

Report of the Review Panel on the Erwin Schrödinger International Institute for Mathematical Physics

November 30th – December 1st 2002

Members of the panel:

N J Hitchin (Oxford) Chairman

R Dijkgraaf (Amsterdam)

J Jost (Leipzig)

N Reshetikhin (Berkeley)

V Rivasseau (Orsay)

§1. Overview of the Institute

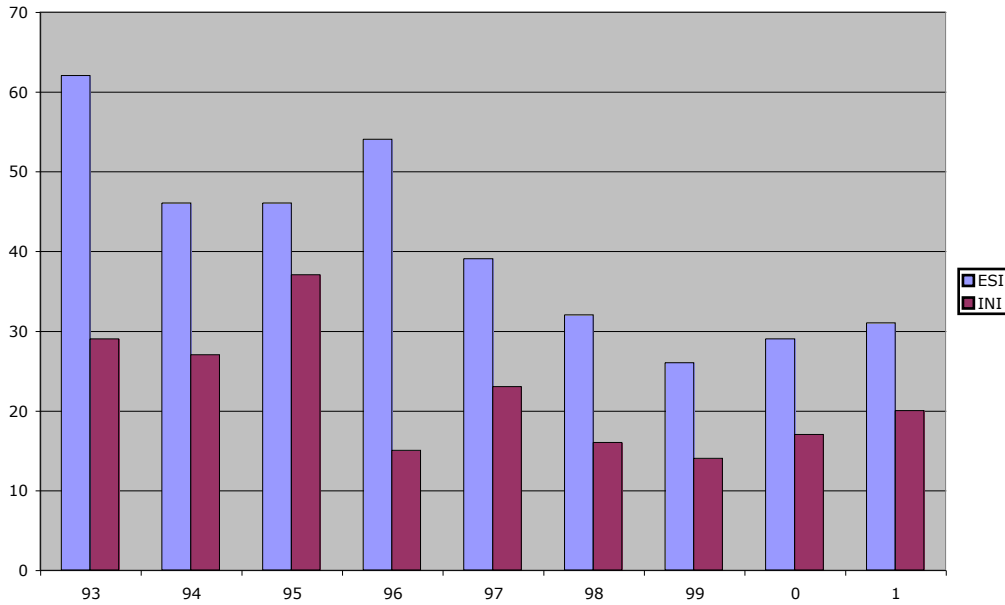
The ESI was founded in the early 1990's to provide "a focal point for both Eastern and Western science and an international platform at the highest level of research". This mission was strongly influenced by the desire to aid the scientific community in the former communist countries of Eastern Europe, with the aim of trying to stem the brain drain from those countries. Its first activities in 1993 attracted some very strong participants but over the next three years its programmes were constrained by the size of the location, adjacent to the last home of Erwin Schrödinger. In 1996 the Institute moved to its present premises, within a 200-year old Catholic seminary whose interior was attractively and innovatively remodelled for its new purpose. At the same time the International Scientific Advisory Board was restructured to include leading international figures with both a high research profile and active knowledge of parallel institutions.

The new Institute, with its capacity of 35 desks, has evolved a method of hosting programmes and visitors which is particularly economical with regard to staffing resources. The Directors and President receive no salary, but benefit from their "shares". (In this respect, the panel acknowledged also the tremendous time and effort which the President and Directors have spent in running the Institute.) The computer system is deliberately kept simple and can be managed without a full-time computing officer. The three secretarial staff handle the needs of the visitors with the minimum of bureaucracy.

