



«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE  
TO PAY A PERMANENT TRIBUTE TO GALILEO GALILEI, FOUNDER OF MODERN SCIENCE  
AND TO ENRICO FERMI, THE "ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES



# INTERNATIONAL SCHOOL OF FUSION REACTOR TECHNOLOGY

## 11th Course: ENERGY CONVERSION SYSTEMS IN TOKAMAK REACTORS

ERICE-SICILY: 9 – 15 SEPTEMBER 2007

Sponsored by the: • Italian Ministry of University and Research • Sicilian Regional Government  
• Italian Agency for New Technologies, Energy and the Environment (ENEA) • University of Rome "Tor Vergata"

### TOPICS AND LECTURERS

*The Tokamak Reactor: an Introduction*

• R. TOSCHI, ENEA, Frascati, I

*The European Demonstration Reactor*

• D. MAISONNIER, EFDA, Garching, D

*Problems in Energy Conversion Systems of a Tokamak Reactor*

• A. PIZZUTO, ENEA, Frascati, I

*Fission: Generation IV Projects*

• L. CINOTTI, Del Fungo Giera, Livorno, I

*Effects of Neutrons Irradiation*

• G. VELLA, University of Palermo, I

*Experimental Results and Modelling of High Energy Neutrons in Metals*

• J.L. BOUTARD, EFDA, Garching, D

*Experimental Results and Modelling of High Energy Neutrons in Ceramics*

• A. KOHYAMA, University of Kyoto, J

*The Neutron Kinetics in ITER and PPCS*

• L. PETRIZZI, ENEA, Frascati, I

*Neutrons Kinetics in Fission Reactors*

• A. BORIO, University of Pavia, I

*Heat Removal Issues (Gas and Water Cooling)*

• S. PAPASTERGIOU, EURATOM, Frascati, I

*Heat Removal Issues (Liquid Metal Cooling)*

• R. STIEGLITZ, FZK, Karlsruhe, D

*Problems in Liquid Metal Circuits*

• G. BENAMATI, ENEA, Brasimone, I

*Corrosion and Erosion Phenomena*

• C. FAZIO, FZK, Karlsruhe, D

*Fission: The case of He, Na, Pb*

• L. CINOTTI, Del Fungo Giera, Livorno, I

*Blanket Models*

• A. PIZZUTO, ENEA, Frascati, I

*Divertor Designs*

• L.V. BOCCACCINI, FZK, Karlsruhe, D

*Electricity Generation Cycles*

• P. SARDAIN, EFDA, Garching, D

*Hydrogen Production and Water Desalination*

• A. CUCCHIARO, ENEA, Frascati, I

### PURPOSE OF THE COURSE

The power produced by a fusion reactor will be converted to electric energy or other goods like hydrogen or desalinated water. Neutrons produced in the D-T fusion process carry 4/5 of the energy. They will be slowed in the blanket where the tritium breeding takes place. Power by  $\alpha$ 's goes to the divertor and first wall (FW). One or two fluids circulate in the blanket and in the divertor/FW to extract the energy and to provide stable operational temperature of the components. The fluids must flow at high velocity (often in conditions of turbulent flow) while structural materials, pipes, junctions must withstand neutron bombardment, corrosion/erosion, high operational temperature, high heat flux.

The presence of a magnetic field plays an important role in optimising the flow regime in electrically conducting fluids. Therefore the energy conversion system is a process that requires a trade off analysis among the various solutions.

In the Course the problems outlined above will be treated. Advantages and disadvantages of water, He, Li and Pb as circulating fluids will be examined. The case of the new fission projects will be also illustrated for comparison.

### APPLICATIONS

Persons wishing to attend the Course should apply in writing to:

- Dr. Eng. Aldo PIZZUTO  
c/o Mrs Maria Laura Sansovini  
ENEA  
Via E. Fermi, 45 - C.P. 65 – 00044 FRASCATI, Italy  
Tel +39.06.94005602 – Fax +39.06.94005147  
e-mail: [sansovini@frascati.enea.it](mailto:sansovini@frascati.enea.it)

specifying:

- full name, address, age, nationality;
- academic qualification, present position and affiliation;
- specific interest in the workshop.

- PLEASE NOTE

Participants should arrive in Erice on September 9, not later than 5 pm.

### POETIC TOUCH

According to legend, Erice, son of Venus and Neptune, founded a small town on top of a mountain (750 metres above sea level) more than three thousand years ago. The founder of modern history — i.e. the recording of events in a methodic and chronological sequence as they really happened without reference to mythical causes — the great Thucydides (~500 B.C.), writing about events connected with the conquest of Troy (1183 B.C.) said: «After the fall of Troy some Trojans on their escape from the Achaei arrived in Sicily by boat and as they settled near the border with the Sicilians all together they were named Elymi: their towns were Segesta and Erice.» This inspired Virgil to describe the arrival of the Trojan royal family in Erice and the burial of Anchise, by his son Enea, on the coast below Erice. Homer (~1000 B.C.), Theocritus (~300 B.C.), Polybius (~200 B.C.), Virgil (~50 B.C.), Horace (~20 B.C.), and others have celebrated this magnificent spot in Sicily in their poems. During seven centuries (XIII-XIX) the town of Erice was under the leadership of a local oligarchy, whose wisdom assured a long period of cultural development and economic prosperity which in turn gave rise to the many churches, monasteries and private palaces which you see today.

In Erice you can admire the Castle of Venus, the Cyclopean Walls (~800 B.C.) and the Gothic Cathedral (~1300 A.D.). Erice is at present a mixture of ancient and medieval architecture. Other masterpieces of ancient civilization are to be found in the neighbourhood: at Motya (Phoenician), Segesta (Elymian), and Selinunte (Greek). On the Aegadian Islands — theatre of the decisive naval battle of the first Punic War (264-241 B.C.) — suggestive neolithic and paleolithic vestiges are still visible: the grottoes of Favignana, the carvings and murals of Levanzo.

Splendid beaches are to be found at San Vito Lo Capo, Scopello, and Cornino, and a wild and rocky coast around Monte Cofano: all at less than one hour's drive from Erice.

**More information about the «Ettore Majorana» Foundation and Centre for Scientific Culture can be found on the WWW at the following address:**  
<http://www.ccsem.infn.it>

**Registration details and more information about the Course can be found on the WWW at the following address:**  
<http://www.isfirt-erice.enea.it>