ICTP − The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

smr1330/Announcement

Workshop on Non−Linear Dynamics

and Earthquake Prediction

15 − 27 October 2001

Miramare − Trieste, Italy

The Abdus Salam International Centre for Theoretical Physics, in collaboration with the Department of Earth Sciences of the University of Trieste, will organize the Sixth Workshop on Non−Linear Dynamics and Earthquake Prediction. The Workshop will take place from 15 to 27 October 2001 and will be directed by Professors V.I. Keilis−Borok (International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Moscow, Russia) and G.F. Panza (Department of the Earth Sciences, University of Trieste/ ICTP, Italy). The Workshop is co−sponsored by the European Commission.

PURPOSE AND NATURE

The Workshop is dedicated to the application of methods of non−linear dynamics to understand the instability of the Earth lithosphere. Earthquake prediction is an intrinsic part of the problem, pivotal for understanding the dynamics of the lithosphere, as well as for the reduction of disasters.

The Workshop will be focused specifically on the interface between analysis of geophysical observations and mathematical models of chaotic systems, on numerical modelling of lithosphere dynamics and dynamics of other complex systems, and on the applications of results of modelling earthquake prediction. Among practical aspects, great attention will be given to accuracy and statistical significance of predication methods, their rate of errors, and to the interaction of disaster management authorities. Particular attention will be paid towards the planning of future research based on the requests received from the participants. Leading experts in geosciences and non−linear dynamics will be among the lecturers.

The vulnerability of human civilization to natural dangers and, in particular, to earthquakes is critically growing, due to proliferation of high−risk objects, clustering of population, and destabilization of large cities. Today a single earthquake may take up to a million lives; cause material damage up to US$1,000,000,000,000, with a chain

reaction expanding to world−wide economic depression; trigger major ecological catastrophes (e.g. several Chernobyl−type calamities at once); paralyse national defense. In many developing countries the damage from earthquakes consumes all the increase in the GDP. Critically vulnerable are the low seismicity regions, e.g. European and Indian platforms, Eastern US etc. The other natural dangers are at least of the same scale.

Earthquakes and other dangers are governed by non−linear systems which are hierarchical and have an intermediate number of degrees of freedom: an earthquake−prone or a creep−prone region, harbouring high risk objects; a megacity, on a way to self−destruction. The prediction of these disasters, which is a critical component of their reduction, is a very difficult problem due to the absence of an adequate theoretical base of prediction research, in particular, to the impossibility of understanding a non−linear system by studying it piece by piece. Integration of modelling and phenomenology of earthquake occurrence should help overcome the difficulties connected with the absence of fundamental constitutive equations and the impossibility of direct measurements at the depth, where the earthquakes are originated.

The efforts are specifically focused on the interface between analysis of geophysical observations and mathematical models of chaotic systems. The following developments in science and technology form the basis for modelling of the lithosphere dynamics and, therefore, for understanding and prediction of earthquakes:

− non−linear dynamics with its concept of chaos, self−organization, and phase transitions, as a highly useful tool for the study of short−term dynamics of lithosphere, including seismicity;

− a variety of models recently developed, including the lattice−type ("universal") models, as well as, models reflecting fault−geometry and observations on seismicity and other relevant fields;

− concept of the "geometric incompatibility" that measures instability of a tectonic blocks− and−faults system and links together the structure of the lithosphere, its dynamics (interaction with mantle included), the movements in a broad velocity range (from seismicity to creep to GPS to neotectonics), stress and strain fields, migration of fluids in a fault system, and accordingly, geoelectric fields and geochemistry;

− pattern recognition for small samples, developed for phenomenological analysis of highly complex data;

− the powerful and inexpensive personal computers and workstations that allow modelling of 3D dynamics and seismicity for complex crustal blocks−and−faults structures;

– the relevant interactive software which gives a simple and friendly access to the application of the methods developed.

The methods and training given at the Workshop will create the possibility to reduce drastically the cost of field studies and instrumentation by means of application of the corresponding software for the deep analysis of data already available. At the same time these methods may have wide applications in many other problem areas connected with critical phenomena. Among such problems there are other geological disasters, oil exploration, structural engineering etc.

