CAMTP

LET'S FACE CHAOS
through
NONLINEAR DYNAMICS

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4th International Summer School/Conference
at the University of Maribor
27 June - 11 July 1999

CAMTP

Center for Applied Mathematics and Theoretical Physics
Univerza v Mariboru • University of Maribor
Krekova 2 • SI-2000 Maribor • Slovenia
Phone +386 62 213151 and 2296440 • Fax +386 62 213151 and 213541
email Robnik@uni-mb.si • http://www.camtp.uni-mb.si
Director: Prof.Dr. Marko Robnik

The Supporting Scientific Institution of

The 4th International Summer School/Conference
"Let's Face Chaos through Nonlinear Dynamics"
University of Maribor, Maribor, Slovenia
27 June - 11 July 1999
e-mail ss99@uni-mb.si
http://www.uni-mb.si/~ucamtpssn/
The mailing and contact address otherwise as for CAMTP above

thanks the Patron and the General Sponsor

REPUBLIC OF SLOVENIA
Ministry of Science and Technology
Slovenska cesta 50
1000 Ljubljana
SLOVENIA

THE ORGANIZING COMMITTEE

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Tomaž Prosen (Ljubljana, Slovenia)

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Aneta Stefanovska (Ljubljana, Slovenia)

• • •

INVITED LECTURERS AND SPEAKERS
— all confirmed —

Professor Dr. Yoram Alhassid
Yale University, New Haven, USA

•

Professor Dr. Yoji Aizawa
Waseda University, Tokyo, Japan

•

Professor Dr. Steven Bishop
University College London, UK

•

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•

Professor Dr. Giulio Casati
University of Como, Italy

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Niels Bohr Institute, Copenhagen, Denmark
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•

Professor Dr. Bruno Eckhardt
University of Marburg(Lahn), Germany

•

Professor Dr. Hirokazu Fujisaka
Kyoto University, Japan

•

Professor Dr. Giovanni Gallavotti
University La Sapienza, Rome, Italy

•

Professor Dr. Theo Geisel
University of Göttingen, Germany

•

Professor Dr. Leon Glass
McGill University, Montreal, Canada

•

Professor Dr. Janko Gravner
University of California, Davis, USA

•

Professor Dr. Siegfried Grossmann
University of Marburg(Lahn), Germany

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THE SCIENTIFIC PROGRAMME

INTRODUCTION AND THEORETICAL BACKGROUND

Synergetic approach to self-organizing systems
Discrete versus continuous representation of dynamical systems
Mathematical background
Physical background
Classical and quantum Hamiltonian systems
Dissipative systems
Ergodic theory
Open systems
Information dynamics
Fractal structures - geometry of chaos
Quantum aspects of classsical chaotic systems (quantum chaos)
Qualitative and quantitative analysis of time series
Modelling and simulation of system dynamics
Qualitative modelling - problems and perspectives

SCIENTIFIC DISCIPLINES

Physics and Mathematics

Classical Hamiltonian nonlinear dynamics
Dynamics of dissipative systems
Fluid dynamics: Theory of turbulence
Cellular Automata
Quantum physics: Quantum chaos
Semiclassical mechanics
Periodic orbit theory (Gutzwiller approach)
Random matrix theories
Mesoscopic systems (microstructures, quantum dots)
Microwave cavities and wave chaos

Engineering
Structural and dynamical stability
Control of chaos in mechanical systems
Electrical circuits
Neural networks and neural computers
Chemical reactions
Mesoscopic solid state systems

Biophysics and physiology
EEG
Brain functioning
ECG
Blood flow (revealing oscillators)
Modelling of complex biological and physiological systems
Turing structures

Economy
Evolutionary economics, macroeconomic cycles
Stock market dynamics
Financial systems
Sociological aspects of economical structures and developments

FOREWORD, SOME HISTORY AND PURPOSE

Chaos, either classical or quantum, conservative or dissipative, pure or applied, has become a fashionable subject of pronounced activities of nonlinear science during the recent decade. It is attracting the attention of not merely scientists in the relevant and related multidisciplinary and interdisciplinary scientific fields but even of philosophers or writers, coming up in daily papers and popular magazines. It often gives rise to turbulent controversies and disputes concerning its scientific merit and its practical use.

