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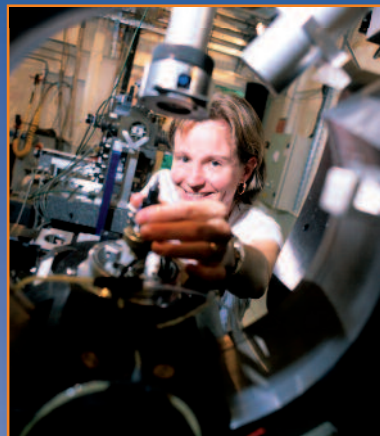
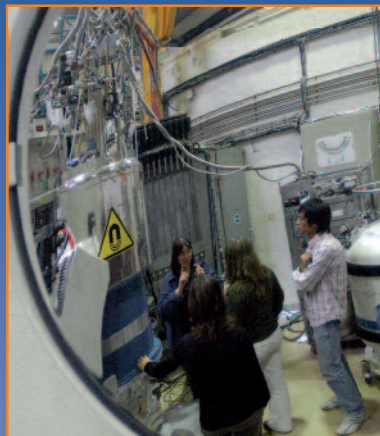
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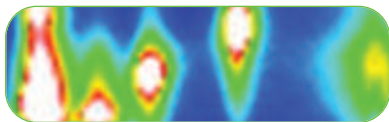
20
YEARS

HERCULES

HIGHER EUROPEAN RESEARCH COURSE FOR USERS OF LARGE EXPERIMENTAL SYSTEMS

<http://hercules.grenoble.cnrs.fr>





20 years of HERCULES



Since its first session, in 1991, HERCULES has displayed a number of features that differentiate these courses from the rest: i.e. simultaneous training in neutron and synchrotron radiation science for about 75 participants over several weeks, multidisciplinary, lectures and tutorials given by highly qualified

international specialists, and a substantial fraction of the programme devoted to practical sessions carried out on cutting edge instruments, at European Large Facilities partner institutes. In my opinion these are essential features that must be retained in the future.

Another fantastic bonus, pointed out by many former participants, are the informal human networks established following these courses; these are particularly important scientifically, with a substantial fraction of the participants remaining connected to Large Facilities.

The achievements of HERCULES would not have been possible without the wide support it receives from not only the organising Universities, but also from French authorities and research institutes, European Large Facilities and many partner research institutes across Europe. The joint efforts of many people, at the European level, have allowed the HERCULES school to achieve the international recognition it enjoys today.

HERCULES has evolved considerably over these last twenty years, and should continue to do so by continually adapting to state-of-the-art science and techniques. The XXth anniversary event wishes to be a major step along this line, with a series of lectures clearly turned towards the future. Our publications are greatly appreciated, and this policy should be pursued. The short courses on specialised, "hot topics", neutron and/or synchrotron radiation-related developments, organised over the last four years, have been able to satisfy a need quite different from the one covered by the annual sessions.

HERCULES (followed by other schools in Grenoble) was designed, from the very beginning, to be both European and "long term". But these European schools often appeared, to many partners, to be important but "extraordinary" events, which would be unable to establish themselves as recurring events. I believe this is not the case: as a whole, these schools have a permanent role. The fact that the demand, from both European and international publics, is still so high twenty years later, shows that the role of HERCULES is far from diminishing, provided the School continues to integrate new, hot topics such as emerging new neutron and X-ray sources, and technical upgrades, which offer new opportunities for new science. The specific organisation and funding scheme of HERCULES must be such that it can guarantee the continuation of this specially-adapted training course targeting all motivated young scientists who wish to embrace these exciting evolutions of science.

José BARUCHEL
DIRECTOR OF HERCULES
HEAD OF X-RAY IMAGING GROUP, ESRF



First Hercules Specialized Course 2006



First HERCULES Course 1991

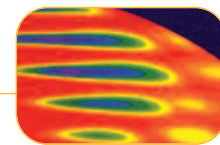
IDENTITY CARD

Name: **HERCULES**
Born: **28/01/1991 (conceived in 1989!)**
Place of birth: **Grenoble**
Parents: **UJF, Grenoble INP / CNRS, CEA ESRF, ILL, European Commission**
Family: **European Universities and Large Facilities**
Nationality: **European!**



"The HERCULES course offers a unique experience to young researchers from all over the world by exposing them to state-of-the-art synchrotron and neutron facilities, thus enriching the international scientific community by investigators eager to perform cutting edge research using large facilities."

