

Communication and Outreach

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SIDS - Scientific Information and Documentation Service

From many years, the LNF has been interested in and active in communication in the area of scientific education. Throughout the year they provide basic education in physics by means of a vast outreach program for the general public, teachers and students.

The aims of the program are various: “open the laboratories” inviting general public to be part of INFN “scientific world”; to “stimulate” the curiosity on scientific issues; to offer a more complete view of the scientific institutions operating in the area; to transfer scientific knowledge, methodology and technologies of the research; to inform people about the latest developments in physics; to enable people to acquire the knowledge and understanding of INFN research activities.

Most of the activities are organized inside LNF, such as Visits, Scientific Week, Open Days, Physics Lessons, Meetings with authors of scientific books, Concerts.

Special events are dedicated to schools: the Incontri di Fisica - a course for high school teachers and Stages for high school students.

Other activities are organized outside the LNF such as Seminars at school or at the public libraries, European Researchers Night.

These activities are made possible by the enthusiastic involvement of INFN-LNF people: graduate students, postdocs, researchers, engineers and technicians.

1) **Visits** www.lnf.infn.it/edu/visite to LNF are a well established tradition. They consist of a brief historical presentation of the Laboratories and their activities on site and abroad and of a guided tour to the open air museum and to the experimental areas.

The visits are organized for high school students (age: 17-19) and for primary and secondary schools (age: 10-14, Quasar Project). In this last case a special program is foreseen that includes a first meeting with the students at their school to introduce the world of research and some basic concepts of modern physics followed by the visit to the LNF in small groups.

The visits are requested not only by Italian schools, but also by other countries: Denmark, Austria, Czech Republic, Belgium, Germany, Romania, France, Greece, Japan, India, Taiwan, USA.

During 2012 about 5000 people visited the LNF.

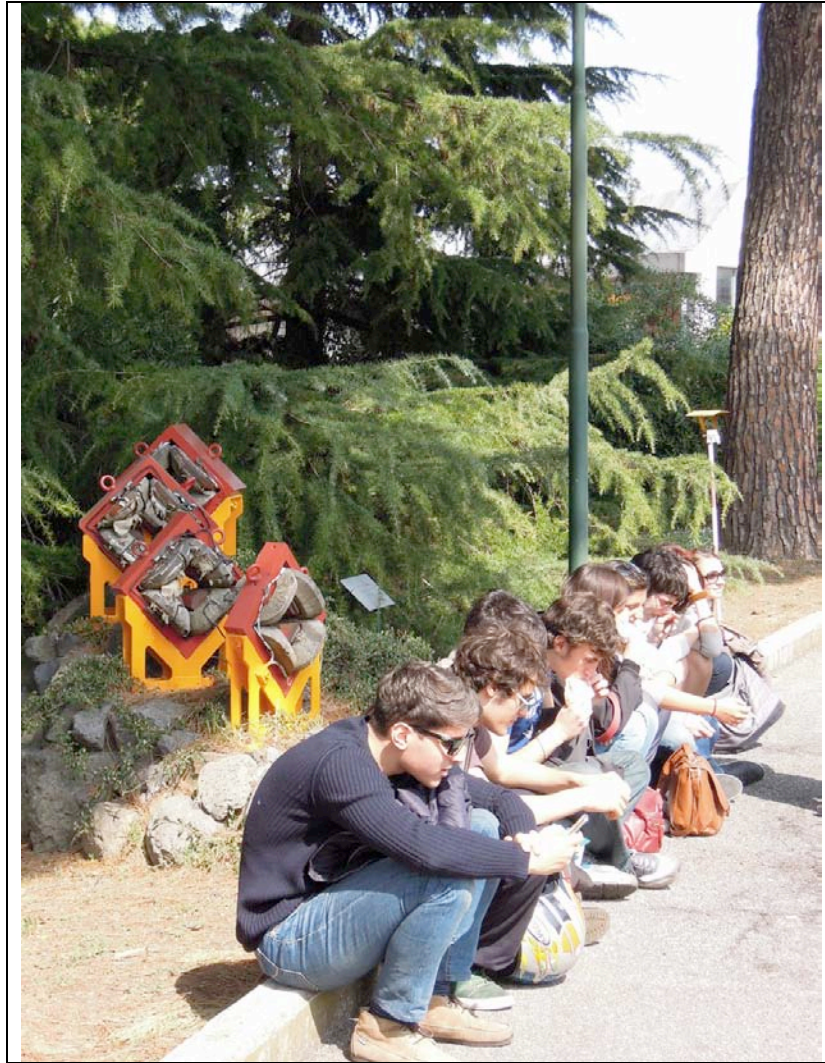
(Scientific Coordinator: D. Babusci and B. Sciascia for the Quasar Project)

