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No. 39, December 1995

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Secretariat:

Instituto de Matemática Pura e Aplicada - IMPA
Estrada Dona Castorina, 110

Rio de Janeiro, RJ
22460-320 Brazil

The International Mathematical Union

Executive Committee

January 1, 1995 to December 31, 1998

President:
David Mumford

Vice Presidents:
Vladimir Arnold
Albrecht Dold

Secretary:
Jacob Palis

Members:
James Arthur
Simon Donaldson
Björn Engquist
Shigefumi Mori
K.R. Parthasarathy

Past President:
Jacques-Louis Lions

Members of the Union

The following countries were members of IMU as of January 1, 1996:

Group I:

Armenia, Bulgaria, Cameroon, Croatia, Cuba, Egypt, Greece, Hong Kong, Iceland, Ivory Coast, Kazakhstan, Democratic Republic of Korea, Lithuania, New Zealand, Nigeria, Norway, Philippines, Portugal, Romania, Saudi Arabia, Singapore, Slovenia, Tunisia, Turkey, Venezuela, Vietnam

Group II:

Argentina, Austria, Chile, Czech Republic, Denmark, Finland, Georgia, Iran, Ireland, Republic of Korea, Mexico, Slovakia, South Africa, Yugoslavia

Group III:

Australia, Belgium, Brazil, Hungary, India, Netherlands, Poland, Spain, Sweden, Switzerland

Group IV:

Canada, Israel, Italy

Group V:

China, France, Germany, Japan, Russia, United Kingdom, United States of America

IMU and ICM on the World Wide Web

The following letter has been sent to all Adhering Organizations and National Committees of IMU country members and many other mathematical organizations:

We are writing on behalf of the International Mathematical Union to draw your attention to a new initiative of putting the IMU on the World Wide Web. The Konrad-Zuse-Zentrum für Informationstechnik in Berlin (ZIB) has been working together with the Executive Committee of the IMU to compose a "home page" for IMU. You can access this home page using any of the standard Internet tools, such as Mosaic, Netscape, etc. through the URL:

http:/elib.zib.de/IMU/

Gopher access is possible through the following address:

gopher://elib.zib.de:70/11imu

The IMU server can be accessed via telnet as follows:

telnet elib.zib.de
Login: imu
no password required

We invite you to try this out and send us your comments.

We hope this WWW home page will serve several purposes. The first is to inform all members of the international mathematical community of what the IMU is doing. Secondly, they can find there descriptions of various programs from which they can benefit:

- the IMU lectures,
- exchanges with the developing countries,
- conferences being sponsored, etc.

Thirdly, the IMU server is also a collection of data that everyone can use to find the addresses of the main mathematical organizations of the world. We are planning to extend the scope of the IMU server so that it will become a true "home page of the world of mathematics". You can already find a number of links to mathematical and mathematics related information offered around the world. Just look at the "Links to the Mathematical World" in the IMU server.

Fourthly, the IMU server will give everyone immediate access to the latest information on the next International Congress (ICM98 in Berlin), as well as the ability to preregister for this congress by the WWW server of ICM98 that can be "clicked" in the IMU server or can be directly accessed through the following URL:

http://elib.zib.de/ICM98

The ICM98 server contains a forms page for "preliminary preregistration". This is not a formal registration yet. Everybody preregistered for ICM98 will be informed in the future automatically about the progress of the organization of the congress by email and will receive the final registration material etc. this way. Please encourage your colleagues interested in ICM98 to preregister for the congress.

Whoever does not have the possibility to use the advanced Internet tools described above can send an email to the following address:

icm98@zib-berlin.de

and writing

PRELIMINARY PREREGISTRATION

into the SUBJECT line.

Inthe body of the mail the following information should be contained:

Last Name:
First and Middle Name:
E-mail:
Phone Number:
Fax Number:
Institution:
Street:
ZIP Code:
City:
Country:

Every member country of IMU is listed in the IMU server. We have one very specific request:

Can you examine the entry dealing with your country, and check whether the names and addresses are correct? We want to make every effort to keep this data collection up to date and correct. Of course we would be happy if you could provide us with additional information that we could add to the entry of your country. In particular, links to existing or planned servers of mathematical societies, institutes etc. are most welcome. The best way to inform us of any changes is to email us the corrections and suggestions to

"groetschel@ZIB.DE", with a copy to *"imu@impa.br"*.

We have a second request. We are aware of the fact that Internet communication is sometimes slow due to network overload. We would therefore be glad if some institution in your country would agree to mirror both the IMU and the ICM98 servers so that mathematicians in your country have a faster and more comfortable access. Technical details concerning this matter will be handled by the Konrad-Zuse-Zentrum für Informationstechnik in Berlin (ZIB). An institution willing to mirror the servers should contact Martin Grötschel (email: *groetschel@zib-berlin.de*).

Finally we have a third request. We would be happy if you could distribute the information contained in this letter to the mathematicians in your society and your country in whatever form you find appropriate (emailing a copy of this letter to interested colleagues, a note about this letter in your newsletter, etc.).

Sincerely yours,

Martin Grötschel (President of the ICM98 Organizing Committee and Vice-President of ZIB)
David Mumford (IMU President)
Jacob Palis (IMU Secretary)

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Fax: +55 21-512 4112 or 21-512 4115
E-Mail: jpalis@impa.br or imu@impa.br

World Directory of Mathematicians - 1998

National Committees and Mathematical Societies are requested to prepare the list of mathematicians in their country. Each of them should be the authors of at least two papers published in jounal whose articles are internationally reviewd . E-mail address and fax numbers should also be provided, when possible.

Meeting of the Executive Committee of IMU

The Executive Committee of IMU met on May 11-12, 1995 at the Collège de France.

Excepts of this meeting:

Program Committee

The members of the Program Committee were appointed at the meeting. The Chairman is Professor Phillip A. Griffiths. Any suggestion concerning plenary speakers, invited presentations, or the structure of the program in general, please write to:

Phillip A. Griffiths
Institute for Advanced Study
Olden Lane, Princeton, NJ 08540-0631 - USA
Fax: (1) 609 683-7605
e-mail: pg@math.ias.edu

Elections

Following the Resolution 6 of the last General Assembly, the Executive Committee of IMU redrafted the proposed Procedures for the Election of the Executive Committee of IMU, as well as those of ICMI and CDE. They have been sent to all IMU Adhering Organizations and National Committees as follows:

Procedures for the Election of the Executive Committee of IMU 1998

1. Not less than a year before the meeting of the G.A., the E.C. shall request proposals for the membership of the E.C. from the National Committees for Mathematics, to be considered before the meeting of the E.C. in the spring before the Assembly. The E.C. shall then draw up its own list of nominations, making certain that each candidate is willing to serve if elected. The slate should be mailed to the National Committees at least three months before the G.A., together with background on the candidates, their fields and countries/geographic areas.

2. After the slate drawn by the EC is known, the National Committees can make further proposals of names specifically for the offices of President, Secretary, Vice-President, and Members at large. These proposals shall reach the Secretary not less than one month before the G.A. The same information as above concerning the nominees, including their willingness to serve if elected, should be provided. The Secretary will inform all National Committees of these last proposals before the G.A. The National Committees are asked to cooperate in having their delegates to the G.A. fully informed..

3. Further nominations may be made in writing before the last session on the first day of activities of the G.A. provided that they are drawn from names offered by the National Committees as in (1), signed by at least ten delegates and convey the same information as in items (1) and (2) above.

4. On the first day of the meeting, the General Assembly shall appoint a Nominating Committee consisting of:

   a) the President (chairman),
   b) all Past Presidents who are present (ex-officio),
   c) eight further delegates.

   Election to (c) shall be from names either proposed by the President or proposed and seconded from the floor; and shall be by show of hands unless the meeting decides otherwise.

5. The Nominating Committee shall propose a slate from the nominations made under (1), (2) and (3) above and shall make it known to the meeting.

   No person shall be a candidate for more than one office.

6. The General Assembly shall then elect the new President, Vice-President, Secretay and members at large by written ballots.