ADA YONATH
PROFESSOR, WEIZMANN INSTITUTE OF SCIENCE, ISRAEL,
LECTURER AT HERCULES, NOBEL PRIZE 2009



Unique features of the HERCULES courses

HERCULES organises courses with the aim of training users of European large facilities in neutrons and X-rays, enabling them to take full advantage of the scientific opportunities these labs provide.

HERCULES exhibits unique features, including:

- an annual session, consisting of one 5-week course / year.
- a series of one-week courses focused on more specialised topics.
- identifying/highlighting complementary aspects of neutrons and synchrotron radiation.
- attracting top specialists as lecturers, with an evaluation process that helps retain the best teaching methods.
- giving emphasis (40% of the programme volume) to practical sessions, carried out in small groups, on cutting-edge set-ups used in research.
- contributing to the creation of a European network of young research scientists, with know-how in the use of neutron and synchrotron radiation tools.
- establishing and improving contacts between scientific staff at large facilities and course participants.

Who participates?

PhD students, post-doctoral and confirmed scientists.

What topics?

All topics where neutrons and synchrotron radiation contribute to the scientific knowledge, including materials science, cultural heritage, environment, biomedicine and health.

When?

Five weeks each year, in February-March, for the annual session, and one week in Spring/Autumn for the specialised courses.

How many?

Annual sessions: about 75 participants, 60 lecturers and 100 scientists in charge of practicals/tutorials.

Specialised courses: 20 participants and about 12 lecturers (courses, practicals, tutorials).

Who organises and manages?

UJF, INPG with the help of ILL, ESRF, LLB, SOLEIL, ELETTRA, CNRS, CEA Local Organising Committee and International Scientific Advisory Committee.

Who finances?

Participants' fees, European Commission (Marie Curie, ELISA, NMI3...), European research Institutes (ESRF, ILL), Grenoble Universities (UJF, INPG), French authorities and research institutes (MESR, CNRS, CEA...), local authorities (Région Rhône Alpes, Ville de Grenoble...), private industry.

HERCULES ANNUAL SESSIONS

Given in English for an international audience, a Hercules Annual Session alternates theoretical courses and seminars (mornings) with set work and practical sessions (afternoons, plus six full days). A series of common lectures is followed by two parallel sessions focused on Physics and Chemistry of Condensed Matter (session A) and Biomolecular Structure and Dynamics (session B). Visits to laboratories and a poster session aim to promote scientific exchanges between participants, lecturers and the scientists in Grenoble.

A very extensive neutrons/synchrotron radiation practical/tutorial training course (50 hours, about 40% of the time) is carried out, with groups of four students under the supervision of scientists in charge of research instruments located in partner institutions (ESRF, ILL, Elettra, Soleil, LLB, EMBL, IBS, CNRS, CEA, UJF, INPG).

HERCULES SPECIALISED COURSES

"Hot topic" one-week course, always based on the successful Hercules scheme

Limited to 20 participants/course

Lectures (50%) + practicals on cutting edge instruments /tutorials (50%)

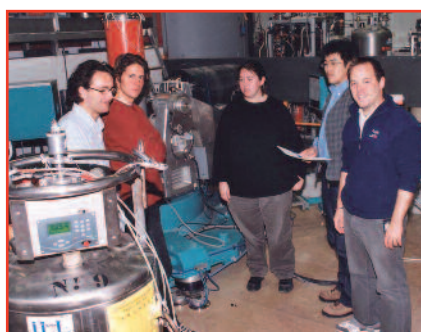
Eleven sessions were organized over the last four years:

X-ray imaging / nanostructures and interfaces / structural genomics (2006)

Magnetism / cultural heritage / new applications of SR for biology (2007)

High pressure / environment / soft condensed matter (2008)

Nanoscience / neutrons and SR for magnetism (2009)



