

## 9<sup>th</sup> CAROLUS MAGNUS SUMMER SCHOOL ON PLASMA AND FUSION ENERGY PHYSICS.



August 31 - September 11, 2009  
Eurovillage, Herbeumont-sur-Semois, Belgium

Organised by the Trilateral Euregio Cluster (TEC)

1. ERM/KMS Laboratory for Plasma Physics, Brussels, Belgium
2. FOM – Instituut voor Plasmafysika, Nieuwegein, The Netherlands
3. IEF-4, Institute of Energy Research, FZJ, Jülich, Germany

<b>Deadline for application:</b>	<b>May 1, 2009</b>
<b>Notification of acceptance:</b>	<b>June 1, 2009</b>
<b>Abstracts of posters:</b>	<b>August 1, 2009</b>
<b>Start of Summer School:</b>	<b>August 31, 2009</b>

The most recent information on the Summer School can be found on the internet address: <http://www.carolusmagnus.net/>

## 9<sup>th</sup> CAROLUS MAGNUS SUMMER SCHOOL ON PLASMA AND FUSION ENERGY PHYSICS.

Together with the FOM- Instituut voor Plasmafysika “Rijnhuizen” and the Institute for Energy Research of the Forschungszentrum Jülich GmbH, the Laboratory for Plasma Physics of the Association “EURATOM – Belgian State” in the ERM/KMS (Brussels, Belgium) forms the Trilateral Euregio Cluster (TEC). This cluster is responsible for the organisation of the Carolus Magnus Summer Schools. Most lectures will be given by senior physicists from the three TEC institutes and by academic staff from nearby universities of North-Rhine Westphalia, Belgium and the Netherlands. A few will be delivered by experts from other laboratories associated in the European fusion research programme and from the Euratom Directorate.

The 9<sup>th</sup> Carolus Magnus Summer School will be devoted to the theoretical and experimental aspects of high temperature plasmas confined in toroidal magnetic traps and is relevant to controlled fusion energy production. Special emphasis will be laid on tokamaks, but stellarators and spherical devices will also be discussed. The ITER project now officially being underway, increased attention will be paid to physics relevant for this next-step device. The summer school program typically also contains two evening lectures on subjects outside the fusion research scope but closely related to it.

The Summer School is primarily intended for Ph.D. students and undergraduates in their last year. Experienced scientists who, coming from other disciplines, recently entered the field of plasma physics will also benefit from the school, which both provides an overview of the various interconnected research domains and describes the latest developments in various aspects of fusion research.

The proceedings of the summer schools are published as a special issue of the *Transactions of Fusion Science and Technology* scientific journal. The participants will receive a copy of the proceedings. The slides and corresponding papers of the various lectures are also available on the [www](http://www.itep.fr).

Participants will have the opportunity of presenting and discussing their own work during two special poster sessions, for which they should send one-page abstracts to the conference secretariat before August 1, 2009.

An excursion will be organized to the Institut für Plasmaphysik, Forschungszentrum Jülich GmbH, hosting the TEXTOR tokamak.

## ACCOMMODATION, FEE

The 9<sup>th</sup> Carolus Magnus Summer School will be held in Eurovillage, Herbeumont-sur-Semois, a leisurely spot in the Belgian Ardennes. Take a look at the www site <http://www.corsendonkvillage.be> to get an impression.

On the free weekend in between the 2-week lecture period, participants can enjoy walking through the Ardennes or they can take a train and visit Brussels or other nearby cities. Except for breakfast, the weekend meals are not included in the participation fee. Herbeumont ([www.planetware.com/tourist-attractions-/semois-valley-b-lux-semois.htm#B-LUX-HERBE](http://www.planetware.com/tourist-attractions-/semois-valley-b-lux-semois.htm#B-LUX-HERBE)) is a small village that counts approximately 700 inhabitants and is tucked away in the dense woods at the right bank of the river Semois. It is a beautiful authentic place that radiates rest. Nature is magnificent here and the Semois as well as the former railway line (with splendid bridges and tunnels) dominate the surrounding area. Just outside the village centre, at the right bank of the Semois, the remains of a castle from the 11<sup>th</sup> century, built by Jehan de Rochefort, are to be found. The castle served till the middle of the 17<sup>th</sup> century as residence for the counts of Herbeumont. The castle was destroyed by the troops of 'Sun King' Louis XIV. From the ruins, you have a splendid view over the valley of the Semois. There are also numerous places of interest to visit nearby: Bouillon, Orval, the impressive valley of the Semois, Torgny, the slate quarry of Herbeumont, the book village Redu and the Space Center. At approximately 13 kilometres, you will find the city of Bertrix, a relatively large place with, shops, supermarkets, restaurants and a train station.

The fee, including accommodation, meals and proceedings amounts to 800EUR.

Limited support to students from non-EU countries will be discussed on request on a case-to-case basis. As the summer school is a non-profit organization, the extent of the support we can give depends on the sponsoring we get. All applications for funding should be accompanied by a recommendation of the scientific supervisor.

The deadline for registration is May 1, 2009. Acknowledgement of receipt will be sent within a few weeks after the application is received. Attendance is limited to approximately 55 students and early application is recommended. Applicants will be notified about their acceptance by June 1, 2009. Practical information will be made available to successful candidates approximately one month before the School begins.