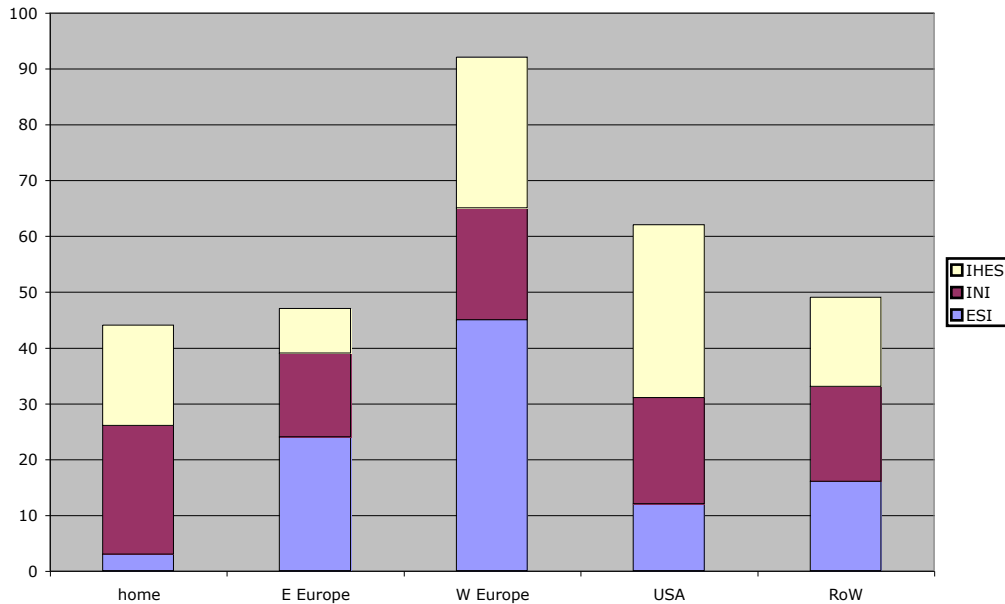
After nearly ten years the ESI has gained a recognized position amongst the research institutes in mathematics and physics in Europe by building upon the scientific tradition of Vienna in the fields of mathematics and physics and the cultural tradition and the regional contacts in Central Eastern Europe. It participates in particular in the postdoctoral EPDI programme which links the two Max Planck Institutes in Germany, the IHES in Paris, the Isaac Newton Institute in Cambridge, and institutes in Warsaw and

Spain. For a country of eight million, Austria is clearly competing well at the same level as much larger countries in this area. It is also exposed to the same phenomena, one of which is the decline of long-term visitors, largely due to social changes. The first graph below illustrates that the ESI has always had a higher proportion of long term visitors than the Isaac Newton Institute but follows the same trend, and in the second we see that having established itself in the same league as the other European Institutes, the visitor profile (for the year 2001) is distinctively weighted more towards Eastern and Western Europe.