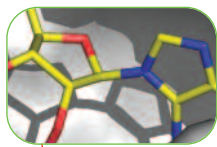
HERCULES Practical,
ILL, Grenoble

"For the long-term vitality of a multinational user institute like ILL, the most important priority is to build up a dedicated group of knowledgeable users, for whom these unique facilities make an indispensable contribution to solving wide ranging scientific questions. So when the rector of UJF came to see me in 1989 to tell me that he had received funding from the French government to encourage his university to set up international courses based on the Grenoble institutes, I was immediately enthusiastic. I consulted our in-house scientists, who shared my enthusiasm, so without delay I was able to say that we would make instrument time available for practical demonstrations and that many of our staff would be delighted to give time to introduce newcomers to their techniques. Thus HERCULES was born. It is therefore a very special pleasure to mark the twentieth anniversary of this unique European course. Over the years it has brought together young people from many countries, who took their first steps into neutron scattering in Grenoble. Happy birthday, HERCULES – and may there be many more of them!"

PETER DAY

EMERITUS FULLERIAN PROFESSOR OF CHEMISTRY, ROYAL INSTITUTION OF GREAT BRITAIN;
EMERITUS PROFESSOR OF CHEMISTRY, UNIVERSITY OF LONDON; DIRECTOR OF ILL 1989-1991





Scientific programme and evaluation

The scientific content of the HERCULES courses is defined by the Organising Committee, with the advice of the International Scientific Committee, which is composed of directors of the large European facilities, professors of universities utilizing these facilities, and external experts. A careful evaluation (anonymous questionnaires, discussion groups) during each of the courses, is also used to adapt the teaching programme (content, duration ...) to the most recent scientific needs.

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Scientist, ESRF

D. BELLET
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Director of studies

J. L. HODEAU
Scientist, CNRS Grenoble

Special consultant

J. R. REGNARD
Professor, UJF / CEA Grenoble

Glossary

CEA – Atomic Energy Centre
CNRS – National Centre for Scientific Research
CRG – Collaborative Research Group
ELETTRA – Synchrotron Facility (Trieste)
ELISA – European Light Sources Activities, European Commission Research Infrastructures
EMBL – European Molecular Biology Laboratory
ESRF – European Synchrotron Radiation Facility (Grenoble)
Grenoble INP (INPG) – Grenoble Institute of Technology
IBS – Structural Biology Institute
ILL – Institut Laue Langevin (neutrons, European institute, Grenoble)
LLB – Léon Brillouin Laboratory (neutrons, Paris area)
LURE – Synchrotron Facility (Paris area, now closed)
MESR – Research and Higher Education Ministry (France)
NMI3 – Integrated Infrastructure Initiative for Neutron Scattering and Muon Spectroscopy, European Commission Research Infrastructures
SOLEIL – Synchrotron SOLEIL (Paris area)
UJF – Joseph Fourier University (Grenoble)

Former and present HERCULES Directors:
from left to right Jean René REGNARD,
José BARUCHEL and Claire SCHLENKER.



"In 1989, the University Joseph Fourier asked me to team up with my colleague Claire Schlenker of the INP Grenoble to organise a European school on synchrotron radiation. I had just returned from performing experiments at the Daresbury synchrotron, where I met Bill Stirling, then professor at the University of Keele. He told me about Keele Masters' project entitled "Synchrotron radiation and Neutron scattering applied to materials" (I kept the poster to remember it!). That sounded to me like an excellent set of themes for a school aimed at a European audience at the doctoral level.

We were therefore quickly able to incorporate neutrons and synchrotron radiation (SR) into our project of a European School. With the assistance of José Baruchel, then scientist at ILL, we placed key emphasis on practical work in the large scale facilities in Grenoble (ILL and ESRF) and Paris (LURE and LLB).

For my part, I was greatly motivated to set up this school following my reconversion in 1986 to the field of the SR. Indeed, I realised that my expert colleagues were not always available for explanations, especially during beamtime when they were under pressure to deliver results. It is in this context that I realised that a course like HERCULES, which would deliver both theoretical and practical training, would be extremely important, as it could have quickly helped me to gain the necessary expertise.

My greatest satisfaction was on 28 January 1991, after more than one year of preparatory work with Claire and my colleagues of the Committee, to welcome the first group of young European scientists (for an 8-week course!). The following courses have given me as much joy! After having interacted with the participants for several weeks, and gauging their opinion of our programme by means of evaluation forms (in general, very positive), I always looked forward to launching the following session!