   The voting slips shall contain all the names nominated under (5) and (3) (unless a candidate withdraws), but no others. A vote shall be invalid if more names are marked in any category than the number of places to be filled (i.e., one each for President and Secretary, two for Vice-Presidents and five for Members at large). A candidate for President or Secretary may be elected only if unopposed or if he or she obtains a majority of the votes cast. If the first ballot is indecisive, there shall be a second ballot. In the ballots for the Vice-Presidents and Members at large, the two or five candidates respectively who obtain the largest numbers of votes shall be elected. In the event of a tie, the President shall decide.

Note: Statute (9) provides (inter alia) that: "each delegation shall be free to cast the votes to which it is entitled either as a unit or divided in such a manner as it may determine".

Procedures for the Election of the Executive Committee of ICMI

The rules for the election of the Executive Committee of ICMI are similar to those for the election of the Executive Committee of IMU with the same Nominating Committee.

The E.C. of IMU shall request proposals for the membership of the E.C. of ICMI from the National Committees for Mathematics and will conduct extensive consultations with the existing Executive Committee of ICMI before proposing slates to the Nominating Committee.

No person can be a candidate for more than one office.

Procedures for the Election of CDE

The rules for the election of the Commission of Development and Exchange are similar to those for the election of the Executive Committees of IMU and ICMI with the same Nominating Committee.

The E.C. of IMU shall request proposals for the membership of CDE from the National Committees for Mathematics and will conduct extensive consultations with the existing CDE before proposing slates to the Nominating Committee.

No person can be a candidate for more than one office.

Scientific Meeting

In the last ten years or so, the Executive Committee and the local mathematical community has been organizing scientific meetings, on the occasion of most of the EC ordinary anual meetings. In the week of May 9-12, 1995, one of these conferences took place at the Institut Henri Poincaré.The list of invited speakers consisted of some Past Presidents and Secretary of IMU and the new members of the EC:

Vladimir Arnold
Henri Cartan
Simon Donaldson

B. Engquist
Ludwig Faddeev
Olli Lehto
S. Mori
Jürgen Moser
K. R. Parthasaraty

The Proceedings of the conference are published in this issue of the Bulletin, starting on page 23 Professor Ludwig Faddeev contributed to the Proceeding but was unable to attend the meeting. Other scientific meetings were supported by IMU as described in the report of activities for 1995 on page 14

Joint activities at ICM-98 (resolutions of the General Assembly, 1994)

The Executive Committee of IMU will ask the Program Committee to take steps to implement the resolutions 3, 4 and 5 of the General Assembly, 1994. The EC also decided to invite the members of the PC to attend the Congress. Concerning ICMI, it was decided to ask the Program Committee and the Local Organizing Committee to announce their activities in the Program of the Congress. The EC decided to invite the President of ICMI to be part of the panel. As for ICHM, the EC also decided to ask the Program Committee and the Local Organizing Committee to make some room for their activities, and to announce their activities in the Program of the Congress.

Program "Turn of the Century" - World Mathematical Year 2000

Following the Resolution 2 of the General Assembly 1994, The EC discussed the planning of World Mathematical Year 2000, in particular the organization of activities such as an invitation to a select group of outstanding mathematicians to present their views on topics they expect to be central to mathematical activity in the next century and the selection of a number of symposia, some possibly organized together with other scientific bodies, dedicated to mathematics, its applications and to its role in society, and also events held under the auspices of ICMI, CDE and ICHM. To select the authors of a book that should be published by early 2000 year, on the mathematical perspectives for the 21st century, the EC nominated the following committee: Vladimir Arnold (Chairman), Barry Mazur, Michael Attiyah, Peter Lax . The discussions about other activities shall proceed and some decisions should be taken in the next meeting of the EC in April, 1996.

Books/Journals for Russian Mathematicians

The Executive Committee decided to continue with the contribution of US 5,000 to the a main mathematical library in Moscow through the Moscow Mathematical Society and the Steklov Institute or Euler Institute at St. Peterburg. This is a renewal of a previous grant in the same amount. On that occasion the gesture was appreciated by the Russian colleagues and the deliver of books/journals well accomplished.

ICM 2002

Following the recommendation of the 1990 General Assembly in Kobe, Japan, the Executive Committee has approved the following new guidelines for the operation of the Site Committee for ICM 2002.

1. The Site Committee will consist of the members of the Executive Committee and Prof. Martin Grötschel of the Organizing Committee of the ICM 1998.

2. All Adhering Organizations are now formally invited to place bids to hold ICM 2002. To be considered by the Site Committee, these bids must be received by the Secretary of IMU by November 30, 1996. The Site Committee then will make its recommendation by May 31, 1997. The recommendation of the Site Committee will be communicated to all Adhering Organizations immediately afterwards.

3. The final decision will be taken by the General Assembly to be held at the middle of August, 1998, just prior to the ICM'98 in Berlin. The General Assembly is free to consider bids placed after November 30, 1996 but the E.C. considers most advisable that the Adhering Organizations comply with the above procedure.

4. While it is impossible to spell out precisely all factors that will influence the final recommendation of the Site Committee, it will take into account the mathematical ambiance, the infrastructure and the economic conditions offered by each bidder, as well as the accessibility of the proposed site and the broad geographical distribution of congresses. All countries interested in making a bid are strongly encouraged to do so.

Notes on what information the Site Committee would like to have for each bid are:

BIDS FOR ICM 2002

BIDS FOR ICM 2002

REQUESTED INFORMATION

Among other relevant information that each potential host country may want to supply, the Site Committee wishes to know about the following items:

I. Finances

Clearly, costs may vary considerably from country to country. However, according to the reports of the latest ICM'S, a potential host country may consider a budget of about 1.5 million US dollars, of which about 0.5 or 0.6 million US dollars might be raised through registration fees (such fees should be at most about 200 US dollars). Again, these numbers may go up or down according to local costs and facilities. In considering the budget, printing costs of the Proceedings and other material (posters, announcements, summary of invited lectures, ...) as well as mailing, deserve special attention.

The host country should be prepared to lodge freely about 120 young research mathematicians from developing countries, selected by IMU; they get their trips paid by IMU through its Special Development Fund. Also, in special cases, invited speakers are expected to receive some financial support for attending the meeting when other funds to cover their expenses are not available. Registration fees are waived for invited speakers and the above young research mathematicians from developing countries.

On the other hand, is to be noted that there is an IMU subvention to the ICM as well as some provision in its budget to defray costs of the General Assembly Meeting that takes place just before the Congress; for 1998, these sums amount to 106.000 Swiss Frs. and 16.000 Swiss Frs., respectively.

II. Infrastructure

It is important that good facilities to hold the Congress are available. All lectures should take place in sizable, well equipped, pleasant and audible rooms. Special attention should be given to the Plenary Talks.

III. Accessibility

The city and site of the Congress should be easily accessible. That is, flight connections from all over the world should be easily available, as well as transportation to the site of the Congress. Lodging facilities constitute an important item.

Finally, it is expected that the local mathematical community get involved in the preparations of the Congress, so as to create a nice ambiance during the meeting.

Special Development Fund

The Special Development Fund aids IMU to fulfill the important obligation of helping developing countries within the framework of mathematical research. The means of the Fund, which go unreduced to mathematicians from developing countries, are used primarily for travel grants to young mathematicians, to make it possible for them to participate in International Congresses of Mathematicians. The Executive Committee of IMU elects an international committee to distribute the grants.

Means to the Special Development Fund come from donations. Donations can be sent, at any time and in any convertible currency, to the following accounts:

Account no. 0862-656208-21
Schweizerische Kreditanstalt
Stadtfiliale Zürich-Rigiplatz
Universitätstrasse 105
CH-8033 Zürich
Switzerland

The following contributions have been received in the years 1991-1994:

1991		
American Mathematical Society	US $	14.772,93
Royal Society	US $	8.780,27
London Math. Society	US $	1.730,10
1992		
American Mathematical Society	US $	27.787,00
Wiskundig Gennotschap, Netherlands	US $	1.825,40
Royal Society	US $	8.377,21
Deutsche Math. Vereinigung	US $	6.406,74
1993		
American Mathematical Society	US $	32.500,95
Wiskundig Gennotschap, Netherlands	US $	1.418,43
1994		
American Mathematical Society	US $	30.550,06
Mathematical Society of Japan	US $	18.881,11
Royal Society	US $	4.477,00
Com. Nat. Frac. Math., France	US $	3.404,86
CNPq, Brazil	US $	6.944,44

On behalf of IMU, the Executive Committee of IMU expresses its deep gratitude for these donations.

