

COMMUNICATION AND OUTREACH

S. Arnone, S. Bertelli (Resp.), D. Bifaretti, G. Di Giovanni, P. Di Nezza (Ref. CC3M),
C. Federici, A. Luciani (Bors.), C.P. Maglione (Art.15), A. Mecozzi,
S. Reda (Art.15), E. Santinelli

The Education and Public Outreach Service (EPOS) of LNF fosters the scientific literacy through a wide programme of initiatives addressed to students, teachers and general public to bridge science and society, either inside or outside the LNF site. The main mission is to engage the public with science, inform about the latest issues in research conducted by INFN-LNF and the collaborations, enhance the valorization of scientific heritage and building network with the society.

The Service includes many areas: communications (web and social), press and media relations, multimedia, graphics and photos, public events and visits, student and teacher programmes.

1 Student programme

EPOS-LNF offers different types of activities to raise awareness, curiosity and passion towards science and its applications to society among young people. In some of these initiatives pupils work together with LNF researchers in laboratory-based activities, having the chance to experience life inside a research centre. In particular for High School students these events represent an unique opportunity that could help in the choice of higher education or career. The activities can be recognized in terms of work-related learning project.

1.1 [EDU]kids

[Edu]kids is the science education programme dedicated to pupils attending the Primary and Lower Secondary Schools that aims to increase the interest of young generation towards the fascinating world of Particle Physics. In 2019 LNF hosted 800 students who participated in the core project "Io dico l'Universo" that includes: guided tour of LNF, meeting a researcher either at LNF or at schools and public libraries, as well as specific activities designed for the young public during the openday.

lnf.infn.it/edu/kids/

1.2 Matinées di scienza - Science Matinées

The event is dedicated to High School students attending the last year and consists in seven lectures on Modern Physics including experiment-based demonstrations. In 2019 these lectures were proposed to 350 students coming from all over Italy, from January to May. Each lesson lasts 3 hours and students received a certificate of attendance. The topics of the lectures are: bionanotechnologies, superconductivity, cosmic rays and particle accelerators.

edu.lnf.infn.it/matinees-di-scienza-2019/

1.3 International Day of Women and Girls in Science

For the International Day of Women and Girls in Science, 11th of February, established by the UN General Assembly to promote STEM careers (Science, Technology, Engineering and Mathematics), LNF organized a special "Matinée di Scienza" (Science Matinée) addressed to 200 High School students in their last years in which women in science talked about their experiences and careers.

edu.lnf.infn.it/international-day-of-women-and-girls-in-science-2019/

1.4 IPPOG - International Masterclass

This one-week internship (11-15 March) is organized in collaboration with the IPPOG Masterclasses International Project. It lasts 40 hours in which 38 students attended lectures on Modern Physics and analyzed the LHCb experiment (CERN) data. The results were discussed in a dedicated video-conference together with students participating in other countries.

edu.lnf.infn.it/ippog-international-masterclass-2019/

1.5 INSPYRE INternational School on modern PhYsics and REsearch

INSPYRE - International School on modern PhYsics and REsearch, Challenges in Quantum Physics and Technologies is a course dedicated to the latest issues of Modern Physics addressed to students in their last two years of High School. The School lasts one week and its structured in lectures, laboratory-based activities and visits to the main LNF experimental sites. The lectures and the working groups are given by researchers and professors either affiliated with LNF or other INFN sections and Universities. In 2019 the School hosted 90 students coming from many Countries: Argentina, France, Germany, United Kingdom, Ireland, Norway, Portugal, Spain, Turkey and Italy. English is the official language of the school.

edu.lnf.infn.it/inspyre-2019/



Figure 1: *This picture displays the group of 90 students during INSPYRE 2019.*

1.6 Summer School

The Summer internship is open to students who attended their fourth year in High School and includes lectures and hands-on activities. There are eight educational plans, seven of them Quantum Mechanics, Superconductivity, Cosmic Rays, Coding -Sir Isaac Newton and the digital apple, Mechanics - Thermal engineering, Library and Publications, Communication of Science last five days (10-14 June), whereas the Computer Science one lasts ten days (10-21 June). In 2019, 80 students participated in this School.

edu.lnf.infn.it/summer-school-2019

1.7 Studenti in staff - Students in staff

During 2019, 71 students worked alongside the LNF staff. Two students were involved in the production of a part of the Inner Tracking System of the ALICE experiment, in the cleaning room ASTRA, two students took part to the software development activities in the Computing Service and 67 students participated in the organization of the outreach events OpenLabs and European Researchers' Night.

edu.lnf.infn.it/studenti-in-staff-2019/

1.8 Researchers @School

LNF researchers held several lectures in Primary and Secondary Schools and Universities. The topic of these lectures deal with General Physics and Modern Physics. In some of these lectures laboratory-based activities are presented and students have the chance to carry out hands-on experiments. 3343 students attended these lectures in 2019.

edu.lnf.infn.it/archivio-seminari-divulgativi-2019/

2 Teacher programme

This programme consists in two courses addressed to Science Teachers who want to deepen their knowledge in the fields of Physics and Technology.