In August 1992, a group of students at the University of Ljubljana, lead by the initiator Maja Malus, came up with the idea to organize a summer school covering the variety of topics in pure and applied research on chaos. The main organizational effort was undertaken by the voluntary student staff under the direction of Maja Malus, then undergraduate student of electrical engineering at the University of Ljubljana and with active support of the international student association IAESTE. The scientific advisory board of the School (Professors Igor Grabec, Aneta Stefanovska and Marko Robnik) set up in March 1993, enjoyed the enthusiasm of the students, their devotion and hard work which eventually resulted in a very successful meeting. Financial support of many Slovenian sponsoring and donating companies and institutions, especially IBM Slovenia and the Ministry of Science and Technology, was highly appreciated and acknowledged. The hard and enthusiastic work of the student staff, the technical organizer of the School, was crowned with the prestigious charter and the golden tablet of the University of Ljubljana, for the *"...exceptional achievements in organizing the International Summer School..."*.

The Summer School has become a tradition now: The second School was held at the University of Ljubljana in August 1994 (one week), and the third one on 24 June - 5 July 1996 at the University of Maribor. All Schools were strongly international, in the sense that about 90% of all participants (lecturers and "students") were from abroad. The lecturers, about twelve in 1993 and 1994, and about 27 in 1996, were from among the leading scientists in the relevant scientific disciplines, from many countries worldwide, including USA, Canada, Russia, Japan, Western Europe, etc. The School was intellectually dignified by the attendance and the lectures of such distinguished scientific scholars as Professor Boris Chirikov from Novosibirsk, Russia, Professor Siegfried Grossmann from Marburg, Germany, Professor Giulio Casati from Como, Italy, Professor Erik Mosekilde from Lyngby, Denmark, Professor Uzy Smilansky from Rehovot, Israel, Professor Hermann Haken from Stuttgart, Germany, Professor Oriol Bohigas from Orsay, France, Professor Giovanni Gallavotti from Rome, Italy, Professor George Contopoulos from Athens, Greece, and many others.

Therefore our 4th International Summer School/Conference "Let's Face Chaos through Nonlinear Dynamics" is a natural continuation of this tradition, again in the same environment as in 1996, namely at the University of Maribor, in the period 27 June through 11 July 1999. This environment proved indeed to be ideal for such purposes for many reasons, including the rich cultural life offered by the marvelous performances on the world top level of the Maribor Festival Lent'96, the sportific facilities, the mountains, the excellent local Slovenian wines, the touristic attractions etc.

The scientific programme is covering the broad interdisciplinary and multidisciplinary field of nonlinear dynamics and synergetics, concerning applications and manifestations of chaos in diverse fields of human knowledge, ranging from mathematics to physics and chemistry, from medicine to economy, from biology to engineering, and includes even sociological aspects. It seems natural for us to speak about chaos versus order in an interdisciplinary context. The organizers of this School/Conference share the belief that interdisciplinary trends and developments in science are of primary importance, especially in order to counteract the strongly increasing specialization taking place in the science and technology in our most modern era, however certainly not at the expense of the quality of the disciplinary research: In order to achieve strong interdisciplinarity we certainly need in the first place strong disciplinarity. There is an obvious and urgent need for meetings of this kind, giving an opportunity of scientific exchange among seemingly distant disciplines, and, most of all, allowing students and junior scientists to understand better the role of interdisciplinary research, and to bring them in touch with science in making.

The level at the beginning of each lecture course (delivered by invited lecturers as a series of one-hour (60 minutes) lectures) will be adapted to the late undergraduate students and graduate students (most of the students usually are Ph.D. students (research students) and junior postdocs), but there are also many senior postdocs, junior scientists/professors and senior scientists/professors), whilst in closing the series of lectures (the last third or so) may be and typically will be at the conference level, containing the most recent results comprehensible for the majority of the audience and subject to the discussion among the attending invited speakers and specialists.