IMU Lectures

Since 1971, the Executive Committee of IMU has been inviting, from time to time, a distinguished and active thematician of high international standing, to give a set of four to five lectures, on important new developments in mathematics, to which the lecturer, directly or indirectly, has made a contribution and which deserve to be "surveyed" at some length, for the benefit of younger mathematicians as well as others.

IMU provides an stipend of US$ 2000 to the lecturer upon receiving a manuscript corresponding to his talks. The present Executive Committee has also decided to consider the payment of the transportation of the lecturer when an institution of a developing country is involved.

The lectures should be given at mathematical centers and they will be published in the L'Enseignement Mathématiques.

Guidelines for a Country that Wishes to become a Member of IMU

A country interested in becoming a member of the International Mathematical Union, shall send to the Secretary of IMU, a sample of activities in mathematics, specially concerning research, as well as a sample of research papers published in international journals by the local mathematicians in the last 10 years or so. The Secretary of IMU shall then present the case to the Executive Committee, and, upon a recommendation of this board, the Adhering Organizitions are consulted. The final decision depends on a majority vote of the members at a General Assembly or through a Postal Ballot.

Report for 1995 of the International Mathematical Union

Professor Jacob Palis
Secretary

Introduction

The International Mathematical Union was founded in its present form in 1951. The purpose of the Union is to promote international cooperation in mathematics, to support and assist the International Congress of Mathematicians and other international meetings and to encourage and support other international mathematical activities considered likely to contribute to the development of mathematical science in any of its aspects , pure, applied, or education. IMU has two commissions, the International Commission on Mathematical Instruction and the Commission on Development and Exchange. The International Commission on the History of Mathematics is a joint commission with the International Union of the History and Philosophy of Science.

Membership

The members of IMU are countries. At the moment IMU has 60 members

In 1995 information concerning IMU can be found IMU-pages on the World Wide Web. The pages are located through URL:

> http://elib.zib.de/IMU/

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> telnet elib.zib.de
> Login: imu
> no password required

Scientific Meetings

Conferences supported by IMU - 1 9 9 5

- WORKSHOP ON DYNAMICAL SYSTEMS, held in Montevideo, Uruguay, March 1995. IMU representative - J.Palis
- 16th ROLF NEVANLINNA COLLOQUIUM IN JOENSUU, Finland, August 1-5, 1995 IMU representative: Olli Lehto
- MODELLING AND OPTIMIZATION OF DISTRIBUTED PARAMETER SYSTEMS WITH APPLICATIONS TO ENGINEERING, held in Warsaw, July 17-21, 1995 IMU Representative: B.Engquist
- FOURTH AMU PAN-AFRICAN CONGRESS OF MATHEMATICIANS, IFRAM, held in Marocco,

September 18-26, 1995 IMU Representative: J.L.Lions

- VI LATIN AMERICAN CONGRESS ON PROBABILITY AND MATHEMATICAL STATISTICS (CLAPEM) held in the Univ. Catolica de Valparaiso, Chile, November 20-24, 1995 IMU Representative: K. Parthasarathy

- 3rd INTERNATIONAL CONFERENCE ON APPROXIMATION AND OPTIMIZATION, held in the Caribbean, Puebla, Mexico, October 8-14. 1995 IMU Representative: J.Palis

- 2nd INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH held in Havana, Cuba, October 3-5, 1995 IMU Representative: J. Palis

The following conference was supported by IMU in 1995, but without financial help:

- MATHEMATICS OF NUMERICAL ANALYSIS - REAL NUMBER ALGORITHMS, four-week conference held in the summer of 1995, in Park City, Utah IMU Representative: J.L.Lions

EDUCATION

International Commission on Mathematical Instruction - ICMI
Report prepared by Mogens Niss, Secretary

1. Organisation

On the 1st January 1995, the new Executive Committee of ICMI, elected at the IMU General Assembly in Switzerland (in August 1994), took office. In 1995 the EC met in Madrid (Spain), 26-27 February. A sub-set of the EC met informally at the ICMI Study Conference on geometry (see below) held in Catania, Sicily (Italy) 28 September - 2 October 1996. Beside in meetings, the work in the EC is conducted by correspondence and electronic communication under the direction of the President and the Secretary.

In 1995 no new member state joined ICMI, but applications from a number of countries to do so were received by the EC. Decisions concerning these applications will be made in 1996.

ICMI continues to have four affiliated study groups, HPM (The International Study Group for the Relations Between the History and Pedagogy of Mathematics), IOWME (The International Organisation of Women and Mathematics Education), and PME (The International Group for the Psychology of Learning Mathematics), and WFNMC (The World Federation of National Mathematical Competitions).

2. ICMEs

The planning of ICME-8, to be held in Sevilla (Spain), 14-21 July 1996, is in full progress. The Second Announcement with registration forms etc. was disseminated internationally, on paper and in electronic form, during the last months of 1995.

In October 1995, the EC decided unanimously, and with great pleasure and gratitude, to accept the bid submitted by Japan to host ICME-9 in the year 2000. The Congress will be held in Chiba, near Tokyo. Informal contacts between the Japanese Invitation Committee and ICMI to initiate the organisation and planning of ICME-9 were established at the end of 1996.

3. ICMI Studies

The mounting and conducting of so-called ICMI studies on crucial themes and issues in mathematics education was continued in 1995.

The proceedings of the ICMI study conference on Gender and Mathematics Education, held in Höör (Sweden), 7-12 October 1993, were published in 1995 by Lund University Press. The proceedings are edited by Barbro Grevholm and Gila Hanna. The final outcome of the ICMI Study, the book Towards Gender Equity

in Mathematics Education - An ICMI Study, edited by Gila Hanna, is to appear in the ICMI Study Series, published by Kluwer Academic publishers, early in 1996.

The ICMI Study volume What is Research in Mathematics Education, and What Are Its Results? (the study conference for which was held in College Park, Maryland, USA, in May 1994), edited by Jeremy Kilpatrick and Anna Sierpinska, will be published in the ICMI Study Series (by Kluwer Academic Publishers). It is expected to appear in the course of 1996.

The study conference for the ICMI Study Perspectives on the teaching of geometry for the 21st century was held at Università di Catania, Sicily (Italy) 28 September - 2 October 1995. The International Programme Committee, appointed in 1994, was chaired by Vinicio Villani, Pisa (Italy). The Local Organising Committee was chaired by Carmelo Mammana, Catania. The Discussion Document for this study was published officially in l'Enseignement mathématique 40, fasc. 3-4, juillet-décembre 1994, pp 345-357, and in the ICMI Bulletin, No. 37, December 1994, pp 6-16. About 75 participants from more than 30 countries attended the conference. ICMI is grateful to the UNESCO/ROSTE office in Venezia (Italy) which sponsored the conference with a grant of US$ 3.000.

Reports on each of these studies will be given at ICME-8 in Sevilla.

The EC has decided to devote the next study in the series to The position and rôle of the history of mathematics in the teaching and learning of mathematics. The study conference will be held in France in 1997. An International Programme Committee for the study will be appointed by the EC in the beginning of 1996.

Ideas concerning future studies include, among others, mathematics education at the tertiary level, stochastics and probability, mathematics for and from the work-place, teacher education for the 21st century, visualisation in mathematics education, the development of mathematics education within a region during the past 40-50 years, studies of the mathematics classroom.

4. Regional Conferences

The EC has decided to adopt the following (minimum) requirements for granting the status of ICMI Regional Meeting to a conference under planning:

- There has to be evidence of a broad national support of the meeting;
- There has to be evidence of a fair degree of regional support;
- The conference should have a theme which is of specific significance to the region at issue;
- An International Programme Committee has to be appointed. It should include at least one member representing the ICMI EC (not necessarily an EC member) who is prepared to produce a brief report of the organisation and proceedings of the conference;
- A conference report in English should be published;
- If ICMI is asked to provide financial support, a budget and a subsequent brief account, should be made available to the ICMI EC. Normally, only regional conferences to be held in non-affluent countries will be eligible to financial support from ICMI.