2.1 Incontri di Fisica Moderna - Modern Physics Meetings

This two-day course (25-26 March 2019) is dedicated to the experimental aspect of teaching Modern Physics. This course consists of an introductory part and hands-on sessions in which teachers will carry out three different experiments. In the first part the crisis of Classical Mechanics and the evolution of Modern Physics are presented. The laboratory-based activities proposed are:

- Franck-Hertz experiment
- Atomic Spectra
- Electron Physics
- Millikan experiment
- Stefan-Boltzmann law
- Planck constant determination
- Electron spin resonance and nuclear magnetic resonance

This course was attended by 18 teachers.

edu.lnf.infn.it/idfm-incontri-di-fisica-moderna-2019-modulo-esperimenti/



Figure 2: *This photo was taken during Physics Meetings 2019 and shows four teachers during the working group "Innovative photovoltaic devices".*

2.2 Incontri di Fisica - Physics Meetings

Physics Meetings is a refresher course on Modern Physics. The course lasts three days (9-11 October 2019). The teachers enrolled had the chance to choose among two different modalities:

- IDF course 2.0 (e-learning + presence at LNF)
- IDF course (presence at LNF)

The goal is to stimulate the teachers professional training and provide an occasion for interactive and hands-on participation in the latest developments in Physics. The online course includes 6 topics: Pedagogy; Didactic Laboratory; Classical Physics Multimedia Laboratory; Physics Laboratory for schools; Modern Physics. The program proposed in presence at LNF consists of a plenary session, presentations of INFN-LNF activities, visits to LNF experimental area and discussions. The peculiarity of this course is represented by the working group (14 in 2019 edition) focused on a theoretical lesson followed by hands-on activity. Teachers have a direct contact with researchers and learn how to use the typical experimental instrumentation employed in research. Also in this case, lectures and working groups are given by researchers and professors either affiliated with LNF or other INFN sections and Universities. Teachers, authorized by the Minister of Education, received a certificate of attendance. In the case of IDF course 2.0 in blended modality, the University Marconi, partner of this event, also 6 University credits were released. All the programs are published on the LNF web site (lessons, videos, photos). There were 185 participants in 2019.

lnf.infn.it/edu/incontri/2019/index.php

3 General public

This programme consists of public seminars given by LNF researchers, guided tours and open days addressed to people passionate about science and people who want to discover science and the places in which it is investigated.



Figure 3: *The gift of mass installation inside the Bruno Touschek Visitor Centre is displayed.*

3.1 Bruno Touschek Visitor Centre and Guided Tours

During the year it is possible to visit the Bruno Touschek Visitor Centre, the outreach hub dedicated to the history of LNF. The visits are guided by LNF researchers who present the exhibition and interact with people answering their questions. This visit can be included inside a longer itinerary which includes a stage dedicated to the Dafne control room and a stage at KLOE experimental site. 1811 people visited LNF in 2019.

visitorcentre.lnf.infn.it

3.2 Frascati in Pink- Science stage - Waiting for *Il Giro d'Italia*

On April 12, LNF joined "Frascati in Pink - Science stage" a special public event organized together with the research centres of the Frascati area in the framework of Il Giro d'Italia, that in 2019 stopped in Frascati. LNF proposed guided tours to the main experimental apparatus and the Visitor Centre. 220 people visited LNF in this event.