The Workshop is a continuation of the nine previous meetings organized by the Trieste Science Centres (Italy) in 1983, 1988, 1991, 1993, 1995, 1997, 1999, CERESIS (Lima, Peru, 1986), and IDEA (Caracas, Venezuela, 1991).

It is designed for scientists at Post–Graduate or M.Sc. level in Physics, Mathematics or Computational Geophysics, with experience in computer applications. The purpose of the Workshop is to facilitate and promote research, and not to provide some ready–made methods. However, the know–how will be provided for the testing of some algorithms of intermediate–term earthquake prediction, and for modelling of lithosphere dynamics as the starting points of further research.

Participants will also be trained in the use of relevant computer software, and in some elements of exploratory data analysis, through practical working sessions using personal computers. A substantial portion of the time will be devoted to practical exercises and the outline of future projects. A set of lectures on relevant fundamental problems of Solid Earth Sciences and adjacent fields of Non–Linear Dynamics will also be given.

Participants are encouraged to prepare reports on the results of their studies and theses and to bring their data and materials. They will be assisted in working out plans for future studies and their own research proposals.

The data for practical exercises will be provided by the convenors of the Workshop. The participants will also be given the opportunity to analyze the data, relevant to their own countries. At the end of the Workshop participants will be given the above–mentioned software for future independent use.

II. PROGRAMME

The programme of lectures and practical exercises will cover the following topics:

LITHOSPHERE AS A NON−LINEAR DISSIPATIVE SYSTEM

Lectures:

− Chaos and self−organization in non−linear dissipative systems;

Symptoms of instability; Scaling, self−similarity, fractality

− Numerical models of seismicity: lattice−type ("universal") models and models of lithosphere block structure dynamics; Geometric incompatibility in blocks−and−faults systems; Physical background of major regularities in earthquake occurrence, as inferred from synthetic and real earthquake sequences

Practical exercises:

− Models; Analysis of earthquake sequences; Use of Global Data Banks for regional studies; Software

PATTERN RECOGNITION

Lectures: Exploratory data analysis; Algorithms; Software; Numerical tests

Practical exercises: Data analysis; Software

EARTHQUAKE PREDICTION

Lectures:

− Premonitory phenomena in models and reality; Integration of data in different fields

− Algorithms of prediction; Evaluation of reliability of prediction methods, error diagrams; Seismic risk estimate; Interaction with practical decision−making

Practical exercises:

− Diagnosis of premonitory phenomena; Reliability of prediction; Software

Several meetings are planned to discuss the studies performed within the framework of international projects. In particular, the results obtained by the NATO SfP 972266 Project ³Impact of Vrancea Earthquakes on the Security of Bucharest and other Adjacent Urban Areas (Ground Motion Modelling and Intermediate−Term Prediction)² will be presented.

Scientists and students from all countries that are members of the UN, UNESCO, or IAEA can attend the Workshop. The main purpose of the Centre is to help researchers from developing countries through a programme of training activities within a framework of international co−operation. However, students and post−doctoral scientists from developed countries are also welcome to attend, and may be supported thanks to the contribution from the European Commission under the Human Potential Programme (High−level Scientific Conferences). As the Workshop will be conducted in English, participants should have an adequate working knowledge of that language. A degree in Physics, Mathematics, Geophysics (theoretical or computational), Computer Science and/or similar disciplines is required.

As a rule, travel and subsistence expenses of the participants should be covered by the home institutions. Some funds will be available for participants from developed countries under the EC. Such financial support is available only to those who attend the entire Workshop. As scarcity of funds allows travel to be granted only in a few exceptional cases, every effort should be made by candidates to secure support for their fares (or at least half fare) from their home country. For logistic reasons, connected with the number of Personal Computers available, the total number of participants in the Workshop is limited. There is no registration fee for attending the Workshop.