In 1995, the Proceedings of the ICMI-China Regional Conference, Shanghai, 1994, was published by Shanghai Educational Publishing House.

In 1995, the conference Regional Collaboration in Mathematics Education: An ICMI Regional Conference was held at Monash University, Melbourne (Australia), 19-23 April 1995. As this conference took place in a developed country, ICMI's sponsorship did not involve financial support.

The ICMI EC has agreed to support The Seventh South East Asian Conference on Mathematics Education (SEACME 7), to be held at Hanoi University of Technology, Hanoi (Vietnam), 3-7 June 1996, with a grant of US$ 2.000.

5. Other initiatives

Further to a proposal made by Nicolas Balacheff (Grenoble, France) at the ICMI Study Conference in College Park, Maryland (USA), May 1994, the EC has decided to appoint an Ad Hoc Committee on the Identity of the

Professional Community of Mathematics Education Researchers. It is hoped that the Committee, which is chaired by Nicolas Balacheff and Gila Hanna (Toronto, Ontario, Canada), will be able to give a preliminary report on its work at ICME-8 in Sevilla (Spain), July 1996.

6. The Solidarity Programme

In 1992 ICMI established a Solidarity Programme to help the development of mathematics education in countries in which there is a need for it that justifies international assistance. The first stage in this programme was the mounting of a Solidarity Fund based on private contributions by individuals, associations, etc. The Fund is to be activated to support concrete initiatives and activities that may foster solidarity in mathematics education between well-defined quarters in developed and less developed countries.

In 1995 the Fund received a generous donation of Australian Dollars 2.000 from the Mathematics Education Research Group of Australiasia (MERGA).

7. ICMI Bulletins

In 1995 ICMI Bulletin Nos. 38 (June) and 39 (December) were published under the editorship of the Secretary of ICMI. In 1995, an ISSN-number (1024-3127: Bulletin - ICMI) was attached to the Bulletin. As from the end of 1995, the ICMI Bulletin is available in the following electronic forms: In ASCII-format by direct request to the editor. On the World Wide Web, where it can be found under the following coordinates on the IMU-pages, through URL:

http://elib.zib.de/IMU/ICMI/bulletin/*[no.]*

8. ICMI on WWW

In 1995 information concerning ICMI can be found on the ICMI-pages of the IMU-pages on the World Wide Web. The pages are located through URL:

http://elib.zib.de/IMU/ICMI/

ACTIVITIES INVOLVING DEVELOPING COUNTRIES

Commission on Development and Exchanges - CDE

Report prepared by Pierre Bérard, Secretary

The Commission on Development and Exchanges has offered two programs.

The purpose of CDE Programs is to stimulate, supporting financially mathematical research activities in developing countries.

1. The program "Support to Individual Mathematicians"offers partial travel support to mathematicians who make an extended research visit in an advanced mathematical center which commits itself to cover the local expenses. This program applies both to mathematicians from developing countries and to mathematicians from advanced countries who visit a mathematical center in a developing country. This program includes the "IMU-UNESCO Visiting Mathematician Program" and has been made possible through special funding by ICSU, UNESCO-ROSTA and UNESCO-ROSTE.

2. The program "Support to Conferences" offers partial support for the academic activities of conferences organized in developing countries.

As in the past years, the CDE has received many applications an has to make a strict selection before awarding funding.

The CDE has also continued supporting the two research teams.

A list of beneficiaries is given below. The activities of the CDE were make possible through funding received from IMU, ICSU, Societé Mathématique de France and UNESCO

CDE 1995 Support to Individual Mathematicians

N A M E	RESEARCH FIELDS	ORIGIN	RESEARCH VISIT	PROGRAM	YEAR
M.N.Ndumum	Stochastic Anal. and Geometry	Cameron	2 months, Warwick, UK	ROSTA	95
T.S. Rao	Func.Analysis	India	1 month, Italy	ROSTE	95
Le Hai Khoi	Analysis	Vietnam	1 month, Sophia Univ., Japan	ROSTE I C S U	95
Njkoku	Appl. Math.	Nigeria	1 month. ICPT, Italy	I C S U ROSTA	95
T.N. Venkataramana	Group representation	India	1 month Orsay, France	I C S U	95
Gonzalez de Paz	Appl. Analysis	Guatemala	2 months, ICTP	I C S U	96
Qiu	Complex Anal.	Brazil	Denmark, 94	I C S U	96

CDE 1995 Support to Conferences

Country	Title of the Meet./Conference	Organizers	Year	Programme
Argentina	Workshop on Representation of Lie Groups,Aug 7-20,1995	J. Tirao	95	I C S U
Marocco	Colloquium in AnalysisJun 19-21, 1995	A. Bakali	95	I C S U ROSTA
India	Winter School Nonlinear Systems, Jan 8-26, 96	K.M. Tamizhamani	95	I C S U
Thailand	ACM95 (2nd Asian Math.Conf)	S.Tangmanee	95	I C S U
India	Int. Conf. on Discrete Math		95	I M U
Vietnam	Int. Conf. on Commutative Algebra and Alg.Geometry	N.V. Trung	96	I C S U

CDE 1995 SUPPORT TO RESEARCH TEAMS

Country	Research Field	Head	Year	Programme
Vietnam	Topology and Singularity Theory	Le van Thanh	94/95	I C S U
Benin	Differential Geometry and Theoretical Physics	J.P. Ezin	95	I C S U

OTHER SCIENTIFIC ACTIVITIES

International Commission on the History of Mathematics - ICHM
Report prepared by Eberhard Knobloch, 1996

New Editors of Historia Mathematica:

Karen Parshall, USA, and Jan P. Hogendijk, The Netherlands, have taken over the editorial responsibility of Historia Mathematica and have slightly changed the Editorial Board. The journal runs well, and has developed a healthy backlog of submitted high quality papers. We would like to take this opportunity to thank David Rowe for his deeply appreciated work and his untiring efforts at the head of the Journal during the last two years.

Past congresses to which the ICHM contributed:

International Workshop "History of science, history of text".

This international workshop was organized by Karine Chemla, French member of the ICHM, on behalf of the EINSTEIN Forum and the Wissenschaftskolleg in Berlin. It took place in the so-called "Literarrisches Colloquium" in Berlin from March 30 to April 2, 1995, and brought together scholars from diverse fields, including history of mathematics, in order to conceptualize problems inherent in studying the interrelationship between scientific practices and scientific writing across cultural, geographical and chronological differences. The proceedings will be published (Akademie-Verlag, Berlin) by the organizer.

Actualité de Leibniz: Les deux labyrinthes

An international colloquium was organized by Dominique Berlioz and Frédéric Nef in the Centre Culturel International de Cerisy-la-Salle, France, June 15-22, 1995. Six lectures dealt with History of Mathematics, among them those of Javier Echeverria, Spanish member of the ICHM, and Eberhard Knobloch, chairman of the ICHM.

Conflict and cooperation in building the scientific estate:

Johann Bernoulli, other cases and a general perspective. The symposium, that took place at Groningen, July 5-6, 1995, was organized by the ICHM member Jan van Maanen. It was held to mark the tercentenary of the appointment of Johann Bernoulli as Professor of Mathematics at Groningen University.

1695 Christiaan Huygens 1995

This international conference was organized by A. Eyffinger under the auspices of the Royal Netherlands Academy of Arts and Sciences and in cooperation with the Boerhaave Museum in Leiden and the Museum Hofwijck in Voorburg. It took place in Leiden and in Voorburg, The Netherlands, July 7-9, 1995. One of the opening addresses (by Joella Yoder) and a whole session were devoted to Huygens and mathematics. The proceedings will be published in De seventiende eeuw.

The first European Honours Course in History of Mathematics:

History of the 17th century mathematics, Utrecht, The Netherlands, July 1995 Henk Bos, Utrecht University, organized the course and was one of the six lecturers, among them being the chairman of the ICHM Eberhard Knobloch, Jan van Maanen, Dutch member of the ICHM, Kirsti Andersen, Vicechairman of the ICHM, and Silvia Roero, Italian member of the ICHM. Some 20 advanced students of history of mathematics participated in the Course, coming from eleven European countries.