THE PARTICIPANTS

The participants ("students") whom we encourage to apply and to attend are:

- **late undergraduate students**
- **graduate students (Ph.D. students, research students)**
- **junior and senior postdoctoral students**
- **junior scientists/professors**
- **senior scientists/professors**

If you are interested in the scientific topics of our School/Conference, if you are already studying some issues in this field, or if you are even working in the field, or if you are expert in one aspect of the interdisciplinary field of nonlinear dynamics and synergetics, but wish to learn more about the other aspects and other branches of this vast and important field of research, then you are welcome to apply to attend. Please follow the instructions below and observe the deadlines.

THE SCIENTIFIC COMMUNICATIONS

If you already work in the field, you might have the opportunity to present your work and your results as a **communication**, namely either as a **poster** or as a **short report**. A poster can have typical dimensions of 100 cm x 150 cm. We suggest to make a collage of A4 sheets, easily adaptable to the poster boards, warranting the high technical quality of presentation. A short report (seminar) can be maximally 20 minutes long. Both types of contributions are subject to the refereeing procedure and the acceptance by the Organizing Committee. The category of communication, the title and the abstract should be stated in the application form, with an extra sheet if necessary. Also, it would be helpful if you include C.V. and the list of publications in your submission of the application form. **The deadline** for this type of application is **15 May 1999**.

The selection will be quite strong and only a limited number of communications will be accepted (about 10-20 short reports, and about 20-30 posters). The posters will be displayed during the full period of the School/Conference (two weeks), which is a very important advantage in favour of the authors, allowing them a thorough presentation and discussion with the interested persons, especially during the coffee breaks, in the mornings and in the evenings. Therefore there will be no special poster session.

Subject to the willingness of our sponsors **we shall** make arrangements to **award a few of the most outstanding works. The awards traditionally are substantial, worth about 1,000.-DM each.**

THE PROCEEDINGS OF THE SCHOOL/CONFERENCE

The accepted (selected) and presented communications of the participants will be published together with the lectures of the invited lecturers and speakers in the Proceedings of the School/ Conference. The organizing committee plans to publish the Proceedings in a special volume of the Supplement of Progress in Theoretical Physics (Kyoto, Japan). The deadline for submission of the articles (typescripts) will be 31 December 1999. The Proceedings will have about 600 pages in total, and should be printed and distributed worldwide in about May/June 2000.

FINANCIAL SUPPORT FOR PARTICIPANTS

There will be available some very limited financial support for most highly qualified participants (mainly from the economically weak countries) by various funding institutions, e.g. by Soros Foundation, by the European Physical Society and by the Ministry of Science and Technology of the Republic of Slovenia, especially for participants from the Eastern European (former socialistic) countries. To apply send an informal application together the application form, enclosing C.V., list of publications and two letters of recommendation, together with the (advance) payment for 800.-DM. As for this advance payment: Either send a bankers cheque made payable to the **CAMTP** (for the Summer School) for 800.-DM, or a confirmation/proof of payment, namely a copy of transfer to the account of the Summer School/Conference given on the application form, and also below. **The deadline** for applying for financial support is **18 April 1999**. The candidates will be notified before 25 May 1999 about what financial support has been approved. If the support is 100% then they will be reimbursed the advance payment of 800.-DM upon their arrival and registration in Maribor, normally on Sunday 27 June 1999.