3.3 OpenLabs - Moving into Science

OpenLabs is the main open day of LNF. The programme includes guided tours, public lectures, exhibitions, laboratory-based activities, scientific demonstrations and a very rich program for kids. Many LNF employees were in action to present their research field, answer questions and engage their guests with science. 2500 people visited the LNF on Saturday May 18th, 2019.

lnf.infn.it/edu/openlabs/2019/

3.4 European Researchers' Night

The European Researchers' Night is an initiative created in 2005 by the European Union which aims at promoting valuable occasions of meeting between science and society in enjoyable and

bracing contexts. As partner of the ScienzaInsieme association, the LNF took part to the 2019 European project ERN-Apulia in the framework of the Marie Skłodowska Curie actions of Horizon 2020. For this open day, LNF proposed a series of guided tours of the experimental sites and the Bruno Touschek Visitor Centre, special activities for kids, science demonstrations and the closing event "Dinner with researchers" in which researchers met the public and talked about science during dinner served at LNF canteen. This year the event was held in September 27th with a presence of 720 visitors.

lnf.infn.it/notte-europea-dei-ricercatori-2019-lnf/
edu.lnf.infn.it/la-scienza-per-i-bambini-ai-lnf/

3.5 Public seminars

LNF researchers gave several lectures either at LNF site or in public places like libraries. 300 people took part to these events.

3.6 AccendiScienza - e-learning for science dissemination

AccendiScienza is a tool for e-learning and scientific culture diffusion. The platform, financed by MIUR (Ministry of Education, Universities and Research) has been completed thanks to the collaboration with Consorzio GARR and University Marconi. Created to collect and freely make available lessons and seminars held at LNF, this web-portal contains four sections dedicated to its different targets: high school teachers, students, general public, young people. The main goal of the portal is to enhance and give more extensiveness to the activities organized every year by the Laboratory here in Frascati by enabling remote participation too. In addition, it will be a valuable support to traditional scientific teaching and education.

Videos : 179

Users : 1010

Visualisations : 10331

accendisienza.lnf.infn.it

4 Communications

The Communications office aims to create and distribute informational contents concerning the ultimate issues related to LNF experiments and collaborations, moreover it enhances the valorization of LNF scientific heritage. The principal communication activities are on the website and on socials.

4.1 Web Editorial board

The LNF Web Editorial board role is to improve the development of web content in order to keep the website constantly up to date. The Editorial Board is made of representatives of all the LNF divisions, services and the Director and provides for the collection, editing and publication of the various news, dissemination articles and other texts and communications addressed both to the general public and the LNF personnel.

cdrweb.lnf.infn.it

4.2 Social media

LNF fosters public engagement with science via social media and is currently active on Facebook, Twitter, Instagram and YouTube.

Facebook @lnf.infn.it

Twitter @inf_nfn
Instagram @lnf_infn
YouTube [youtube.com/user/INFNLNF](https://www.youtube.com/user/INFNLNF)

5 List of Conference Talks in Year 2019

1. L. De Paolis, S. Bertelli, D. Bifaretti, R. Centioni, C. Curceanu, INSPYRE - International School on modern PhYsics and Research, 105^o Congresso Nazionale Società Italiana della Fisica 2019 , L'Aquila, Italy.
2. S. Bertelli, The Frascati National Laboratory Visitor Centre: a journey through the history of particle physics, XXXIX Congresso della Società Italiana di Storici della Fisica e dell'Astronomia, Pisa, Italy.

6 Publications

S. Bertelli *et al.*, "Meaningful student involvement. Students as researchers: a physics laboratory experience from space to microworld", in Journal of Physics: Conference Series, Volume 1286, GIREP-ICPE-EPEC 2017 Conference 3-7 July 2017, Dublin, Ireland, (2019).

7 Acknowledgements

Outreach activities are made possible by the enthusiastic involvement of the INFN-LNF personnel: graduate students, postdocs, researchers, engineers, technicians and administration staff. Many thanks to the LNF Director and the Heads of the Accelerator, Research and Technical Divisions. Special thanks to all LNF Tutor and Services.

Table 1: *Student programme overview*

| Event | Number of participants |
|---------------------|-------------------------------|
| EDUkids | 800 |
| Matinée di scienza | 550 |
| IPPOG Masterclass | 38 |
| INSPYRE | 90 |
| Summer School | 80 |
| Researchers @school | 3343 |
| Studenti in staff | 71 |

Table 2: *Teacher programme overview*

| Event | Number of participants |
|-------------------------|-------------------------------|
| Physics Meetings | 185 |
| Modern Physics Meetings | 18 |

Table 3: *General public programme overview*

| Event | Number of participants |
|----------------------------------|-------------------------------|
| Public lectures | 300 |
| Frascati in pink - Science stage | 220 |
| OpenLabs | 2500 |
| European Researchers' Night | 720 |
| Guided tours - Visitor Centre | 1811 |