



EUROPEAN SCHOOL OF ANTENNAS (ESoA)

DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF ELECTROMAGNETICS

September 21-25, 2015 Torino, Italy



Co-organized by:

COST EMF-MED (Action BM1309)



Course coordinators:

Prof. Ovidio M. Bucci, Università di Napoli Federico II
Prof. Giuseppe Vecchi, Politecnico di Torino and ISMB



Sponsorships:



Course Motivation

Clinical and diagnostics applications of electromagnetic (EM) fields are rapidly increasing; research and technology development in this multi-cultural field extends beyond the well-known (and very important) issue of health protection from EM fields.

EM fields are already part of present-day clinical applications, although this is not widely known in the EM community. RF minimally-invasive surgery has drastically changed surgery rooms; Magnetic Resonance Imaging (MRI) stands as the most successful exploitation of EM interaction with biological systems, but a wide range of new applications are emerging in health care fields. They are as different as Microwave Imaging, EM Hyperthermia, monitoring of vital functions, remote localization and/or control of miniature implants or surgery equipments. Moreover, the advent of nanotechnologies, can open completely new scenarios, including remote control of nanomachines and biological processes.

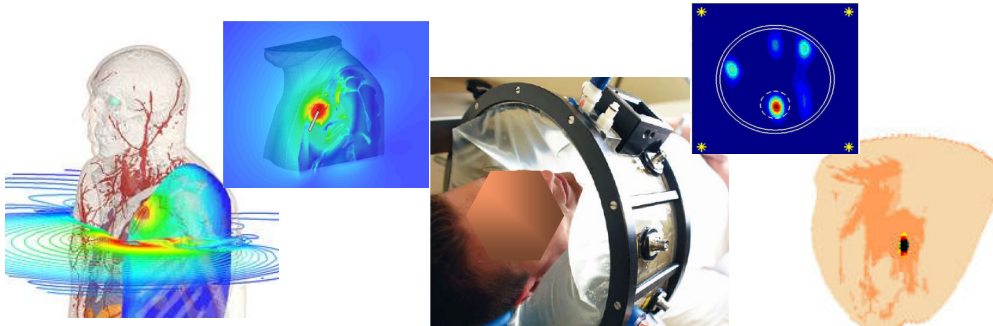
This evolution can disclose a wide range of new opportunities to Antenna and Electromagnetic engineers and researchers; research and professional work in this field requires meeting the challenges posed by well defined technical problems, as well as the ability of appreciating clinical needs and translating them into technical problems.

Course Aim

The Course aims at introducing this new and interdisciplinary area into the Antenna (and Electromagnetic) Community, giving the ability to understand the issues and challenges of medical applications of electromagnetic fields. It is primarily conceived for Doctoral students and researchers with an engineering or physics background.

After an introduction to Bioelectromagnetism, with particular attention to the safety aspects, the main current diagnostic and therapeutic applications of EM fields will be presented. The challenges posed by these applications to the electromagnetic engineer will be presented and discussed, emphasizing their multi-physics nature and the constraints which must be faced when dealing with medical applications. Selected emerging applications will be considered in more detail, and some foreseen developments will be presented. Guided numerical simulations and experimental demonstrations are planned as part of the course.

In this cross-disciplinary course, instructors will be from EM- and biomedical engineering, biology, and clinical fields. A special focus will be on EMF for cancer treatment; clinical and system aspects of EM-based hyperthermia will be discussed by **Prof. Gerard C. van Rhoon**, Erasmus MC Cancer Institute, Dept. Radiation Oncology, Head Hyperthermia Unit, Rotterdam, The Netherlands; and: President European Society for Hyperthermic Oncology, and member, NARF.





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Course Structure

Course Topics	
Motivation, rationale and roadmap Review of applicable electromagnetics and multi-physics Applicable low-frequency and wave-electromagnetics Electromagnetic characterization of biological tissues Basics of non-invasive detection and imaging Bio-heat equation and Thermal effects Introduction to electrophysiology A Biology primer (review of cell biology; relevant physiology) Cell response to direct stimulation Review of known effects of EM fields (non-thermal, non-direct stimulation)	Regulatory aspects Radio-protection legislation (exposure and SAR) Present clinical applications MRI: general working principles; EM challenges and issues Electrosurgery Magneto- and Electro-magneto therapy Hyperthermia (in Radiation Oncology) Emerging applications and future trends EM tomography/diagnostics Neuro-imaging Nano-inspired applications Short-pulse therapy
Guided examples of EM simulation in biomed	Guided visit to MRI systems

Course lecturers

Prof. G. van Rhoon, Erasmus
MC Cancer Institute
(The Netherlands)

Prof. O.M. Bucci, UniNa (Italy)
Prof. F.P. Andriulli, Inst. Mines-Telecom (France)
Dr. L. Crocco, IREA-CNR (Italy)

Prof. F. Molinari, Polito (Italy)
Dr. M.R. Scarfi, IREA-CNR (Italy);
Prof. G. Vecchi, Polito (Italy)

Course location

Politecnico di Torino, Torino, Italy - September 21-15, 2015



Registration fee: 440€ for Universities and non-profit Research Institutions, 880€ for business companies

Several grants are available for selected PhD candidates; see the webpage for info

Credits: PhD students 3 ECTS

For registration, grants, and any other course details please visit:

http://www.antennasvce.org/Community/Education/Courses?id_folder=582

Please write to giuseppe.vecchi@polito.it for detailed/further information