Over the 18 years of planning the course, it is with a great pleasure I have spent a large amount of time working on the evolution of the teaching programme, on progressively opening the course to the international community, on innovations (Euroconference, Specialised Courses, HERCULES in Brasil)... and on finding the funds to carry them out.

I wish every success to the celebration of the 20th anniversary of HERCULES, for which I have been pleased to bring my help, and to the future of HERCULES. I am convinced that HERCULES will continue within our European and international action plan to successfully meet the needs of the User Community for SR and neutrons in the years to come."

JEAN RENÉ REGNARD
PROFESSOR UNIVERSITY JOSEPH FOURIER,
DIRECTOR OF HERCULES FROM 1991 TO 2009

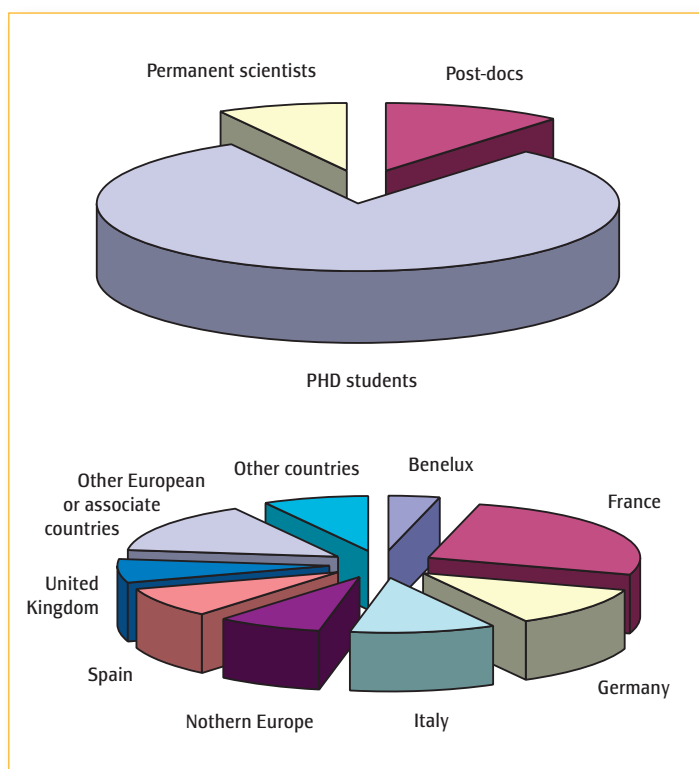
Participants, Lecturers, Teachers



1600 PARTICIPANTS

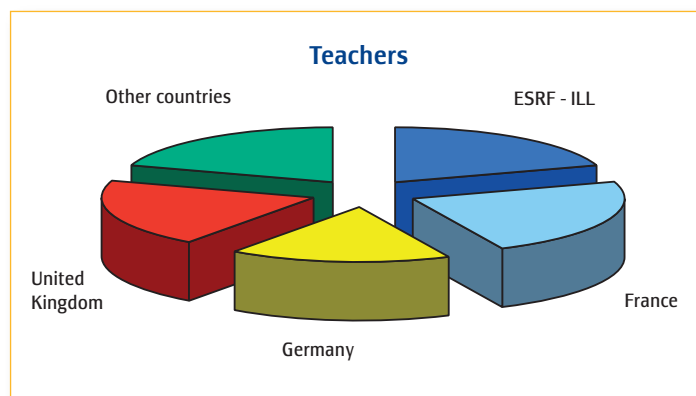
HERCULES is designed for PhD students, post-doctoral and confirmed research scientists. The participants are primarily from Europe, but there is always interest from other countries, such as Brazil, USA, Taiwan or Australia.

The 1600 participants (out of more than 2400 applicants) are selected on scientific criteria. The limited number of participants (48 for session A, physics/chemistry, 24 for session B, biology) is imposed by the requirement of having small (about 4 people) groups for the practicals, to perform them in optimal conditions. Females make up an average of 30% of participants.



LECTURERS AND TEACHERS

The speakers are selected from all over the world for their scientific excellence. The lectures are complemented by practicals and tutorials performed by small groups of students under the supervision of about 100 research scientists. The ensemble of these lecturers and scientists, from a wide range of nationalities, exhibit not only a high degree of competence, but also a recurrent commitment and enthusiasm that constitutes a fundamental pillar on which the HERCULES courses rest.