THE CULTURAL, TOURISTIC AND SOCIAL EVENTS

During the whole period of the School/Conference there will be **the International Maribor Summer Festival "Lent 1999"**, each evening offering at least four cultural events (performances), among which you can freely choose, including theatre, opera & ballet, symphonic and chamber music concerts, jazz performances, folkloristic festival performed by groups from all over the world, etc... The quality level is substantial, some of the best artists in the world come to Maribor, especially in the domain of jazz. For example, in 1996 we had Ray Charles. And a brilliant presentation of the opera "Carmen" by George Bizet. And much more. All performances are taking place either at various open air places/squares in the old medieval part of the town, called "Lent", by the river Drava, or inside some historic buildings in the same city quarter, or in the opera, theatre or other concert halls in the city. The entrance is free (included in the participation fee), and reservations can be made (in block) for the interested persons by the assisting staff to the Conference (registration desks). The detailed programme (programme brochure) of the Festival performances will be available and distributed upon your arrival in Maribor. The brochure is the entrance ticket for *all* performances. Alos, upon your arrival, together with the conference materials, you will receive the book "Discover Slovenia", to guide you through our country.

On Saturday afternoon, 3 July 1999, there will be a tour through the city of Maribor and the neighbourhood, including in particular some wine tasting tour. The participation might be charged extra. On the same Saturday evening there will be the closing festivity of the folkloristic part of the Festival "Lent 1999", accompanied by a big firework performance.

On Sunday, 4 July 1999, there will be an excursion to some of the most beautiful parts of Slovenia. The participation will be charged extra (about 130.-DM). That will include the transportation, the (high-level) lunch and dinner and the entrance fees.

THE ORGANIZATION OF LIFE DURING THE SCHOOL/CONFERENCE

The School/Conference will be organized as follows:

Each working day Monday to Friday: lectures 9-10, 10-11; coffee/tea 11-11:30; lectures 11:30-12:30,12:30-13:30; lunch 13:30-15:00; lectures 15-16; coffee/tea 16-16:30; lectures 16:30-17:30, 17:30-18:30; dinner 18:30-19:30; 19:30 - evening festival programme or other private programmes and activities. Exceptionally we will have a few evening lectures due to the extremely dense programme and high-quality offers by the invited lecturers.

On Saturday morning, 3 July, there will be lectures and short reports followed by lunch as on working days. In the afternoon there will be a trip through the Maribor area as described above. On Saturday morning, 10 July, there will be lectures and short reports followed by lunch as on working days. In the afternoon there will be a social event or/and trip to celebrate the closure of the (successful) School/Conference.

The Conference Place:

The lectures will take place in the Lecture Room (Dvorana) of the University Library, on the first floor, at Gospejna ulica 10. The capacity of the lecture room is about 100. If there will be more participants, we shall have to move in some of the nice larger lecture rooms in the immediate neighbourhood, also in the city center. The University Library is a new building, in excellent shape with excellent infrastructure, including access (terminals) to the University Computer, and PCs. There will be extra PCs provided for your use during the Conference time, especially to check and to send your e-mail.

The University Library Building is located just behind the central and most beautiful square of the city, called Slomškov trg, with the Cathedral situated in central position, and surrounded by the historic buildings of the Theological Faculty, the University Building, the National Theatre and Opera, the central Post Office building. There is a small park inside, surrounded by many nice coffee houses offering a variety of refreshments, suitable for private discussions in small groups. Also, the University Library is just at 3 minutes walking distance from the Hotel OREL, at Grajski trg 3, (which normally is the accommodation place for the invited lecturers and those participants wishing explicitly the accommodation there - the latter one at their own extra expenses), and also only at 8 minutes walking distance from the students residence in Dijaški dom DRAVA, at Smetanova ulica 67.

The Accommodation:

All invited lecturers and speakers will be accommodated in single rooms (unless requested otherwise) in **Hotel OREL, Grajski trg 3, SI-2000 Maribor, Telephone +(386) (62) 26 171, Telefax +(386) (62) 28 497**, where they can also register upon arrival to get the Conference materials. Hotel OREL is situated at a central and most beautiful location in the City Center (pedestrian zone!), just nearby the baroque City Castle and close to the very nice City Park. It is a B-Category hotel, since it does not have a swimming pool and a sauna, but otherwise meets all standards of an A-Category hotel, having all other features of best quality, especially the cuisine. However, in the city we have several superb swimming, fitness and health centers. As mentioned above, it is just at the 3 minutes walking distance from the Conference place (the University Library). All those participants accommodated in Hotel OREL will have all meals (breakfast, lunch and dinner) in the restaurants of the hotel. The participants ("students"), normally accommodated in the students residence, will also join us to have lunch and dinner in the restaurants of the hotel OREL. This is included in their participation fee.