Those wishing to participate should complete and return the request for participation form, to be found at the back of Bulletin No. 1 (also obtainable via e−mail: smr1330@ictp.trieste.it, by typing on the subject line: get index, or via WWW server: http://www.ictp.trieste.it/), before 28 May 2001 to the following address:

the Abdus Salam International Centre for Theoretical Physics

Sixth Workshop on Non−Linear Dynamics

and Earthquake Prediction

Strada Costiera 11,

I−34100 Trieste, Italy

UNITED NATIONS EDUCATIONAL SCIENTIFIC AND CULTURAL ORGANIZATION

and

INTERNATIONAL ATOMIC ENERGY AGENCY

the ABDUS SALAM INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

Strada Costiera 11 Telephone: +39−040−2240355

I−34014 Trieste Telex: 460392 ICTP I

Italy Telefax: +39−040−224585

REQUEST FOR PARTICIPATION

6th Workshop on Non−Linear Dynamics and Earthquake Prediction

15 − 27 October 2001

E−mail: SMR1330@ictp.trieste.it

INSTRUCTIONS

Each question must be answered clearly and completely. A recent photograph of

Type or print in ink. If more space is required, the candidate should

attach additional pages. This form should be forwarded be attached here,

to the: the Abdus Salam International Centre for signed legibly on the
Meo), 6th Workshop on reverse

on Non−Linear Dynamics Earthquake Prediction, Strada

Costiera 11, I−34100 Trieste, Italy, to arrive no

later than 28 May 2001.

NOTE: This request will be processed only if the permanent address (and present address, if different) is clearly indicated. The ICTP cannot process any visa request, unless all

requested personal data are provided.

If sending an application by e−mail, please save and send file attachments in RTF format.

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P E R S O N A L D A T A

SURNAME/FAMILY Name: MAIDEN NAME: First name: Middle name(s):
Sex:

For women only (if applicable)

IMPORTANT: PLEASE ALSO COMPLETE THIS SECTION, IF YOU NAME(S) IN YOUR PASSPORT

ARE SPELT DIFFERENTLY FROM THE ABOVE.

SURNAME/FAMILY Name: MAIDEN NAME: First name: Middle name(s)

For women only (if applicable)

Place of birth (City and Country): Present nationality: Date of birth:

Year − Month − Day

Full address of permanent Institution: Institute: Tel. No.

Telex/Cable

Telefax

Your Office: Tel. No.

Telefax

E−mail:*

Full address of present Institution (if different from permanent):

Institute: Tel. No.

Telex/Cable

Telefax

Your Office: Tel. No.

Telefax:

until date .....

E-mail:*

Home address:

Tel. No.

Mailing address - please indicate whether: Permanent address _____

Present address _____

Home address _____

Name and address of person to notify in case of emergency -
Relationship:

Tel no:

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* I agree that my e-mail address(es) be made public on the
ICTP WWW page: YES _____ NO _____

EDUCATION (higher degrees)

University or equivalent Years attended
Degrees

Name and place From To

Seminars, summer schools, conferences or research

Name and place
Year

SCIENTIFIC EMPLOYMENT AND ACADEMIC RESPONSIBILITY

Research Institution or University Academic Name and place	Period of duty From To	 responsibilities

Present employment and duties, and foreseen employment upon return to home country after the activity:

Have you participated in past ICTP activities: Yes _____ No _____

If yes, which?

Are you applying to any other 2000 ICTP activities?

If yes, which? Yes _____ No _____

Mention briefly your previous research experience, and explain your reasons for wishing to participate in this activity:

NB: Our Scientific Information System keeps track of all applications made by the candidate to earlier ICTP activities. As a consequence, when the subject of the present activity is far from your previous applications, an explanation (not more than 200 words) of your change of interest should be included.

PRESENT FIELD OF INTEREST (please indicate on the list below your TWO primary fields of interest in order of priority).