HERCULES Course,
Trieste, Italy



GIULIANA AQUILANTI, SCIENTIST AT ELETTRA, BEAMLINE RESPONSIBLE, ITALY:

"My time at the HERCULES school has proved fundamental to my professional life. The environment was one of scientific rigour and community, and it was there that I was confronted with young scientists from all over Europe, many of whom I have gone on to collaborate and work with."

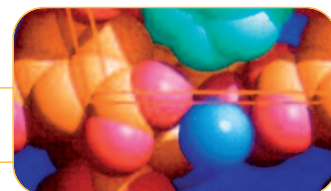


HEINZ AMENITSCH, INSTITUTE OF BIOPHYSICS AND NANOSYSTEMS RESEARCH (IBN), AUSTRIAN ACADEMY OF SCIENCES, BEAMLINE RESPONSIBLE FOR THE IBN AT ELETTRA:

"I had been working solely with neutrons during my PhD and as a post-doc I had to construct an entire small angle X-ray scattering beamline at a 3rd generation source from scratch. Without the HERCULES course, I would not have made it."



They participated to HERCULES...



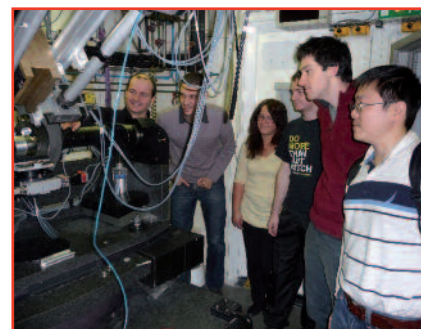
MICHAEL KRISCH, HEAD OF DYNAMICS AND EXTREME CONDITIONS GROUP, ESRF, GRENoble:

"I attended the first HERCULES course during my thesis, which I conducted at the ESRF. The course allowed me a unique insight into neutron and X-ray science, and I was excited by the stimulating atmosphere. I could establish several contacts with lecturers and students and this translated into future scientific collaborations."



REGINE WILLUMEIT, HEAD OF DEPARTMENT "STRUCTURE RESEARCH ON MACROMOLECULES", GKSS RESEARCH CENTER GEESTHACHT, GERMANY:

"My participation in the HERCULES course stimulated my cross-disciplinary thinking and opened my mind to the various possibilities you can look at biological molecules by using neutrons and X-rays. I am still profiting from that experience. And with HERCULES my own networking started: I am still in contact with some fellow participants and lecturers, and this can be quite helpful in professional life."



HERCULES Practical, ESRF, Grenoble



M.-VANESSA COULET, IM2NP, CNRS, PAUL CEZANNE UNIVERSITY, MARSEILLE, FRANCE:

"HERCULES school gave me a glimpse of the very stimulating atmosphere of large scale instruments, with plenty of opportunities to meet and discuss with scientists with similar interests."

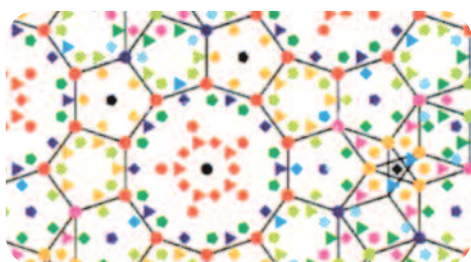


HERCULES 2008



ALEXEI KUZMIN, SENIOR RESEARCHER, INSTITUTE OF SOLID STATE PHYSICS, UNIVERSITY OF LATVIA, RIGA, LATVIA:

"I spent a nice time at the HERCULES'93 school in a truly international and friendly atmosphere and I had the possibility to touch the frontiers of modern science. This had an invaluable impact on my research and teaching activities in following years. I would definitely recommend this great school to any young researcher dreaming to push her/his scientific career."