The participants ("students") (who are not invited lecturers), will be normally accommodated in single rooms (unless requested otherwise) in the student residence **Dijaški dom DRAVA, Smetanova ulica 67, SI-2000 Maribor, Telephone +(386) (62) 28 241, Telefax +(386) (62) 28 287**, in single rooms (unless stated otherwise). The registration office there will be open 24 hours a day. The quality of accommodation meets the standards of a decent hotel. They will have their breakfast served in the restaurant of this residence establishment. For lunch and dinner, they will join the lecturers in the restaurants of the hotel OREL, which is included in the participation fee. (Normally it is 1,600.-DM, payable in two payments, the advance payment for 800.-DM which must be enclosed/made by transfer with the submission of the application form, and the rest for 800.-DM payable at the registration either in cash or by cheque. The deadline is 15 May 1999. For late applications after 15 May 1999, and before 24 June 1999, the advance payment increases to 1,000.-DM.). This student residence is very nice, having extra facilities such as fitness rooms, music room with piano, the evening bar (coffee, drinks and refreshments) open until 10-11 pm. The distance from the residence establishment to the Conference place in the University Library is just about 8 minutes walking.

THE HOT LINE (TELEPHONE)
24 HOURS A DAY:
Please call: +(386) (609) 615 000

If you have any problems (one week) before and during the School/Conference, or even after the School/Conference (one week), there will be open a special **hot line (telephone) +(386) (609) 615 000**, where you can get the requested information, advice and help at any time. The line is a sponsorship courtesy of the **MOBITEL** company, running and maintaining the digital cellular telephone systems and networks in Slovenia.

THE PARTICIPATION FEE, THE APPLICATION AND THE DEADLINES

The participation fee normally is 1,600.-DM, whilst for late applications it is 1,800.-DM. It covers all local expenses, except the trips. The important **DEADLINES** are as follows:

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Applications with
Abstracts for communications (posters or short reports): 15 May 1999
(Enclose payment for 800.-DM.  800.-DM  must be paid
upon arrival at registration.)

Normal application....................................: 15 May 1999
(Enclose payment for 800.-DM.  800.-DM  must be paid
upon arrival at registration.)

Late application (after 15 May 1999)...................: 24 June 1999
(Enclose payment for 1,000.-DM.  800.-DM  must be paid
upon arrival at registration.):

Application for financial support for participants.....: 18 April 1999
(Enclose an informal application with C.V., list of
publications, and two letters of recommendation.)

Arrival and Reservation Notice.........................: 24 June 1999
(This should be sent as early as possible,
also by invited lecturers and speakers.)
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The advance payment (for normal application 800.-DM before 15 May 1999, and 1,000.-DM for late application after 15 May 1999 and before 24 June 1999) must be enclosed with the application form either as a bankers cheque made payable to the **CAMTP - for the Summer School/Conference** or as a proof (a copy) of bank transfer to the account of the Summer School/ Conference:

Center za upor. mat. in teor. fiz. CAMTP
Krekova 2
SI-2000 Maribor, Slovenia
Account with NOVA KREDITNA BANKA MARIBOR d.d.
Vita Kraigherja 4
SI-2000 Maribor, Slovenia
Account number: 51800-620-00016-03-16233-82040-7-2859/2
SWIFT code: KBMASI2X

The participants from Slovenia should pay the advance payment by a bank transfer in SIT equivalent (according to the mean exchange rate of the Nova Kreditna Banka Maribor) to the account (**žiro račun**):

Center za upor. mat. in teor. fiz.
žiro račun: 51800-603-34826
pripis: za Poletno Šolo

All the applications should be sent to

The Contact Address of the School/Conference:

CAMTP, Summer School
University of Maribor
Krekova 2
SI-2000 Maribor
Slovenia
Telefax +(386) (62) 213151 and 213541
Telephone +(386) (62) 213151 and 2296440
e-mail ss99@uni-mb.si

Applications without the advance payment will not be processed.

