Future research infrastructures for all fields of science

L. Palumbo 29-07-2015 http://www.primapagina.sif.it/article/303

The workshop **"*Future Research Infrastructures: Challenges and Opportunities*"** (already announced in SIF Prima Pagina a few months ago) was hosted from July 8th to 11th 2015 at Varenna, Italy. The workshop was part of the series of the International School of Physics "Enrico Fermi" organized by the Italian Physical Society.

The workshop directors were Sergio Bertoluci (CERN) and Luigi Palumbo (Università di Roma Sapienza). It was unprecedented for a three-days workshop to be held in the framework of the Enrico Fermi School which so far only included summer courses of longer duration, dedicated to PhD students and post-docs. However the relevance of the topic of the workshop and the excellence of its speakers justified such a choice!

The purpose of the workshop was to bring together the communities of scientists working on and with particle accelerators in order to cast an eye on the current developments and on the perspectives of future research infrastructures, discussing new ideas, technical challenges and scientific opportunities.

The interest and the expectation of the international scientific community in such infrastructures have not slowed down, and the major world research laboratories have planned or are envisaging the construction of new accelerators in order to foster the progress of science in many fields, from high-energy physics, to nuclear physics, material science, biology, medicine, energy, cultural heritage and environment.

The programme and the list of speakers of the workshop, was established with the help of an International Scientific Advisory Committee[(1)]. Talks on science and applications with accelerators were interleaved with talks on the development of future accelerators, with the scope of presenting the future horizon of science in many fields and the need of new scientific instrumentation.

Thursday July 9th was devoted to the perspectives in high-energy physics after the discovery of the Higgs boson (M. Mangano, CERN). Three consecutive talks described the recent developments and ongoing studies on the High-Luminosity LHC (L. Rossi, CERN), the International Linear Collider (S. Komamiya, University of Tokyo), and the Future (electron/proton) Circular Collider (F. Zimmermann, CERN). The Gamma Beam Source, ELI-NP-GBS project, in construction at Magurele, Romania (C. A. Ur, ELI-NP, RO), and the future multifold perspectives of such radiation sources (L. Serafini, INFN) have shed some light on the use of high-energy high-intensity gamma radiation beam in photo-nuclear physics and as exotic colliders. Of high interest was the talk about the

European Spallation Source (R. Garoby, ESS) in construction at Lund (SE). In the last part of the day there was a dedicated session regarding the emerging science of coherent high energy X-rays (C. Jacobsen, ANL), followed by the scientific perspectives of X-FEL radiation (C. Bressler, Europoean XFEL) and by FEL application in multicolor spectroscopy (C. Mastrovecchio, Elettra).

Friday July 10th started with two talks presenting the status of the development of the European XFEL source (G. Geloni, European XFEL), and the SwissFEL source (C. Milne, PSI). Then, a sequence of three talks on hadron therapy (S. Rossi, CNAO), bio-medical applications (A. Bravin, ESRF), cultural heritage (M. Cotte, ESRF) draw the attention on the relevant applications of accelerators.

The future of the synchrotron radiation sources was discussed by two talks on the "diffraction limited storage ring" frontier (M. Borland, ANL) and its implementation in the ESRF ring upgrade (P. Raimondi, ESRF). A particular interesting case of application was the advanced X-ray techniques at the Shanghai SSRF in the catalysis research developed to contrast the serious enviromental issues of CO_2 emission in China (J. Q. Wang, SINAP). The session finished with the presentation of the future perspectives of the Swiss Light Source (A. Streun, PSI), and the Elettra and Fermi sources at Trieste (A. Fabris, Elettra).

Saturday July 11th, the first talk concerned the laser plasma wave acceleration technique with the latest promising experimental results (C. Schroeder, LBL), then the future scenarios in USA (J. B. Rosenzweig, UCLA), China (Z. Zhao, SINAP) and Korea (I. S. Ko, PAL) completed the workshop talks.

Finally the workshop ended with a stimulating panel discussion on ***"The need of International World Infrastructures"*** moderated by Luisa Cifarelli (SIF). The contributions by Sergio Bertolucci (CERN), Fernando Ferroni (INFN), Amy Flatten (APS), Michael Lubell (APS), Zhentang Zhao (SINAP), Sachio Komamiya (Tokyo University), Wolfgang Sandner (ELI-DC, EU), Corrado Spinella (CNR) were focussed on the future developments and international collaboration policies in the world scenario in USA, Europe, and Asia. It has been agreed to publish in the proceedings of the workshop a "summary note" that would keep track of this dicussion where a number of major problems concerning the future of large-infrastructure-based research were tackled.

The talks and the final panel were well appreciated by more than 75 participants in the beautiful scenario of Villa Monastero on the Como lake.

(1) Rafael Abela (SwissFEL), Massimo Altarelli (European XFEL), Pierluigi Arduini (CERN), Michael Benedikt (CERN), Moohyun Cho (PAL), Fernando Ferroni (INFN), Andrea Ghigo (INFN), Chi Chang Kao (SLAC), Sven Landelius (ESS), Wim Leemans (LBL), Claudio Pellegrini (UCLA/SLAC), Leonid Rivkin (PSI), Carlo Rizzuto (CERIC), Wolfgand Sandner (ELI), Francesco Sette (ESRF), Masanori Yamauchi (KEK), Linda Young (Argonne), Victor Zamfir (IFIN-HH), Zhentang Zhao (SINAP).