PAOLA COAN, PROFESSOR AT MUNICH UNIVERSITY, GERMANY:

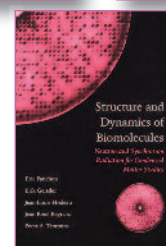
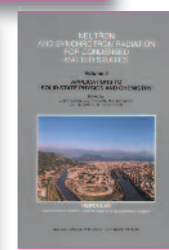
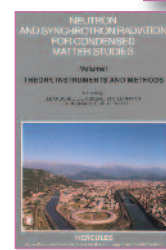
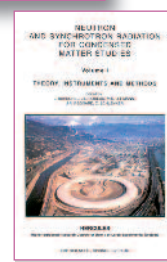
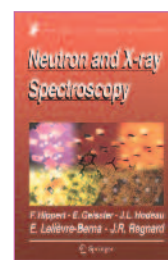
"HERCULES was a unique scientific and personal experience for me. The lectures gave a broad overview of all the possibilities that X-rays and neutrons offer for a wide range of investigations and applications. Moreover, HERCULES provided me with a wide network of young and enthusiastic scientists, with whom I am still in contact after many years."



PUBLICATIONS

The HERCULES lectures are published in the form of five books, and are part of the support for the courses.

- **Neutron and Synchrotron radiation for Condensed Matter Studies**
- **Volume I – Theory, instruments and Methods** (460 pages, 1993)
- **Volume II – Applications to Solid State Physics and Chemistry** (358 pages, 1994)
- **Volume III – Applications to Soft Condensed Matter and biology** (344 pages, 1994)
Edited by J. Baruchel, J.L. Hodeau, M.S. Lehmann, J.R. Regnard and C. Schlenker
Les Editions de Physique and Springer-Verlag
- **Structure and dynamics of biomolecules** (416 pages, 2000)
Edited by E. Fanchon, E. Geissler, J.L. Hodeau, J.R. Regnard and P.A. Timmins
Oxford University Press
- **Neutron and X-ray Spectroscopy** (566 pages, 2006)
Edited by F. Hippert, E. Geissler, J.L. Hodeau, E. Lelievre-Berna and J.R. Regnard
Grenoble Sciences and Springer



WEB

Documents of HERCULES lectures (from 2003 to 2009) and contact information on all past HERCULES participants are available to all participants on the HERCULES website, with the aim of favouring scientific exchange for these new members of SR/Neutron communities.

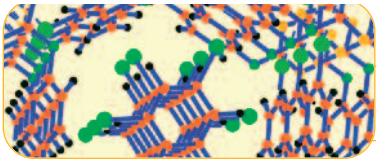


<http://hercules.grenoble.cnrs.fr>

CLEMENS SCHULZE-BRIESE, DIRECTOR MACROMOLECULES AND BIOIMAGING LABORATORY, SWISS LIGHT SOURCE, PSI, SWITZERLAND:

“HERCULES was the ideal course right at the beginning of my PhD at ESRF. It provided an excellent overview on neutron and X-ray applications in combination with exciting practical training. The lecture notes remained my favourite scientific reading for many years.”





HERCULES Funding

The present funding of HERCULES can be roughly described as coming one third each from 1) the participants' fees, 2) French institutions and 3) European institutions.

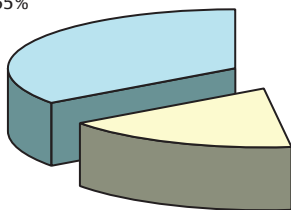
The main expenses correspond to a) participants accommodation and meals, b) lecturers and scientists in charge of practicals costs, c) books and printed material, and d) organisation costs.

The expenses (including all the costs mentioned above) are of the same order for the specialised courses and for the annual sessions, when considering the cost per student and per day (about 125 €/ student / day)

HERCULES COSTS

Committees, general operating/ subcontracting costs : 35%

Printed and web material (including books): 9%



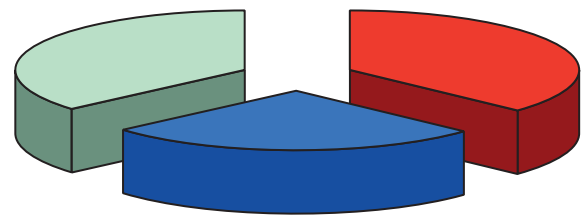
Lecturers travel and stay, practicals/tutorial costs: 17%

Student living expenses: 39%

HERCULES INCOMES

French institutions (Grenoble Univ., Government, Research Labs, Local Authorities): 36%

Registration fees: 37%



European institutions/projects (ELISA, NMI3 (+ ILL, ESRF)): 27%



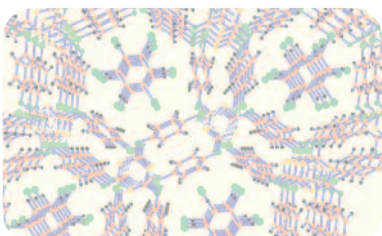
PEDRO GORRIA, UNIVERSIDAD DE OVIEDO, SPAIN:

"15 years ago, the HERCULES course opened my eyes to Materials Science using neutron and synchrotron facilities. Since then, I have been a frequent user, participating in more than 50 experiments."