All further information with the current updates is available **on the World Wide Web home page address:**

http://www.uni-mb.si/~ucamtpssn/

THE APPLICATION FORMS AND THE ARRIVAL AND RESERVATION NOTICE

The Application form and **the Arrival and Reservation Notice** are enclosed to this brochure, but are also available as LaTeX source codes on the **World Wide Web home page address**:

http://www.uni-mb.si/~ucamtpssn/application.tex

Fill and sign them, enclose the payment and send them before the deadlines to the address above. The forms are also available upon request from the same address (The Contact Address of the School/Conference) given above, by air-mail, and also by fax or e-mail, if requested and if necessary.

If you have any further questions, or problems, including financial ones, where you think we might be able to help you, then please contact us as soon as possible at the Contact Address given above. In case of doubt you are welcome to contact the Director Professor Dr. Marko Robnik, Director of CAMTP, at the same address.

A WORD ABOUT CAMTP

Center for Applied Mathematics and Theoretical Physics
University of Maribor, Slovenia

The Center for Applied Mathematics and Theoretical Physics (**CAMTP**) was founded in June 1990 as a new research institute under the direction of Professor Dr. Marko Robnik and became an independent academic institution (member) of the University of Maribor in July 1991. The financial support is provided entirely by the Ministry of Science and Technology of the Republic of Slovenia. Its research activities and collaborations are strongly internationally oriented, and the institute now has already a number of external collaborators and research visitors from among the leading scientists in Slovenia and in foreign countries, especially in Germany, Japan, France, Italy, Belarus and USA.

The theoretical research programme covers three dominant fields:
(1) Nonlinear dynamics of classical and quantum nonintegrable and chaotic systems,
(2) Hydrodynamics and plasma theory,
(3) Computer algebra,
(4) Intelligent systems and computer modelling of complex systems.

Some collaboration in the theoretical astrophysics is also involved in joint projects with the researchers of the University of Bonn. **CAMTP** collaborates also with the University of Ljubljana. The Center is also going to participate in the French-Slovenian Programme PROTEUS, in collaboration with a group at Institut de Physique Nucléaire, Orsay, headed by Professor Dr. Oriol Bohigas.

The purpose of the Center is to carry out the theoretical research, to maintain the international academic relations and collaborations in these fields, and to educate young research students. **CAMTP** has excellent computer facilities including the access to supercomputers. The Center was also the scientific organizer of the Summer Schools *"Let's Face Chaos through Nonlinear Dynamics"* held in 1993 and in 1994 at the University of Ljubljana in collaboration with the international student association (IAESTE), the technical organizer headed by Maja Malus and Mr. Matija H. Golner. The Center is the supporting scientific institution of the Summer School/Conference since 1996, and of the future ones (1999+), to be held traditionally at the University of Maribor.

The address:
Center for Applied Mathematics and Theoretical Physics
Director: Professor Dr. Marko Robnik
University of Maribor
Krekova 2
SI-2000 Maribor
Slovenia
Telephone: + (386) (62) 213151 and 2296440
Telefax: + (386) (62) 213151 and 213541
e-mail: ROBNIK@UNI-MB.SI
WWW home page: http://www.camtp.uni-mb.si

A brochure about activities of **CAMTP** *is available upon request at the above address, and can be obtained also as a LaTeX source code from the above WWW home page.*

The Production Team:

Text, LaTeX Typesetting and Editing:
Professor Dr. Marko Robnik
— Director of the School/Conference —
— Director of CAMTP —

•

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