2) **Scientific weeks and Open Days** www.lnf.infn.it/edu/settimana/ are organized at LNF in collaboration with the other Research Centres located in the Frascati area, Public Institutions, Cultural Associations, International non-government organizations.

This type of event provides guided tours, conferences, public lectures, scientific videos. Most of the LNF employees are in action to present their research centre, answer questions and care for their guests.

Open Day LNF April 2, 2012

(Care of SIDS-Ufficio Comunicazione ed Educazione Scientifica).



Open Day 2012 (INFN-LNF Photo)

3) **Lessons of Physics** www.lnf.infn.it/media/ are held by world leading scientists in various field of the science. Students and teachers are invited to attend the lessons which are video-recorded. Slides and videos are available on the LNF website to be utilized even for lessons at school.
(Care of O. Ciaffoni, G. Di Giovanni and SIDS-Ufficio Comunicazione ed Educazione Scientifica)

4) **Seminars** www.lnf.infn.it/edu/seminaridivulgativi/ Upon request, LNF researchers give lessons to high school students and general public. A special program is performed together with public Libraries, especially with Frascati one Library. The arguments deal with science and society or they take inspirations from scientific or fiction books and theatre.

- *Teoria della Relatività*, C. Curceanu e A. Clozza, March 16th, 2012, Lic. G. da Catino Poggio Mirteto (RI).
- *La realtà quantistica*, D. Babusci, April 19th, 2012, AIF Sezione Romana;
- *Big Bang, particelle, acceleratori... Dall'importanza della ricerca fondamentale alle opportunità di comunicazione scientifica*, G. Mazzitelli, May 7th, 2012, Lic. Sc. Sulpicio, Veroli (FR);
- *Tracce dall'universo oscuro*, M. Pietroni, October 18th, 2012, LNF Frascati;
- *Energia e sostenibilità*, G. Mazzitelli, October 23th, 2012, Lic. Sc. B. Touschek, Grottaferrata (RM);

- *Fisica delle particelle elementari e il Bosone di Higgs: l'ultima frontiera della fisica moderna*. Collegamento in videoconferenza con il Prof. J. Ellis dal CERN, P. Di Nezza, November 16th, 2012, Lic. Sc. E. Majorana, Isernia;
- *Le costanti fondamentali della natura e la fisica moderna*, E. Nardi, November 17th, 2012, ISIS Malignani, Udine;
- *Alla scoperta dell'universo con LHC*, A. de Rujula, December 7th, 2012 LNF Frascati;
- Presentazione del libro *Psicosi 2012*, Matteo Martini, November 28th, 2012, Lic. Sc. B. Touschek, Grottaferrata (RM);
- *Armonia celeste: dal jazz della meccanica quantistica al rock sulle corde dell'universo*, C. Curceanu, December 19th, 2012, Lic. Sc. B. Touschek, Grottaferrata (RM).

5) **Incontro con l'Autore** www.lnf.infn.it/edu/ica/ LNF organize meeting with authors who present their scientific book to the general public, students, teachers.

Il fisico che visse due volte: i giorni straordinari di Lev Landau genio sovietico, Fabio Toscano intervistato da V. Napolano (Ufficio Comunicazione INFN), October 12th, 2012, LNF Frascati.

6) **European Researchers' Night** <http://www.frascatiscienza.it/> organized by FrascatiScienza. The SIDS is involved organizing guided tours at LNF.