The history of reading the Ancients in mathematics

Karine Chemla, France, Eberhard Knobloch, Germany, and Jeanne Peiffer organized an international conference on the above subject at the Centre International de Rencontres Mathématiques (CIRM) in Luminy-

Marseille, France, from October 16 to 20, 1995. It reestablished the tradition of organizing historical conferences at the CIRM. Its director agreed that a next conference of such a kind should be organized in 1997. As a consequence, it can be hoped that conferences on history of mathematics will take place alternately in Luminy and Oberwolfach, Germany. Some 40 historians of mathematics, coming from 14 countries, participated in this conference. 26 lectures discussed interesting aspects of the theme.

4th Austrian symposium on history of mathematics

Christa Binder, Austrian member of the ICHM, organized this symposium entitled "999 years-Austria a part of the global development of mathematics" at Neuhofen, Austria, November 5-11, 1995. 32 speakers coming from 10 countries, contributed to the conference.

Future Congresses

Workshop on the History of Mathematics in Oberwolfach, November 3-9, 1996.

It will be organized by Kirsti Andersen, Aarhus, Henk J.M. Bos, Utrecht, and Menso Folkerts, Munich.The subject of the meeting is: "Significant changes in our picture of mathematics' past - crucial results of four decades of research in the history of mathematics". It aims at analyzing the nature and significance of the results of research in recent decades. Six sub-themes have been chosen for this approach: Interfaces between mathematics and social practices, 1850-1950 Mathematics in the Islam period, Interfaces between mathematics and physics in the nineteenth century, Historical studies on ethnomathematics, Mathematics in the European Medieval Period, History of stochastics.

ICHM and the XXth International congress of history of science Liege, July 20-26, 1997

Organized by the IUHPS/DHS, the Congress will focus on `Science, Technology and Industry'. The Program Committee is chaired by Charles C. Gillispie (USA) and the Local Organizing Committee by Robert Halleux, University of Liége. Two symposia will be organized on behalf of the ICHM: The Heritage of A.P.Yushkevich, under the responsability of K. Chemla, S. Demidov, E. Knobloch Formation of a research area and a scientific community: applied mathematics, under the responsability of G. Israel and J.W. Dauben. These proposals have been accepted by the local organizing committee of the Liége Congress. The first circular has been distributed during the fall of 1995. The address of the Congress office reads as follows: Centre d'Histoire des Sciences et des Techniques, 15 avenue des tilleuls, B-4000 Li!ge, Belgique, tel. 32.41/66.94.79, fax 32.41/66.95.47, e-mail CHSTULG@VM1.ULG.AC.BE

International Congress of Mathematicians, Berlin 1998

The ICHM intends to organize a colloquium on the history of mathematics with the tentative title "Berlin and its relations to other international mathematical centers". The proposal has been sent to Philipp Griffiths, Chairman of the Program Committee, and to the Chairman of the Local Organizing Comittee in Berlin, Martin Groetschel. The ICHM is still waiting for an official approval.

The European Honours Course in History of Mathematics

The SOKRATES Inter-university Cooperation Program (ICP) "History of Mathematics" was established early 1994 with the aim of organizing yearly Intensive Programs for students in History of Mathematics. 34 universities are participating in the ICP. The second course on "Nineteenth-century mathematics" will take place in Palermo, Italy, September 2-20, 1996. Addresses of the Committee: Mathematical Institute, Utrecht University, c/o Henk Bos, Postbox 80010, NL 3508 TA Utrecht Netherlands, tel. 31.30.53.14.30; fax 31.30.51.83.94; e-mail bos@math.ruu.nl Department of mathematics, University of Palermo, c/o Aldo Brigaglia, Via Archirafi 34, I-90123 Palermo, Italy; tel. 39.91.6040401; fax 39.91.6165425; e-mail brigaglia@ipamat.unipa.it

ICHM World Directory of Historians of Mathematics

The new edition, ed. by K. Andersen and M. Dybdahl, University of Aarhus, is available in print or on a disc (DOS.WP51). The price for a printed copy or a disc is $8 for residents of Europe and $10 for residents from outside Europe (postal charges included). Directions for ordering copies:

1. Remit the necessary amount of money to the account of the treasurer of the ICHM. Menso Folkerts, Stadtsparkasse Munich, Haidhauser Strasse 1, 81675 Munich, Germany, Account number 28-267953 (bank code number 701 500 00), key word: World Directory.

2. Send an order to Menso Folkerts, Institut fuer Geschichte der Naturwissenschaften, Ludwig-Maximilians-Universitaet Munich, Museumsinsel, Postfach, 80306 Munich, Germany See Historia Mathematica 22 (1995), 470. The ICHM hopes that its National Members will help in making the existence of the new edition known.

Ongoing ICHM projects

Photo Archive in Leipzig. The chairman wrote to the University of Leipzig in order to help Hans Joachim Ilgauds to continue his work with regard to the Photo Archive. For the time being the ICHM has to wait further on for a clarification of the situation at Leipzig Institute.

Revised ICHM Bibliography

Albert Lewis plans to work with the AMS in producing an on-line version of the ICHM annotated bibliography. The ICHM will give reasonable amount of money in order to help to realize this project.

ICHM Dictionary on History of Mathematics

The Dictionary project edited by John Fauvel continues to progress. It is to be published by Oxford University Press. Anyone interested in the progress of the project should contact John Fauvel, Mathematics Faculty, The Open University, Milton Keynes MK7 6AA, England.

ICHM Historiography project

The ICHM is in the last stages of completing a final draft of a major cooperative effort: Historiography of the History of Mathematicas. At present, nearly forty colleagues from all parts of the world are collaborating to describe the history of history of mathematics from the first historical writings on mathematics by the ancient Greeks and Chinese, to the present. The work will be finished presumably in 1996.

World mathematical year 2000

The ICHM wishes to contribute. Suggestions are welcome.

A still rather new journal for the History and Philosphy of Science and Technology is Neusis. Greek historians and philosophers of science and technology edit this journal which appears biannually. The second volume appeared in spring 1995. All papers, book reviews, etc. are published in Greek. Submitted papers, written in other languages are translated into Greek, if they are accepted for publication. There is a big effort also to translate into Greek and to publish less recent papers who contributed to shape the discipline. This applies, in particular, to history of mathematics. The editorial office is headed by Jean Christianidis, Greek member of the ICHM.

Adresses of the ICHM Chairman and Secretary:

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PUBLICATIONS

IMU published one bulletin in 1995. The 10th World Directory of Mathematicians came out during the summer of 1994. ICMI published 2 Bulletins, both supported by UNESCO grants. Other publications by ICMI were described above. ICHM also had several publications in 1994; they are described above in the topic of the ICHM activities.

ORGANIZATIONAL MATTERS

The Executive Committee of IMU met once this year: on May 11-12, 1995, Collège de France, Paris.

VITAL STATISTICS

members (countries) = 60
8 (IMU) + 3 (ICMI) + 6 (CDE) + 7 (ICHM) = 24 conferences supported
1 (IMU) + 2 (ICMI) = 3 bulletins; most conferences published their proceedings.

IMU - Past and Present

Olli Lehto

At its meeting in April 1990, the Executive Committee of the IMU decided that the largely unorganized archives of the Union should be properly arranged and catalogued. Simultaneously, the Executive Committee expressed the wish that the history of the Union should be written. As Secretary of the Union, I had proposed that these questions be discussed, without having any personal role in mind in the execution of such a project.

At that time IMU files were stored in Zürich, and I had first thought that they could be arranged by Ms. Tuulikki Makelainen, who during eight years as my IMU secretary had become well acquainted with the Union. However, it soon became clear that a few short visits from Helsinki would not be enough to complete the work. Also, a great number of decisions had to be taken: what papers could be discarded, how to arrange the remaining material, etc. Understandably, Tuulikki Makelainen did not want to take sole responsibility for all this. It began to look as if nothing would be done with the archives in Zürich.