# PRELIMINARY PROGRAM

## **Introduction**

- Energy resources and reactor safety
- European fusion program
- Thermonuclear Burn Criteria

## **Confinement concepts**

- Magnetic fields and plasmas
- Guiding center motion
- Tokamaks
- Stellarators
- Plasma equilibrium in tokamaks
- Operational limits

## **Theoretical description of plasmas**

- Kinetic and gyro-kinetic description
- Macroscopic description

## **Waves and Instabilities**

- Propagation and absorption in confined plasmas
- Ideal and resistive MHD instabilities
- Micro-instabilities

## **Plasma Heating and Current Drive**

- Neutral beam injection
- Wave heating (ECRH, ICRH)
- Current drive (ECRH, ICRH, Lower Hybrid, NBI)

## **Transport in Tokamaks**

- Classical, neoclassical and anomalous transport
- Fluctuations in tokamaks
- Degraded and improved confinement
- Transport studies using perturbative experiments
- Transport codes

## **Diagnostics**

- Microwave, optical and spectroscopic diagnostics for the plasma core and edge, equilibrium and fluctuations

## **Edge Plasma Physics**

- Plasma – wall interaction and wall conditioning
- Ash removal, recycling
- Radiation phenomena at edge and divertor
- Divertor Concepts

## **Present Status of Fusion**

- Overview of tokamak results
- Scaling and extrapolation to reactors
- Advanced tokamak concepts

## PRELIMINARY LIST OF LECTURERS

<b>ERM / KMS, Brussels:</b>	F. Durodié R. Koch J. Ongena D. Van Eester M. Van Schoor
<b>FOM, Nieuwegein:</b>	H.J. de Blank M. de Baar A.J.H. Donne G.M.D. Hogeweyj R. Jaspers G. Van Rooij E. Westerhof
<b>IPP (IEF-4), Jülich:</b>	H.R. Koslowski A. Krämer – Flecken A. Kirschner U. Samm B. Schweer M.Z. Tokar B. Unterberg
<b>Others:</b>	H. Bartlett (EEC, Brussels) K. Crombé (UG, Ghent) G. Federici (ITER, Garching) X. Garbet (CEA, France) D. Hartmann (MPI, Garching) R. Keppens (CPA, Leuven) V. Kiptily (JET, Culham) P.U. Lamalle (ITER, Cadarache) J. Linke (IEF-2, Jülich) D. Reiter (U. Düsseldorf) M. Rubel (KTH, Stockholm) S. Sharapov (JET, Culham) G. Van Oost (UG, Ghent) B. Weyssow (EFDA, Garching) H.R. Wilson (UKAEA Fusion) R. Wolf (IPP, Greifswald)
<b>Special Evening Lectures:</b>	S. Poedts (CPA, Leuven) A. Von Keudell (RUB, Bochum)

## APPLICATION

Name:	
Title:	
Affiliation:	
Address:	
Zip Code:	
City:	
Country :	
Phone:	
Fax:	
E-mail:	

**Present level:**

- undergraduate student
- graduate student
- post-doc.
- others : .....

- I would like to attend the 9<sup>th</sup> Carolus Magnus Summer School on Plasma and Fusion Energy Physics
- I will apply for funding and will send the appropriate letter and recommendation of my supervisor by regular mail.
- I would like to present a poster contribution entitled:  
.....  
.....

**Accommodation and fee: 800EUR**

Applicants will be informed about acceptance by June 1, 2009.

Preferably, please apply electronically via the internet server:  
<http://www.carolusmagnus.net/ask>

otherwise, return this form to the address overleaf.

## ORGANISATION

The 9<sup>th</sup> Carolus Magnus Summer School on Plasma and Fusion Energy Physics is organized by the partners in the [Trilateral Euregio Cluster \(TEC\)](#):

### **Association EURATOM – Belgian State**

Laboratory for Plasma Physics  
Renaissancelaan 30 Avenue de la Renaissance  
B – 1000 Brussels, Belgium

### **Association EURATOM – FOM**

FOM – Instituut voor Plasmafysica “Rijnhuizen”  
P.O. Box 1207  
3430 BE Nieuwegein, The Netherlands

### **Association EURATOM – FZJ**

Institute of Energy Research - 4  
Forschungszentrum Jülich GmbH  
D – 52425 Jülich, Germany

### **Program Committee**

Dr. R. Jaspers	(FOM)
Tel./ fax	(31) 30 609 6999 / 84 748 4979
Dr. M. Lehnen	(IEF-4)
Tel./ fax	(49) 24 6161 5102 / 2660
Dr. E. Lerche	(Scientific Secretary, ERM/KMS)
Tel./ fax	(32) 2 742 6586/ 735 2421
Dr. D. Van Eester	(Chairman, ERM/KMS)
Tel./ fax	(32) 2 742 6587/ 735 2421

**All correspondence should be directed to the scientific secretariat:**

**Dr. Ernesto Lerche**  
**Laboratory for Plasma Physics**  
**Ecole Royale Militaire – Koninklijke Militaire School**  
**Euratom Association**  
**B – 1000 Brussels, Belgium**  
**e-mail: [cmssecretary@fz-juelich.de](mailto:cmssecretary@fz-juelich.de)**

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