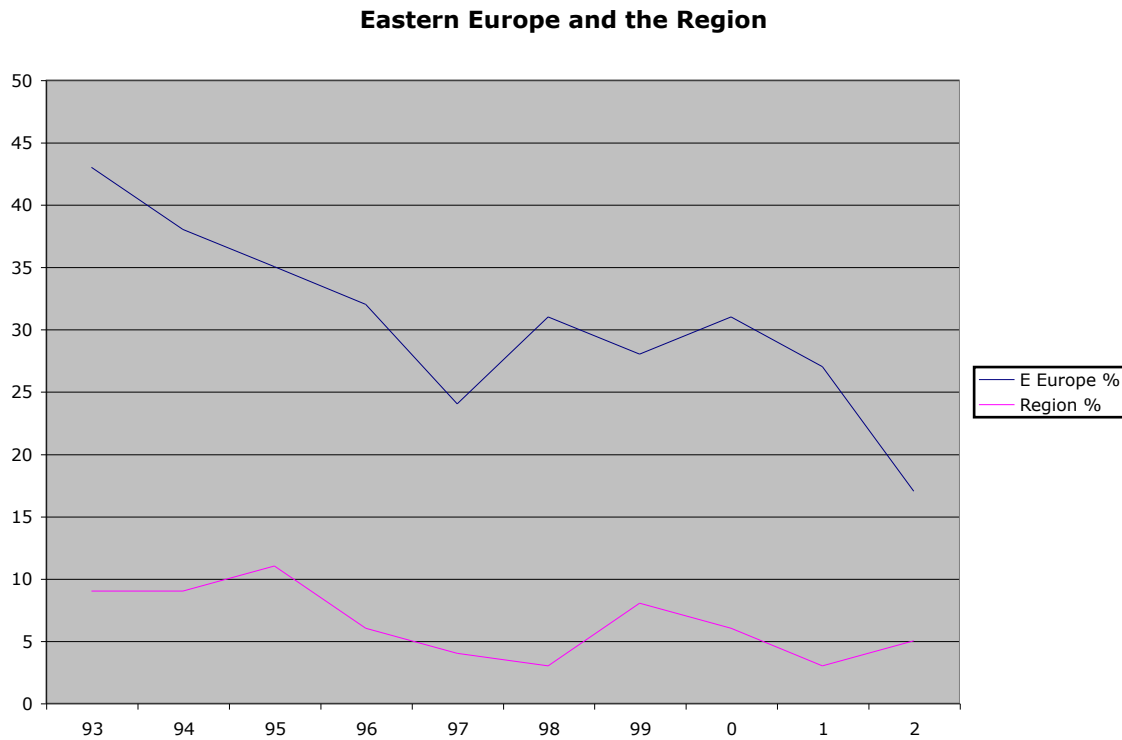
Percentage of long term visitors



Visitor profile



Because of its geographical and historical situation the Institute has attracted over the last nine years a large number of visitors from Eastern Europe. Now as it enters the second phase of its existence, that pattern is changing. The chart below shows the gradual decline in the percentage of visitors from the former communist countries and also the proportion from those nations of Eastern Europe – Hungary, Slovakia, the Czech Republic and Slovenia – which will become new members of the European Union and which belong to the region for which Vienna is a natural focal point.



§2. The Panel's procedures.

The panel members were provided before the visit with the Institute's Scientific Report for the years 1993-2002, together with budget statements for the years 2000 and 2001. They also received while at the Institute synopses of the Advanced Graduate Lecture

Series given by Senior Research Fellows Professors Vershik and Onishchik.

During the first morning of the visit, Saturday November 30th 2002, the panel consulted the President and Scientific Directors and Professor Schwermer, the liaison officer to the Austrian Universities. They then made a tour of the premises and talked to the secretarial staff. There followed a consultation with two Senior Fellows, Professors Todorov and Onishchik, with Professor Losik and two programme/workshop organizers Professors Kamber and Garcia-Prada. Over lunch in the common room contact was made with mathematicians and physicists from the local community which was further developed in panel consultations in the afternoon. Representatives in mathematics and physics from the University of Vienna and the Technical University were present as was a graduate student and postdoctoral researcher. After a private session the panel consulted again with the President, Scientific Directors and Professor Schwermer, discussions which continued in a more informal manner over dinner. On the following Sunday morning, Senior Fellow Professor Vershik gave his opinions to the panel.

§3. The programmes

The core activity of the Institute consists of the five large programmes run annually. Most years have at least one programme which can be favourably compared to any such activity in the area worldwide. The key participants have been secured at some stage in the programme, and the topics covered have been at the cutting edge of research in the discipline. To name a few, there are the programmes on Schrödinger operators (1993), noncommutative differential geometry (1995), ergodic theory (1997), spectral geometry (1998), functional analysis (1999), representation theory and algebraic groups (2000), random walks (2001) and developed turbulence (2002). These demonstrate a wide range of subjects covered at the highest possible level.

Every year there are also programmes which perform a very useful function, bringing together a significant proportion of the world experts in a coordinated way. There are ongoing minor commitments such as the Winter School in Differential Geometry and also sporadic events which capitalize on anniversaries of eminent physicists and mathematicians to bring together leaders in the field.

The panel got a good feeling for how the Institute operates by talking to Franz Kamber, the principal organizer of the current programme on foliations. He had initially budgeted for €90,000 but ESI reduced this to €80,000 in direct funding. The resultant gaps were filled by using a mixture of contributions from Directors' shares, the Clay Institute in the USA and the EDGE European network. This achieved a total funding of €100,000. Out of 140 potential participants, 90 came, and without too much management they averaged 10-15 a week which suited the constraints of desk space. Some of the big names in the field such as the Fields Medallist Alain Connes attended, and in order to provide the space for working on actual problems, lectures were restricted to two days a week. Kamber found the facilities offered by the institute ideal for the programme he ran. The

panel heard a similar response from Dr Garcia Prada, who ran a workshop within the programme. He remarked that, thanks to the way the Institute dealt with the activity, it was possibly the easiest workshop he had ever organized.

Programmes are in general planned two years ahead of time, but the Directors' shares allow the possibility to fund activities at short notice. The panel approved of this flexibility, and would like to see it extended, though could not come to agreement on how the distribution of such extra sources of funding would be managed.