SALVATORE MAGAZÙ, PROFESSOR AT MESSINA UNIVERSITY, ITALY:

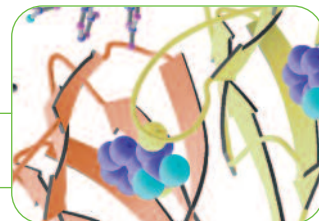
"Hercules was the driving force of my scientific route and boosted my academic career: since participating in the course, I have been working mainly using neutron scattering and synchrotron radiation. I received the Scientia Europaea prize in 2000, became a first class professor in 2002 and am currently a member of two scientific colleges at ILL and ESRF."



ERIK MEJDAL LAURIDSEN, SENIOR SCIENTIST, RISØ-DTU, DENMARK:

"For me HERCULES provided an excellent opportunity to interact with fellow students and lecturers from many different countries. This network has been very rewarding during my professional career."

Hercules in its context



GRENOBLE: A EUROPEAN CLUSTER OF SCIENTIFIC EXCELLENCE

HERCULES was conceived, and mainly operates, in Grenoble. This city, situated in the French Alps, hosts (with surroundings) about half a million inhabitants. It has a tradition of industry, research and teaching. Neutrons and X-rays have been used in Grenoble, from the 1960s, for materials (in particular magnetic) and biomedical investigations.

HERCULES directly results from the installation of large European facilities, like the ILL (“Neutrons for Science”) about forty years ago, followed twenty years later by the ESRF, providing synchrotron radiation for condensed matter research.

The University of Grenoble welcomes 60,000 students, including 8,000 foreign students. About 10,000 people work in public research and Universities, large international research facilities and European laboratories. This figure includes about 1,000 foreign researchers.

One specific feature of Grenoble is the link between industrial and academic research, exemplified in the past by the Nobel prize recipient Louis Néel and collaborators’ work on magnetic materials, and today by the strong effort on biology (IBS, EMBL, Partnership for Structural Biology) and nanosciences and nanotechnologies (“Minatéc”).



... WITH AN INTERNATIONAL IMPACT

The impact of HERCULES goes well beyond the Grenoble area: we can say that it is, today, internationally renowned. This recognition is associated with the published books, but mainly originates from the former participants, now working worldwide and sending their students and colleagues to receive the same kind of training they followed in previous years. The need for training is still just as important, because the number of sources is increasing, the present sources are being upgraded, and new types of sources are being developed, in Europe and all over the world.

HERCULES, whilst focusing its work on Europe, also receives students from other continents (agreement with Taiwan, for instance) or helps to organise schools with the same scheme at other facilities (Latin-American LNLS-HERCULES in Brazil).

HERCULES’ 20th anniversary will celebrate its past achievements but will be an event turned towards the future, with an introduction by Ada YONATH (Nobel Prize 2009 and HERCULES lecturer for many years), with talks by Directors of the new X-ray (X-FEL, Massimo ALTARELLI) neutron (ESS–Lund, Colin CARLILE), or upgraded sources and the new scientific opportunities they offer (review by Bill STIRLING), and with contributions on new results and trends of former HERCULES participants, now leaders in their fields. In this perspective, the HERCULES courses will continue incorporating the evolution of science and techniques in order to provide the best training to the new generation of scientists using neutrons and X-rays.



ELIZABETH BLACKBURN, UNIVERSITY OF BIRMINGHAM, UNITED KINGDOM:

“The broad knowledge of a whole range of experimental techniques presented in the HERCULES course has been vital in helping me to select the right tool for the problems I have investigated. In addition, the chance to spend time with people in a similar position from all over the world was invaluable.”

