng, Lin and many others. Their contributions are highly appreciated, they are published in leading journals and often quoted and used (and there is some parallel work by Zhang Pu and by Guo). Despite the diversity of the approaches and thoughts, all the groups unite at least once a year for several days, a very important measure for the exchange of ideas.

The Volkswagen project found its continuation by an EU-project under the scheme "Asia-Link". The main coordinator is Steffen König (now at Leicester), the Chinese coordination is in the hands of Bangming Deng. It includes four research groups in China (Chinese Academy of Sciences, Beijing Normal University, University of Science and Technology of China, Hefei and Tsinghua University, Beijing) and five in Europe (Leicester, Leeds, Chemnitz, Bielefeld, UIA Antwerp). It started in October 2002 and will run for three years. As part of this Asia-Link project, there will be two conferences held at Beijing in 2005, the first one, in May, will have a broad coverage of topics, the second one is devoted to a more special topic, namely to the theory of triangulated categories.

Moreover, there are plans to establish a joint Chinese-German graduate school. An application (by Henning Krause and Bangming Deng) is scheduled to be

handed in by the end of 2004.

Looking at the ongoing and indeed increasing cooperation, one should note the change which has occurred: Whereas in the early years the flow of ideas was mainly in one direction, there is now a real partnership, and actually China takes a leading role in several research topics. In this way, the vision of Professor Liu expressed in 1985 has been very much fulfilled.

Being introduced by him to the Chinese vision of science and art, this was very valuable for me: I learned from him a deeper understanding of culture. He introduced me to Chinese culture, but at the same time I obtained also completely new views on the European one. His attitude towards arts and culture is the same as the one he exercises towards mathematics: First of all, there is his obvious ambition for perfect presentation. But of course, the main concern has to be the content: the concentration on basic and important problems and the vision of a unified global theory. The struggle between general assertions and concrete examples cannot be resolved in a one-sided way, both directions are of importance. And finally, his drive for understanding the internal structure, for elaborating hidden images corresponds to the old tradition to visualize algebraic results using combinatorial devices. The representation theory of finite-dimensional algebras has a very strong combinatorial flavor, so it does not seem to be surprising that he was attracted by it very early.

Bielefeld, 30.08.2004

Claus Michael Ringel