By a curious coincidence, a new storage area was being built at this time for the archives of the University of Helsinki. The rooms, inaugurated in 1993, were technically advanced, with maximum security, controlled temperature and humidity, etc. The increase of the storage capacity was so large that there were plenty of empty shelves. Professor Jürgen Moser, the President of the IMU in 1983-86, who supervised the IMU archives in Zürich, had asked me some years earlier whether the IMU material could be sent to Finland. I had then rejected the idea, but in view of the improved facilities in Helsinki and the deadlock in Zürich, I began to have second thoughts. I informed Professor Jacob Palis, the Secretary of the Union, of the Helsinki option.

In the spring of 1994, the Executive Committee decided to move the IMU material from Zürich to Helsinki. In September 1994, 14 mail sacks, weighing 20 kgs each, arrived in Helsinki. The files from the eight-year period 1983-1990 were already there. The work with the material was started in October 1994 by Tuulikki Makelainen and myself.

In informing me of the Union's decision to move its archives to Helsinki, Jacob Palis, representing the Executive Committee, asked me to write the history of the IMU. After discussions with Professor K. Chandrasekharan, who in my opinion would have been the first choice, I gave my consent to the Union.

The IMU was founded in 1920 and dissolved in 1932. After a first effort to reestablish the Union during the 1930s had failed, work started again soon after the Second World War. This led to the rebirth of the IMU, formally in 1951. The first General Assembly of the new IMU was held in 1952.

As regards the IMU material, the year 1952 is a dividing line. From the years before 1952, there was not a single paper in the Zürich archives. In contrast, a lot of original source material from 1952 onwards was stored there. The minutes of the General Assemblies and of the EC meetings are all in the files, as well as a good part of the important correspondence.

Searching for documents from the years prior to 1952 became an important part of my work. In spite of some success in locating old material, there are still serious gaps, especially for the years preceding World War II. In order to specify these gaps, I shall give you a brief survey of the old IMU. Since France played an important role, a good part of the missing documents may well lie hidden in Paris. Maybe there are people in the audience who could give advice on how to discover them?

In October 1918, even before World War I was over, discussions were started between France, Great Britain and the United States of America to reestablish international cooperation in science. It was decided that the Allied nations should withdraw from the existing international scientific organizations and establish new ones, with the eventual cooperation of neutral nations. It was further decided to establish a Council under whose aegis international unions could be formed. Thus the International Research Council (IRC) was founded in 1919, and the International Mathematical Union in 1920.

The first General Assembly of the IMU was held in Strasbourg in 1920, simultaneously with the first post-war International Congress of Mathematicians (ICM). Delegates from eleven countries, all Allied Powers, were

present. It was decided to invite neutral countries to join the Union. In contrast, ex-enemies Germany, Austria, Hungary and Bulgaria were explicitly barred from membership. Professor Ch. de la Vallé Poussin from Belgium was elected President for four years and Professor G. Koenigs from France Secretary General for eight years. What is now the Executive Committee was called the Bureau. A link was created between the IMU and the ICMs. According to the Statutes, the Union was to determine the place and date of each ICM, and only mathematicians from countries which were members of the IRC were allowed to participate in the Congresses.

This information is from the short report on the first General Assembly printed in the Proceedings of the Strasbourg Congress. I have not been able to locate the Statutes of the old IMU. Nor do I know whether the Bureau held meetings during the years 1920-1932 of the Union's first existence. It would be highly desirable to find the files of Secretary General Koenigs .

The next International Congress of Mathematicians and the second General Assembly of the IMU were held in Toronto in 1924. The Canadian organizers complied with the policy of the IMU and did not allow mathematicians from the ex-enemy countries to attend the Congress. However, the rules of the IMU were violated to the extent that mathematicians from Russia, Ukraine, Georgia, India and Spain, all countries which were not members of the IRC, were admitted to the Congress. In his report, Secretary General Koenigs said that they could be admitted because these were countries "which had not yet joined the IRC". The General Assembly elected Professor Salvatore Pincherle from Italy as the new President of the Union. He and Koenigs were soon on a collision course regarding the policy to be followed at the ICM 1928.

Even before the ICM 1924, criticism against the Union's discrimination policy had started to mount. In Toronto, the American delegates offered a resolution requesting the IRC to consider whether the time was ripe for the removal of the restrictions on membership. At the 1925 General Assembly of the IRC, several resolutions were put forward to remove such restrictions. The proposals found a majority, but it was not large enough to allow amending the Statutes. But only one year later, at the extraordinary General Assembly of the IRC, it was unanimously decided to invite Germany, Austria, Hungary and Bulgaria to join the IRC and the Unions associated with it. The Council revised its Statutes, and in 1931 a new period began in its history. The IRC was replaced by the International Council of Scientific Unions (ICSU). From the very beginning, ICSU was open to representatives of scientists from throughout the world.

The ICM 1928 was held in Bologna, Italy. In view of the decision of the IRC to invite Germany, Austria, Hungary and Bulgaria to join the Council and its Unions, Pincherle and the other Italian organizers decided to return to the pre-war traditions and invite all mathematicians to the Congress, irrespective of nationality. This policy of openness was widely accepted. More than that, strong voices had been heard from several countries, including the USA and Great Britain, that their mathematicians would not attend the Congress unless it were international without any limitations.

The Italian decision to open the Congress to participants from all nations violated the Statutes of the Union, which were still in force in their original form. In 1924 Koenigs had permitted mathematicians from countries that were not members of the IRC to attend the ICM. But now he made it clear that since Germany, which had not joined the IRC, was allowed to participate, the Bologna Congress was not a Congress of the Union and should therefore not be attended. His action did not much affect the Congress but it paralyzed the IMU incurably.

The Bologna Congress was the largest ICM so far, and it was scientifically a success. The IMU General Assembly was held during the Congress. In spite of the fact that Koenigs had declared it illegal and refused to attend, the French delegation took part in it. The Assembly endorsed unanimously Pincherle's policy of openness and requested the Presidents of the IMU "to study the present situation". (At that time, the Union had 6 Honorary Presidents and 5 Vice- Presidents.) Since Pincherle declined to continue as President and elections were not held, the IMU had no President for a year. In 1929 the Bureau elected the British Vice-President W. H. Young to assume the presidency.

The Statutes of the IMU expired at the end of 1931, at the same time with those of the IRC. New draft statutes should have been prepared and sent to the members before the Union's 1932 General Assembly. The Secretary General should have played an active role. Now I do not know of documents indicating that the IMU had a Secretary General at all. Koenigs's mandate had expired in 1928. The Bologna General Assembly extended the

mandates of those members of the Bureau who did not explicitly decline. Koenigs, who was not present in Bologna, died in 1931. The Secretary of the 1932 General Assembly, Professor G. Valiron, was called "secrétaire provisoire".

Valiron's minutes of the 1932 General Assembly of the IMU have not been found, but two records are available. One is a résumé of the minutes, the other an American report. The American delegates had prescribed among themselves the line of action to be pursued: "A permanent international organization had no problems important enough to warrant its existence". The long debates about the future of the IMU led to a dead end. Finally, it was proposed that an international Commission be set up to investigate the desirability of continuing an international mathematical organization and to report to the next ICM and that during this period, the IMU would be suspended. The proposition was accepted with 23 votes, 16 opposed, 5 abstentions.

A Commission was set up in Zürich in 1932, with Professor F. Severi as Chairman, to study the possibility of reestablishing the IMU. In spite of many attempts to locate documents pertaining to its work, practically nothing has been discovered so far. At the ICM 1936, the Commission's Vice-Chairman G. Julia laconically stated that re-founding the Union could not be recommended.

After the Second World War the preparations which led to the rebirth of the IMU were largely in American hands, with Professor Marshall Stone as the key person. As noted earlier, there was no material about this period in the Zürich archives. In this case, some relevant documents have been found and more discoveries can be expected, now that Stone's papers have been located at Brown University, Providence, R.I. I am grateful for the help that I have received from many directions. In particular, I would like to thank Professors Henri Cartan, Bent Fuglede, and David Mumford.

It is an important question to determine what material in the IMU archives should be kept classified and for how long. For the moment, while the papers are being sorted, everything is closed. Even after the work has been completed, users are ordinarily not admitted to the storage area. They have to order the desired documents. Thus a catalogue must be produced of all the material, as detailed and descriptive as possible. Once a draft version is completed, it will be easier to consider which dossiers should be kept closed for a certain number of years. The procedure of how to preserve the continuity of organized files should then also be discussed.