10. PHYSICS OF CONDENSED MATTER
    - 11. Solid State Physics
    - 12. Atomic and Molecular Physics
    - 13. Materials Science
    - 14. Surfaces and Interfaces

60. PHYSICS TEACHING
    - 61. English
    - 62. French
    - 63. Spanish
    - 64. Arab

15. Statistical Physics

16. Computational Physics in Condensed Matter

20. PHYSICS OF HIGH AND INTERMEDIATE ENERGIES

21. High Energy and Particle Physics

22. Relativity, Cosmology Astrophysics

23. Plasma Physics

24 Nuclear Physics

30. MATHEMATICS

31. Applicable Mathematics including:

- Mathematical Ecology,
- System Analysis,
- Mathematical Economy
- Mathematics in Industry

33 Algebra

34. Geometry

35. Topology

36. Differential Equations

37. Analysis

38. Mathematical Physics

80. MISCELLANEOUS

81. Others

82. Digital Communications and Computer Networking

90. PHYSICS OF THE LIVING STATE

91. Neurophysics

92. Biophysics

93. Medical Physics

AO. APPLIED PHYSICS

A1. Physics in Industry

A2. Microelectronics

A3. Fibre Optics for Communications

A4. Instrumentation

A5. Synchrotron Radiation

A6. Non−destructive Evaluation

A7. Lasers

AA. Applied Superconductivity

B1. SPACE PHYSICS

40. PHYSICS AND ENERGY

41. Physics of Nuclear Reactors

42. Physics of Controlled Fusion

43. Non-Conventional Energy

(Solar, Wind and others)

50. PHYSICS OF THE ENVIRONMENT

51. Solid Earth Geophysics

52. Soil Physics

53. Climatology and Meteorology

54. Physics of the Oceans

55. Physics of Desertification

56. Physics of the Atmosphere, Troposphere

Magnetosphere, Aeronomy

57. Environmental Monitoring and Remote

Sensing

Kindly supply a keyword description of your current scientific activities, as follows (strictly within indicated lengths):

1) Area of research: (e.g. GEOPHYSICS)

|_____|

(no more that 15 characters)

2) Specific topic of interest: (e.g. SEISMIC HAZARDS)

|_____|

(no more than 30 characters)

_____

List your scientific publications including books and articles
(authors, title, Journal) in the period 1995–2000:

_____

Kindly state any positions you hold in the scientific administration of
your Institution or any of the national scientific Institutions.

It would be of assistance to the Selection Committee if this
request for participation were accompanied by a letter of
recommendation, especially for junior
physicists.

_____

Indicate below your proficiency in the English language

Indicate below your proficiency in the English language

Reading: Good _____ Writing: Good _____ Speaking: Good
_____

Average _____ Average _____
Average _____

Poor _____ Poor _____ Poor
_____

APPLICABLE ONLY FOR CANDIDATES FROM DEVELOPING COUNTRIES (Important: Owing to limited funds, support for travel will be granted only in exceptional cases. Therefore, every effort should be made by applicants to secure support for their fare (or at least a partial contribution) from their home country).

Request for Financial Assistance: (Please tick ONE box only)

_____ Full Travel + Subsitence _____ Subsistence only

_____ Half Travel + Subsitence _____ No financial support requested

I certify that if granted funds for my travel, I shall attend the whole activity

Signature .....

I certify that the statements made by me above are true and complete. If accepted, I undertake to refrain from engaging in any political or other activities which would reflect unfavourably on the international status of the ICTP. I understand that any breach of this undertaking may result in the termination of the arrangements relating to my visit at the Centre.

_____
_____

Signature of candidate Date

6th Workshop on Non−Linear Dynamics and

Earthquake Prediction

15 − 17 October 2001

Supplementary Information

(to be attached to the "Request for Participation" form)

The information requested here is not a determining factor in selecting participants, but can help us to organize the computer exercises. The ICTP computing facilities include a Main CONVEX C−210 system, a few SUN 386i workstations and many IBM compatible PCs. The computer exercises during the Workshop will be given on IBM compatible PCs.

− What kind of computer are you currently using (including PCs)?

− For which purpose (research, data management, writing...)?

− What kind of programming language?

− Is your programming ability:

excellent good sufficient insufficient

− Can you present any software of particular interest to this course (if "yes" please specify)?

− What kind of floppy−disk drives for IBM compatible PCs are available at your Institution?

51/4 HD 1.2M 51/4 DD 360K 31/2 HD 1.4M 31/2 DD 720K

– Comments/proposals/suggestions:

Communications by Participants.

– Would you like to present papers/communications?

Yes please specify title(s) No

– Would you like to present poster (s)? Yes please specify title(s)
No

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