This event is also performed in other European cities to promote the activities of the main research centres at international level. During all day and night are organized: experiments held by the researchers, games for children, visits to major Italian and European research laboratories, science shows, scientific coffees, and so on. These initiatives enable dialogue with researchers and help people to discover science through entertainment.

LNF September 28th, 2012.

Among the activities organized inside LNF two particular events are performed in the education program: Incontri di Fisica and Stages.

7) **Incontri di Fisica** www.lnf.infn.it/edu/incontri/ is organized since 2001. The event is a three-days course for high school teachers and people involved in scientific research dissemination. About 200 from all over Italy, attend this event each year. The goal is to stimulate teachers' professional training and provide an occasion for interactive and hands-on contact with the latest developments in physics.

The program consists of plenary lessons, presentation of INFN-LNF activities, visits to LNF experimental area and discussion. The peculiarity of this course is the second day entirely dedicated to the special participation in working groups (8 hours laboratory).

The working groups concern INFN research topics (nuclear and subnuclear physics, astroparticle physics and technology). They are conducted by INFN researchers, engineers and technicians and they are held in the various experimental LNF laboratories.

Each working group consists of a theoretical lesson, hands-on activity or data analysis of a real experiment. In this way, teachers have a direct contact with researchers and they can use typical experimental instrumentation employed in contemporary physics.

The lessons are given by speakers from INFN or from other Institutions such as Universities, or other Laboratories like CERN. They concern arguments on physics or other scientific matters, application of physics and more general topics.

If we only think that each teacher is in contact with about 120-130 students and their families, Incontri di Fisica represents an important occasion for dissemination of physics.

Moreover, by informing them on cutting-edge science, it is possible to introduce modern and contemporary physics in school programs. Teachers can stay in contact with INFN researchers also after the course.

The evaluation of the course is performed by a questionnaire. The analysis is very useful for the study of future programs.

Teachers, authorized by the Minister of Education, receive a certificate of participation.

All the programs are published on LNF web site (lessons, video, photo).

LNF October 10th -12th, 2012.

(Organizing Committee: D. Babusci, R. Centioni, C. Curceanu (Chair), P. Di Nezza, U. Dosselli, R. Fabrianesi (AIF), C. Gatti, G. Venanzoni – Secretariat: E. Santinelli, M. Scudieri)

8) **Stages for students** www.lnf.infn.it/edu/stagelnf have been organized since 2000 for high school students (age 18-19). Students are selected by their teachers on the basis of their curriculum but especially on the basis of their interest and motivation.

Tutors are INFN staff: researchers, engineers and technicians. They prepare the program with the following goals:

- to offer a special experience in an important research Institute;
- to transfer scientific knowledge, methodology and high level research technology;
- to present INFN-LNF experimental activities;
- to promote the teaching of modern and contemporary physics;
- to contact schools from all over Italy and abroad;
- for student orientation (university or career).

In a direct contact with their tutors (1 tutor / 2 students), students are involved in theoretical lessons and practical operations. They acquire knowledge and understanding of INFN research activities in an interactive modality. Curiosity, investigation, hands-on learning, working in a team are the key words of this experience.

During their stay at LNF, students are like staff members, working from 8 a.m. to 4 p.m. and they participate in the social events (e.g. lunch at the LNF canteen). At their arrival students receive educational material and general information about INFN-LNF and they visit the experimental area.

Various types of stages in different periods of the year are organized.



Stages Estivi e Residenziali 2012 (INFN-LNF Photo)

- **The Stage Masterclass** is organized on behalf of IPPOG Masterclasses International Project. It lasts 4 full days, usually during February. Students, in a unique group of 34, follow lessons on modern physics and analyze data from ALICE experiment at CERN.

LNF January 30th, February 2nd, 2012

(Scientific Coordinators: F. Bossi, D. Domenici (Resp), P. Di Nezza)

- **The International Masterclass** is open for 40 students in last year(s) of high school/college coming from all European countries. It is organized in lecture on Modern Physics and its applications in Society, and in activities to be performed in laboratories. The participants have, as well, the opportunity to visit the main experiments and accelerating facilities of the LNF. The official language is English. LNF, LNF January 30th, February 2nd, 2012
(Scientific Coordinator: C. Curceanu);

- **The Summer Stages** are organized in June, at the end of the school year, and last 10 days. Summer Stages – 125 students - LNF June 11th -22nd, 2012.
(Scientific Coordinator: C. Bloise)

The theoretical plenary lessons are scheduled during the morning. Then, divided in small groups, the students participate in various experimental activities.