§4. The International Advisory Committee

The Advisory Committee plays an essential role in the running of the Institute. It is the quality control mechanism for the scientific content of the programmes and provides input to improve proposals. It can also solicit proposals. During the last two years 50% of the proposals have been rejected through this filtering process, some of them of a good quality. This selectivity is a healthy sign of the demand for the ESI's facilities and the quality of the programmes agreed upon.

Unlike other institutes, the committee does not ask for external referees' reports on the proposals, but relies on the expertise of the members of the committee and their close contacts. It would be a significant extra clerical task if such reports were to be sought, which ESI may not want to take on, but it does mean that currently the balance of the programmes and their content is to a large extent in the hands of the committee.

The panel noted that there did not seem to be a systematic turnover of members of this committee, or well-defined criteria for membership. It had changed significantly in 1996-97 and since then the local participation has been reduced, but for example Professor Lieb had been on the committee since the beginning.

The panel believes that ESI should give more thought to both subject coverage and geographical coverage of the membership of the Advisory Committee. For example, one might put a theoretical physicist on it, an eastern European member, and so on. Possibly it should be enlarged. If the committee is to initiate research programmes it is essential that new ideas are fed into it by changing its membership in a regular fashion.

§5. Operation of the Institute

The panel noted that the hotel accommodation offered was of a high standard, but that visitors who wished to pay less of their daily allowance on housing were aided by the secretarial staff to find something suitable – a number of standard locations were used. Although the Franz Josef Hotel was some distance away, access by tram was easy. Since travel is not covered by the institute, payments to visiting scientists are relatively straightforward. The per diem payment is at the moment €75, comparable to that paid at

the Isaac Newton Institute. Visitors when they arrive can register, receive their computer account and have their photograph taken quickly, as the panel experienced. Even when a workshop was beginning, the secretaries told the panel that the numbers were such that they could be easily managed.

The design of the building was very effective as well as being of a high architectural standard. Some remarks were made about the lack of soundproofing between the offices but the computers in the corridor and the chairs and blackboards outside offered ample opportunities for interaction amongst the visitors. The physics library is very close and the mathematics one a short walk away. Facilities for lunch are available in restaurants nearby. One participant told the panel that the size of the city of Vienna was also ideal for a congenial stay.

The panel noted that computer-related problems are dealt with by Dr Cap, who has an office in the building, and for his services he receives a small “share”. One panel member remarked that the introductory notes for visitors on the webpage, in particular for local travel, needed updating. The efficient operation of the Institute owes much to the chosen size of the facilities and the number of people within it at any given time. Any increase in size or scope would be likely to require additional fulltime staff.

§6. Organizational structure

The organization of the Institute under the aegis of the Erwin Schrödinger Society appears to function well. While having a symbiotic relationship with the University of Vienna, the independence of the Institute was felt by the panel to be an important feature, and everything should be done to preserve this.

§7. Senior Fellows

The longer term Senior Fellows are now required to give advanced graduate lectures. The panel was given synopses of two of these: *Real forms and representations* by Arkadij Onishchik and *Measure theoretical constructions and its applications to representation theory, dynamical systems and combinatorics* by A M Vershik. The panel spoke to a student who had attended one of the courses which he had appreciated. The attendance of 10-15 for these is normal at this level. Professor Vershik told the panel that one local student had been writing up notes of the lectures and that this would form the basis of a published version. There was a clear mutual benefit in this activity.

The new form of Senior Fellow serves the local graduate students well but it should not be the only format – the ability to give courses in relevant fields for the Vienna students might narrow too far the choice of candidate. The presence of a brilliant researcher for faculty and visitors benefits Austrian mathematics and physics equally well.

§8. Interaction with the local community

At an everyday level, the ESI interacts with the University of Vienna by sharing facilities – libraries, lecture rooms and computing expertise for example. As far as the panel could see this worked well.

The panel's discussions with members of the local community brought out the links and benefits beyond the tangible contribution of lectures from the Senior Fellows. Since it is normal to have a local organizer for each programme, there is a clear benefit not only for that person's research but also his students in the area. Direct contact with visitors and participation in discussions can advance an individual's research considerably. From the Technical University, the panel was told that, in a background where there is little tradition or funding for weekly seminars, the activities of the ESI have a great impact. Workshops were thought to be particularly important, not just for Viennese scientists but in Austria in general. Some of the local representatives thought that a little more attention could be paid to advance publicity for lectures at the ESI, especially last-minute changes. The panel was informed by the Directors of the mechanisms in place at the moment to do that – notices, e-mail listings etc. Some of the local physicists also conveyed to the panel their feeling that the Institute's programmes were biased too far towards mathematics.