Sakura Pascarelli, Scientist, Deputy Head of Electronic Structure and Magnetism Group, European Synchrotron Radiation Facility, Grenoble:

I attended the first Hercules course, in February 1991. I had just started getting involved in synchrotron radiation research at the Frascati National Labs, close to Rome, where my group, headed by Prof. Mobilio, was designing the Italian CRG beamline at the ESRF (GILDA). Being the youngest in the group, I was given the tedious task of checking the performance of all the proposed optical schemes using Ray Tracing methods, and in order to do so I had to quickly learn all I could on synchrotron radiation and X-ray optics. So when I arrived in Grenoble in February 1991 I already had some background knowledge due to the many papers I had been reading on the subject, but I knew almost nothing about the different techniques and applications of SR (except those related to X-ray absorption) and next to nothing on research with neutrons.

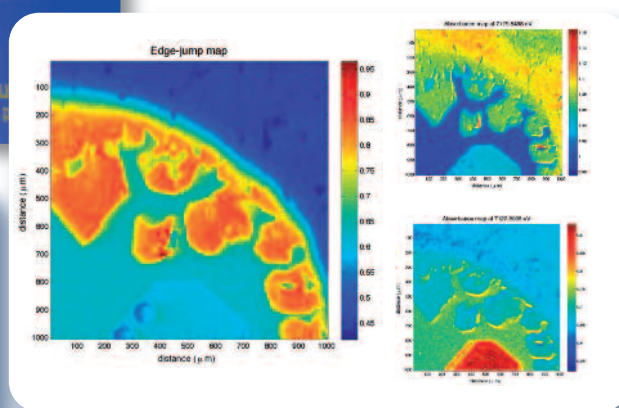
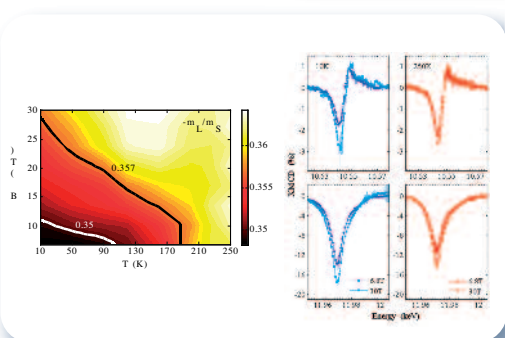
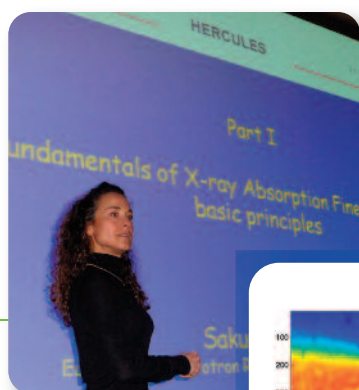
Besides the very high level of the courses offered to us, I think that what made the Hercules course so special to me were the people I met there. First of all, the lecturers. I couldn't believe that I was listening to some of the most famous scientists in the world and that I could discuss with them until all my questions were answered. I already knew most of them from their publications, so I felt a bit intimidated, but somewhat privileged. Then, my classmates. Many of the people I met at the Hercules course that winter continued a career in SR or neutron research. I regularly meet them when I travel to the

different synchrotrons, and it is always fun to remember those "hard times" on the 7th floor of Lycée Mounier. We had a tiny kitchen, so in the evening we had to queue in order to cook. During the school holidays (two weeks in the middle of February), the central heating was switched off and night temperatures dropped to 7°C in the rooms. These apparent difficulties were always taken with good humour, and they helped tighten bonds between us. I must say that life was not all that painful, since during the weekends we often organised car pools to the ski resorts.

I feel that this course will continue to play a major role in the education of young researchers in future years. Successful experimental research, be it with synchrotron radiation or with neutrons, is becoming more and more a matter of being able to establish strong international collaborations between different institutes (universities, other large facilities, etc...). Also, multi-technique approaches are increasingly used, making experiments more and more complex. Hercules opens a window into this world, and provides a platform from which the young researcher is ready to jump into his/her future research career.

Ever since its first edition almost 20 years ago, the Hercules course has continued to maintain the aims it had when it was first launched. I am now a lecturer (what an honour!!) and I am enjoying it a lot. One of the first things I tell my students is that they should take advantage of being together with people from all over the world, to discuss among themselves about their work, but most important... to have fun. This is what makes the precious links for their future careers."

Twenty years on,
from student
to lecturer



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