Topology of Plane Curves, Wave Fronts, Legendrian Knots, Sturm Theory and Flattenings of Projective Curves

V.I. Arnold

The theory of smooth (possibly selfintersecting) curves in the plane is parallel to knot theory (the last being a simplified, commutative version of the theory of plane curves).

Strangely, the theory of plane curves invariants has not been developed until 1992, when the simplest three basic invariants (the "strangeness" St, counting the triple points crossings, and the "tangencies crossings counting" invariants J+ and J-) have been introduced, motivated by the symplectic and contact topology problems.

In a sense these invariants are similar to the Vassiliev invariants of knot theory. Recently Viro has discovered their relation to the real algebraic geometry, then Schumakovich and Polyak have found the expressions of these new invariants in the spirit of the statistical physics and have related them to the Vassiliev knot invariants, while Lin and Wang have described their relations to the quantum field theory and to the Kontsevich and Bar Natan works on integral formulas for the knot invariants.

In spite of the fast progress of the last two years in this domain (including the Aicardi's and Polyak's extension of the theory to the wave fronts, that is to the curves with cusps), the original problems, triggering all the theory, remain unsolved : these problems belong to the symplectic and contact topology of the Lagrangian and Legendrian mappings.

Jacobi stated in Vorlesungen Ueber Dynamics that the curve formed by the conjugate points of a generic point on a generic ellipsoid has exactly four cusps.

As far as I know it had never been proved. However, the number four is really crucial here: is at least a minoration of the number of cusps. This fact is a brother of the four cusps theorem (saying that a plane convex closed curve has at least four extrema of the curvature).

Both the four conjugate points theorem and the four vertex theorem are in fact two particular cases of the same result in symplectic and contact topology. The infinitesimal version of this result is a theorem in Sturm theory, due to Hurwitz, Kellogg and Tabachnikov and saying that a Fourier series starting from higher order harmonics has at least as much zeroes, as the first harmonic presented in the series with a nonzero coefficient.

The simplest case of this Sturm type theorem is just the Morse inequality for the circle. The Sturm type theorems may thus be considered as the higher derivatives extensions of the Morse theory .

The symplectic topology extension of Morse theory replaces the functions by their multivalued versions- the Lagrange and Legendre manifolds. The corresponding extension of the Morse inequalities (called "the Arnold conjecture on the Lagrangian intersections and symplectic fixed points") goes back to 1965 and has been partially proved by Conley, Zehnder, Chaperon, Floer, Givental, Ono and many others (in different particular cases). Perhaps, the Floer homology is the best-known byproduct of this development.

The geometrical problems generalizing the four cusps property suggest that a similar "multivalued functions" version of the Sturm theory might be possible (the simplest example being the "tennis ball theorem": a simple closed curve, dividing the sphere into two parts of equal areas, has at least four inflection points).

In higher dimension this approach suggests (even at the infinitesimal level) a highly nontrivial version of what might be called "higherdimensional Sturm theory". It contains also the extensions of the Moebius theorem, saying that a projective plane curve, close to a projective line, has at least three inflection points.

The higherdimensional versions of this Moebius theorem are the minorations of the numbers of the flattening

points and of the cusps of Gauss mappings of space curves. These results may also be formulated as (apparently new?) theorems on the Chebyshev systems of functions .

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Steklov Mathematical Institute, Moscow and Universite Paris-Dauphine, Paris

Intervention de Henri Cartan

On m'a demandé d'évoquer devant vous quelques souvenirs pouvant contribuer à l'histoire de l'Union Mathématique Internationale. Il s'agit, bien entendu, de l'Union recrée aprés la guerre de 1939/45, et non de la première Union qui était morte en 1932 au Congrès de Zürich. C'est Marston MORSE qui a joué un rôle décisif dans la re-création de l'Union, tant à New York en 1950 qu'a Rome en 1952. Il en a été le premier Président.

Je regrette vivment l'absence ici, aujourd'hui, de l'homme qui en a été longtemps l'animateur: K. CHANDRASEKHARAN. Qu'il me soit permis d'évoquer le rôle qu'il a joué, en relisant ici les paroles que j'ai prononcées le 20 avril 1989, lors d'une cérémonie qui s'est déroulée à Paris, au Collège de France, pour lui rendre hommage.

"When I became a member of the Executive Committee (E.C.) in 1954, the Union was quite young; it had to be protected and it was necessary to conceive the rôle it could play in the mathematical world. Eight years later, as a participant in the General Assembly of the Union before the Stockholm Congress in 1962, I was discovering that Chandrasekharan, who was at that time Secretary of the E.C., had become the mainspring of the Union, taking care of everything, preparing carefully the choice of the members of the next Executive Committee, and nicely convincing me of agreeing to be one of the two vice-presidents for the next four years. Then, being myself a member of the E.C., I was able to observe how it was functioning, and to learn what kind of problems had to be solved. Moreover, I could admire the perfect collaboration between the new President de Rham and the experienced Secretary Chandrasekharan. I regret very much that our friend Georges de Rham has not been able to be with us today; surely he would have been happy to speak about his fruitful collaboration with Chandra. The total understanding between these two men was quite useful to solve very delicate problems, as for instance the problem of adherence of the two parts of Germany to the Union.

During my stay in the Executive Committee I have learned what I shall call the "controlled democracy": of course, at a session of the General Assembly, the voting is free, but if you want to reach good decisions, you have first to study carefully the problems in order to submit good proposals to the voting. In that exercise Chandra was unexcelled. He had also a powerful art of persuasion. I made an experiment of it when before the Moscow Congress in 1966 Chandra wanted to convince me to succeed the Rham as President. But at the same time Chandra had to leave the Secretariat of the Union and to become Secretary General of ICSU, the International Council of Scientific Unions. Otto FROSTMAN succeeded Chandra as Secretary of the Union. I was a little anxious because Frostman did not have the experience of Chandra; fortunately Chandra remained a member of the E.C., and I could be a happy President since he still took care of everything. Finally, when I left the Presidency after the Nice Congress in 1970, it had become clear to everybody that my successor could be nobody, except Chandrasekharan himself!"

"In fact, Chandra stayed as a member of the E.C. during 24 years. up to 1978. Thanks to him, the Union developed itself in many respects. I want now to give some examples:

1. It was decided that the Union should take the responsibility of the Fields Medals: the Executive Committee nominates the members of the Fields jury, which is chaired by the President of the Union.

2. Chandra believed that the Union should take an effective responsibility in the scientific programm of the international congresses. For this purpose the E.C. nominates a so-called "Consultative Committee" and chooses its chairman; the Consultative Committee is in charge of selecting the chairmen of the panels and also the speakers of one-hour lectures.

3. On the proposal of Chandra it was decided that the retiring President of the Union should stay four years more in the E.C. as "Past President".

4. Chandra took the initiative of the edition, under the responsibility of the Union, of the "World Directory of Mathematicians", which has become very useful.

5. Chandra decided to publish regularly a "Bulletin of the International Mathematical Union"

6. Thanks to Chandra it was decided to create fellowships to help young mathematicians of the Third World to attend some meetings sponsored by the Union.

7. It was decided to organize, between two main international congresses, other international meetings devoted to the mathematical instruction. The first one was held in Lyons in 1969.

"If Chandra succeeded to achieve all those changes and many others, it is because he was himself convinced of the importance of the missions of our Union, and also because he had, as I said already, an exceptional art of persuasion. In fact, his diplomatic genius has been quite useful in some circumstances. For instance, the relations with the Soviet Union were not always easy; but thanks to Chandra it has been always possible to maintain good relations with the Soviet mathematicians. Let me tell you a little story as an example: at the Nice Congress Serguei NOVIKOV was one of the four Fields Medallists, but he had not been allowed to attend the congress. The next year, at the occasion of an international conference held in Moscow in honor of VINOGRADOV (who was 80), with the official participation of the Union, Chandrasekharan succeeded to convince Vinogradov to give a dinner in honor of Novikov; Novikov was present with his wife and his parents; at the end of the dinner he received officially the Fields Medal".