One interaction with the community which the panel thought could be enacted on a regular basis is the notion of an introductory workshop at the beginning of every major programme. This would offer surveys of the main themes within the coming programme for graduate students and workers in adjacent disciplines. Similar activities are carried out in Warwick before a year-long programme and at MSRI.

An important feature of the relationship of the institute with its neighbours is the external perception of the high academic standing of the institute. If it is not viewed as a place where there are good scientists, its influence will not be felt, and the resources it takes may be resented. It is important then, at both an international and national level, that the high reputation which it now has should be maintained.

As with most Departments, retirements from senior positions in Vienna will occur during the next few years. The panel believes that the presence of the ESI could be used as leverage to attract high-profile individuals to fill the positions, and it will be possible also to use the Institute and its visitors programme to support the new research directions which the appointee might bring along. The Institute could then become a vehicle for broadening and strengthening the local expertise which in turn would have a beneficial effect on the range of programmes put on during the second decade of its existence. A longterm presence of excellent researchers at the highest international level in Vienna is necessary for the ESI to continue and conversely the Institute can help to preserve that.

§9. Interaction with the region

The Institute was founded in an era of uncertainty in Eastern Europe when the very continuation of academic science in some countries was under threat. The next decade will see a stabilization within the immediate region and an increase of political ties between countries such as the Czech Republic, Slovakia, Slovenia and Hungary within the European Union. These four countries have a population of 27 million and a current total GDP more than that of Austria, and set to expand rapidly in the near future. An opportunity presents itself for the ESI to become a natural focus for mathematics and physics within this larger context.

To emphasize this is not to suggest that the ESI should exclusively depend on the immediate region, simply to point out that there will be more opportunities within the near future to capitalize on the geographical position of Vienna and the established status of the Institute.

§10. Conclusions

The panel was impressed with the overall scientific standing of the Erwin Schrödinger Institute and earnestly hopes that appropriate funding, taking account of any forthcoming changes in outgoings, will continue in order to maintain and advance the achievements of the first ten years. It operates currently at a capacity which enables it to function very efficiently. Centring the scope of its activities on mathematical physics and related mathematics, without excluding theoretical physics, seems to us optimal for ESI. This reflects both the origins of the institute and also its ability to attract world-class experts from a wide range of countries, and especially those of Eastern Europe. Keeping this focus enables the Institute to operate compatibly with its size, budget and surroundings, though it could be open to a moderate diversification should the opportunity arise.

§11. Recommendations

Below we list some specific recommendations which arose out of the panel's consultations:

1. Allow the possibility of a change of emphasis in the Advisory Board when retirements come up. At the moment, the scientific emphasis is perhaps too much oriented towards purely mathematical topics at the expense of the representation of new areas of physics where mathematical tools are already having, or potentially will have, having a large impact.
2. The new system for a Senior Fellow serves some of the needs of local graduate students but it should not be the only format – the presence of a brilliant researcher in the midst of faculty and visitors benefits Austrian mathematics and

physics equally well.

3. Introductory survey lectures could be used systematically to introduce the subject to graduate students, faculty members and those in the parallel programme.
4. Every effort should be made to develop the ESI's role as a Central European research institute, as political ties increase in the area, and funding opportunities in the region expand.
5. The presence of the ESI should be used as leverage to attract high-profile professors to fill vacant positions, and the Institute and its visitors programme used to support, if appropriate, new research directions from the appointee.
6. Maintain and improve communications with the Viennese community and beyond. Advertise the activities internationally and show beyond the immediate academic community how the ESI makes a positive contribution to the image of Austrian science.
7. A physicist as well as a mathematician should be used to liaise with the Universities, compensated for his or her work by a "share".
8. The funding body should consider an appropriate budget increase to compensate for inflation over the past years and to allow additional flexibility, in particular to respond to new scientific developments of direct interest to the partners at the Viennese Universities.