At the end of the stages, students make a report of their experience. This report is presented in the LNF main auditorium during a ceremony in the presence of families, teachers and other students. Each student receives a certificate of participation and evaluates the experience of stages by filling out a questionnaire.

Tutors consider the experience of Stage very positively. They think it can also be replicated in other INFN laboratories or Research Centres.

The project phase of the stage program is very important. Tutors take into account that students belong to various schools so their preparation may not be the same. They give particular importance to the use of a scientific/technical language appropriate to the educational preparation of students. Since the scientific language is very peculiar, tutors recommend that the concepts not included in school programs are explained.

Surely, it is extremely important to keep in contact with school teachers, in order to better understand the preparation of students. Moreover tutors take particular care of the experimental activities which represent the real different pedagogical approaches to the scientific studies.

The Stages are a very special occasion for the students. They can work and study in a big research centre and meet students from other schools. Particularly fascinating is the use of sophisticated instrumentation certainly not available in school laboratories.

The stages offer the opportunity to learn about physics but also computing and electronics and to be oriented for the university choice or career.

The interaction with the scientists is very stimulating as well as the knowledge of their work and their life. Meeting researchers of different ages, nationalities and experience, the students can understand better the role of the researcher, too often simply considered only as a person who works into a laboratory, far from the real world. Students are curious to ask questions about scientists' experiences and their reasons for becoming a physicist, their hobbies and passions.

Teachers note that at the end of the stage students are well oriented in a work environment different from a school one, having had the opportunity to integrate their knowledge on scientific matters. They say that students learn that the research is an enthusiastic adventure made by passion and study realized by working in team on the solution of problems. Concerning science and scientists students appreciate: the importance of the scientific collaboration, being passionate and tenacious to achieve the goals, the effort needed in the study, curiosity, and the importance of making sacrifices.

Each school, participating in the LNF Stage program, includes it into their own Annual Training Project. This also means that schools often organize an event during which students make a report on the stage experience to their classmates and parents. From this point of view, Stages become a special initiative of diffusion of the scientific culture with a big impact on: families, other students, teachers.

Regarding the university choice students who participate in the LNF stages are oriented to scientific studies in particular Engineering and Physics.

The participation in the stage program has increased over these last 10 years: since 2000, 1235 students attended the stages. In the year 2000, LNF hosted 12 students from only one local school while in the year 2012, 206 students from 72 different schools all over Italy came to Frascati.

Tab. 1

Year	Students	Females	Males	School	INFN Tutors
2000	12	1	11	1	7
2001	14	3	11	1	14
2002	57	15	42	8	50
2003	56	11	45	14	22
2004	114	34	80	21	25
2005	154	42	112	29	56
2006	161	48	113	46	58
2007	163	45	118	51	55
2008	161	47	114	51	63
2009	177	40	137	54	67
2010	166	36	130	60	60
2011	184	61	184	60	70
2012	206	59	147	72	59

The LNF monitor the success of the various initiatives proposed mostly through questionnaires (each one specific of the event type) and also keep track of the “history” using dedicated databases by which it is possible to perform simple statistical analysis. The questionnaires are a valid instrument to know students’ evaluation of the stages: general organization, lessons contents and exposition by the tutors, working groups, their personal considerations about the modality and the opportunity of the stages and their idea concerning university or career choice.

9) Web page

On the LNF web site are reported all the events organized: tutors lessons, videos, photos, reports that, together with the educational material and the general information about the LNF research activities, allow general public and schools to the knowledge of modern physics and to INFN-LNF research so to bridge the gap from science and society.

Tab. 2 - Number of participants to LNF events during 2012

EVENTS 2010	PARTICIPANTS
Visits	5000
Scientific Week and Open Days	550
Seminars (at LNF and outside)	1935
European Researchers’ Night	1450
Incontri di Fisica for high school teachers	213
Stages for high school students	206

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