May I now add something? In several occasions I have had the opportunity of discovering the deep admiration of Chandra for some great personalities, like Carl Ludwig SIEGEL or Herman WEYL. I am touched when I see how carefully he is working for keeping their memory. Let me hope that the whole family of mathematicians around the world will have a clear vision of what Chandra did in favor of our science".

Voilà donc ce que je disais en avril 1989. Aujourd'hui je voudrais évoquer brièvement la figure de Georges de RHAM, que j'ai connu comme Président de 1963 à 1966. J'ai alors été témoin de sa gentillesse, de sa courtoisie, mais aussi de sa fermeté sur certains principes. Il dut notamment faire face au délicat problème des deux Allemagnes: jusqu'en 1963, il n'y avait pas de problème pour l'Union, à laquelle adhérait la Deutsche Mathematiker Vereinigung (D.M.V.) qui représentait tous les mathématiciens allemands. Mais en 1963 l'Allemagne de l'Est cessa de reconnaître la D.M.V. et demanda à adhérer indépendamment à l'Union. Heureusement, Friedrich HIRZEBRUCH était alors membre du Comité Exécutif; son intelligence et ses qualités de négociateur permirent de régler le problème sans heurts.

Il y avait assez souvent des difficultés avec les Soviétiques. Elles ne furent pas unsurmontables (quoique bien réelles) du temps où LAVRENTIEFF siégeait au Comité Exécutif, entre 1963 et 1970. Elles devinrent beaucoup plus pénibles avec PONTRJAGIN à partir de 1971. C'est avec Lavrentieff qu'il a fallu préparer la tenue du Congrès International à Moscow en 1966. Pour cela un mini-congrès (assez important, puisqu'il y eut une centaine de conférenciers) fut organisé l'année précédente (1965) à Erevan, la capitale de l'Arménie; il permit de nombreux contacts avec les mathématiciens soviétiques, et il laisse à ceux qui y ont participé le souvenir inoubliable de l'accueil chaleureux de nos collègues arméniens.

Un des problèmes rencontrés avec les Soviétiques était celui des invitations de mathématiciens soviétiques aux colloques et congrés internationaux. Voici, à titre d'example, une liste (non exhaustive) de conférenciers invités en 1970 à Nice et qui n'ont pas pu venir:

DYNKIN, GEL'FAND, GROMOV, KAJDAN, LINNIK, MANIN, MOISHEZON, SERGUEI NOVIKOV, SHAFEREVITCH, SINAI.

Dans un ordre d'idées différent, laissez-moi vous raconter une histoire que est restée jusqu'ici confidentielle. C'etait en 1968, juste après l'invasion de la Tchécoslovaquie par les armées de l'URSS et d'autres pays du Pacte de Varsovie. Le 11 septembre 1968, je reçois une lettre écrite le 8 septembre par un mathématicien tchécoslavaque nommé JAROSLAV KURZWEIL, qui participe alors à Warwick (Angleterre) à un symposium sur les équations différentielles. Il vient, dit-il, de quitter la Tchécoslovaquie et me transmet une lettre que lui a confiée à Prague le mathématicien KATETOV. Cette lettre est datée du 30 août et adressée à Henri CARTAN, President de l'U.M.I. Je vous en donne lecture:

Dear Professor Cartan,

The National Committee of Mathematics of Czechoslovakia wishes officially to inform you that on the 21st of

August Czechoslovakia has been occupied by the armed forces of the Union of the Soviet Socialist Republics and four other countries. The foreign troops have entered Czechoslovakia without the knowledge and consent of the president, government and parliament of our country. Their coninued presence on our soil constitutes a flagrant violation of the Charter of the United Nations and of the provisions of the Warsaw Treaty.

At this grave moment of our history we entreat you as the President of the International Mathematical Union to give moral support to the cause of our country. Only the restoration of the sovereignty of the Czechoslovak Socialist Republic and the complete withdrawal of all foreigh troops from its territory will permit further free development of our science and culture.

Signed: M.Katetov
On Behalf of the members of the National Committeee of Mathematics of Czechoslovakia

Que devait faire l'Union devant cet appel pathétique de l'un de ses membres? (car il s'agit bien d'une organisation nationale adhérente). Je consulte aussitôt Chandrasekharan, puis décide, le 17 septembre, d'envoyer une photocopie de la lettre de Katetov à tous les membres du C.E. en leur demandant de me faire part de leur avis. (Certains d'entre eux, comme Montgomery, consulteront à leur tour des collègues avant de me répondre). Au bout de quelques jours tous les membres du C.E. m'ont répondu; parmi eux, le soviétique Lavrentieff et le hongrois Hajós. Les autres sont surtout préoccupés de manifester notre sympathie à des collègues sans risquer de faire un geste qui pourrait leur nuire. Quant à Lavrentieff, sa réaction est très modérée: il se borne à rappeler qu'une organisation comme la nôtre n'a pas à se mêler des relations politiques entre les pays.

La réponse d'Hajós, datée du 30 septembre, manifeste surtout la surprise; il met en doute l'authenticité de la lettre de Katetov, et comme ce dernier s'est contenté de signer à la main sans reproduire son nom avec la machine à écrire, il lit KALIM et déclare ne pas connaître ce mathématicien. La position prise par Kalim ne correspond pas, dit Hajós, a celle du gouvernement tchéscoslovaque, et il n'y a donc pas lieu d'en tenir compte. Naturellement, je ne manque pas de répondre à Hajós, ce qui me vaudra ensuite 3 ou 4 longues lettres de lui.

Entre temps, mon vieil ami le professeur BORUVKA, de l'Université de Brno, est de passage à Paris. Je lui raconte toute l'histoire et lui demande conseil. Il comprend bien que je souhaite, comme Président de l'Union, manifester ma sympathie à nos collègues thécoslovaques, s'il est possible de le faire sans leur causer des difficultés supplémentaires. Boruvka accomplira si bien sa mission que je recevrai une lettre envoyée de Prague le 31 janvier 1969; elle est écrite en français, sur papier à en-tête de l'Académie tchéscoslovaque:

Monsieur le Professeur et cher Collègue,

Le 30 août 1968, le Comité national tchécoslovaque pour les mathématiques vous a envoyé une lettre exprimant l'attitude des mathématiciens tchécoslovaques à l'égard des événements d'août en Tchécoslovaquie. On nous a informés que vous avez donné beaucoup d'attention à notre lettre. Vu l'état actuel des choses dans notre pays nous ne croyons pas nécessaire de faire des pas ultérieurs dans cette affaire.

Le Comité national tchécoslovaque pour les mathématiques m'a chargé de vous transmettres nos sincères remerciements pour la bienveillance que vous avez manifestée à notre égard.

Veiullez croire, Monsieur le Professeur, à l'assurance de mes sentiments distingués.

Prof. J. Novák
President du Comité National
Tchécoslovaque pour les Mathématiques

Cette lettre en dit long dans sa sobriété...

Permettez-moi, pour terminer et sans vouloir abuser de votre patience, de rappeler les noms de deux anciens présidents de l'Union pour qui j'éprouvais une vive admiration: il s'agit de Heinz HOPF et de Rolf Nevanlinna. Je ne puis pas non plus m'empêcher d'évoquer la mémoire de Hermann WEYL, qui présidait le Fields Committee en 1953-54. Je faisais partie de ce comité, et je n'ai eu aucune peine à convaincre Hermann WEYL

que l'une des deux médailles Fields 1954 pouvait être attribuée à un jeune mathématicien de 27 ans, qui s'appelait Jean-Pierre SERRE.

Je vous remercie de votre attention.

Developments in Symplectic Topology

Simon Donaldson

A symplectic structure on a manifold is a closed non-degenerate 2-form. Each of these conditions is easy to understand individually; it is the interaction between the two which makes the problem of existence and classification of symplectic manifolds and interesting one. In this talk we report on some recent developments - particularly in 4 dimensions - in this area. We describe work of the speaker on the existence of codimension-2 symplectic submanifolds and work of C. Taubes relating the new Seiberg-Wihen invariants of symplectic 4-manifolds to Gromov's pseudo-holomophic curves.

Important features of both of these developments are the extension of ideas from Kahler geometry to the symplectic situation, and the role of curvature of complex line bundles. There are interesting problems to understand in the extension of these ideas from 4 to higher dimensions and we discuss these briefly.