

PREFACE
**THE PHYSICS AND APPLICATIONS OF HIGH
BRIGHTNESS ELECTRON BEAMS**

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The ICFA-sponsored (ICFA Panel on Beam Dynamics, ICFA Panel on Advanced Accelerators) workshop on "The Physics and Applications of High Brightness Electron Beams" was held on October 9-14, 2005, in Erice, Sicily, Italy, at the Ettore Majorana Foundation and Center for Scientific Culture (EMFCSC). It was the 46th Workshop of the Series "INFN Eloisatron Project".

We had a fine international representation from the fields of intense electron sources, free-electron lasers, advanced accelerators, ultra-fast laser-plasma, beam-plasma and laser-beam physics, well according to the tradition of this workshop series, built up on the heritage coming from the merging of two ICFA-sponsored series, one on high brightness beams, and the other on free-electron laser physics. The most recent high brightness beam workshop was entitled "The Physics of High Brightness Beams", endorsed by the ICFA Panel on Novel and Advanced Accelerators, and was held in Los Angeles in November 1999. It concentrated on the emerging physics of intense beam systems, and was notable for the exciting synthesis of methods and concepts between electron beam and ion beams. On applications side, the final installment "Arcidosso Series" of workshops, held in Sept. 2001, was entitled "The Physics of, and Physics With,

the X-ray Free-Electron Laser". This title foreshadows the merging of discussions between the physics of the enabling device (in this case the FEL), with the examination of the physics of the enabled applications. The first workshop merging the two series was held in July 2002 in Sardinia (Italy): the proceedings are available from World Scientific*.

As for the previous one, the mission of this workshop was stated by the increasingly critical role that high brightness electron beams are playing in two frontier fields: radiation generation methods and advanced acceleration schemes. Such state-of-the-art radiation production methods include various types of free-electron lasers, as well as inverse Compton scattering (ICS) of intense lasers, having diverse approaches to creating high peak and average power light sources. As they are capable of harder photon production, ICS sources are candidates not only for X-ray sources, but also high-energy physics applications. Likewise, high brightness beams are at the center of future accelerator schemes, e.g. based on high gradient wakefields, and electron cooling. Indeed, possibilities exist to create unique light sources based on advanced acceleration schemes, just as intense light sources enable advanced accelerator research. The goal of this workshop is to provide a comparative study of the generation, manipulating, modeling and measuring of high brightness electron beams, and the underlying methods linking the physics of these beam systems to the physics of advanced applications.

The workshop would not have been a success without its working group leaders (M. Ferrario, G. Travish, L. Giannessi, M. Uesaka) and their scientific secretaries (D. Filippetto, G. Gatti, A. Schiavi, A. Rossi).

Further debts are owed to the workshop local organization (Rossana Centioni, Silvia Giromini and Mary Jo Robertson), the EMFCSC local team (Fiorella Ruggiu and Pino Aceto), the program committee (C. Pellegrini, W. Barletta, M. Ferrario, P. Emma, D. Dowell, L. Giannessi, J. Murphy, P. O'Shea, J. Rossbach, T. Garvey, M. Eriksson, G. D'Auria, D. Giulietti), and the organizing committee (L. Palumbo, J. Rosenzweig, L. Serafini, G. Krafft, H. Braun, K-J. Kim, S. Bertolucci, I. Ben Zvi, A. Renieri, S. Milton, S. Chattopadhyay, J. Galayda, M. Poole, C. Bocchetta, K. Floettmann, P. Krejcik).

But it's certainly with Prof. A. Zichichi, President of the Ettore Majorana Foundation and Center for Scientific Culture, that we are mostly indebted: thanks to his kind invitation to join the "INFN Eloisatron Project" workshop series, all our participants could enjoy a unique combination of a fascinating land to visit, Sicily, an enchanting town to live, Erice, and a world-wide famous Center of Science and Culture, EMFCSC, to host the workshop activities.

Sicily, the largest island in the Mediterranean sea, displays spots of extreme nature, made of fire and volcanos, as well as marvellous beaches and sea landscapes. Its history is full of culture and merging civilizations, from

* "The Physics and Applications of of High Brightness Electron Beams", Ed. J.B. Rosenzweig, L. Serafini and Gil Travish (World Scientific, Singapore, 2003).

Phoenicians to Greeks, from Romans to Normans: a fusion whose the village of Erice is one of the best example. It is in the context of such a poetic and inspiring environment that EMFCSC developed through the last 43 years an impressive amount of scientific culture, making a deep impact within the world scientific community.

We hope that these proceedings give some flavor of the workshop plenary presentations and the discussions within the working groups, and also that they provide a unique reference to the status of the relevant research fields as well as their development into the future.

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September 2006