



UNIVERSITÉ  
DE LORRAINE

# FUSION-DC: un exemple de Collège Doctoral Erasmus mundus

Gérard Bonhomme ([gerard.bonhomme@univ-lorraine.fr](mailto:gerard.bonhomme@univ-lorraine.fr))

Institut Jean Lamour, UMR 7198, Université de Lorraine

# *Overview of European initiatives and networking in Fusion Science and Engineering Education*

## At Master level

- French national Master “en Sciences de la Fusion”, started in 2006  
<http://www.sciences-fusion.fr/>
- European Master Erasmus mundus “Nuclear Fusion Science and Engineering Physics” FUSION-EP <http://www.em-master-fusion.org/> , started in 2006, and renewed in 2011  
**Strong European coordination through the EURATOM programme  
⇒ FUSion Education NETwork (FUSENET), started in 2008**

## Doctorate

- Joint Doctorate in Fusion Science and Engineering and European Doctoral Network, Padova-Lisbon-München
- European Doctoral Federation in Fusion Science FUSION-EDF, joint initiative from Fusion-EP and French networks, coordinated by Nancy, started in 2010  
→ 64 PhD students enrolled in 2012
- Erasmus mundus “Doctoral College in Fusion Science and Engineering” FUSION-DC (<http://www.em-fusion-dc.org/>)  
accepted in 2011, started September 2012 (enrollment of first PhD students)

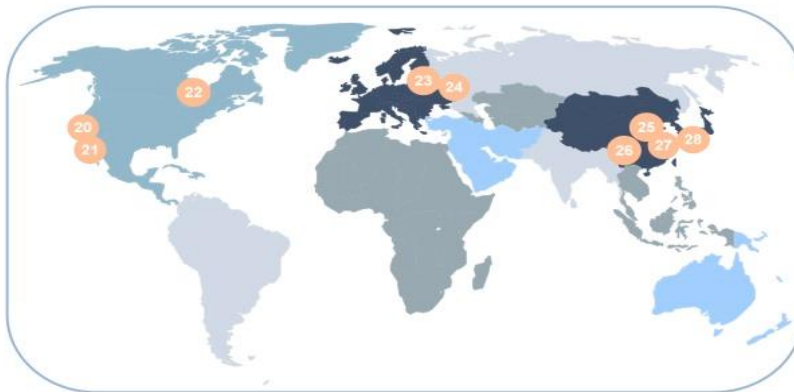


**International Erasmus Mundus  
Doctoral College in Fusion Science  
and Engineering  
( FUSION-DC )**

# ***FUSION-DC Full Partners***

- Ghent University (Belgium) : coordinator
- Université de Lorraine (Nancy, France)
- Universidad Complutense de Madrid *and* Universidad Carlos III de Madrid (Spain)
- Universität Stuttgart (Germany)
- **Università degli Studi di Padova (Italy)**
- **Instituto Superior Técnico (Lisbon, Portugal)**
  
- **Max-Planck-Institut für Plasmaphysik (Germany)**
- **IRFM-CEA (Cadarache, France)**





- Non-EU members**
- UCLA – Los Angeles
  - U. Wisconsin - Madison
  - UCSD – San Diego
  - St-Petersburg Polytechnic
  - MEPhI, Moscow
  - Tsinghua, Beijing
  - SWIP, Chengdu
  - USTC & IPP, Hefei
  - Kyushu University, Fukuoka, Japan

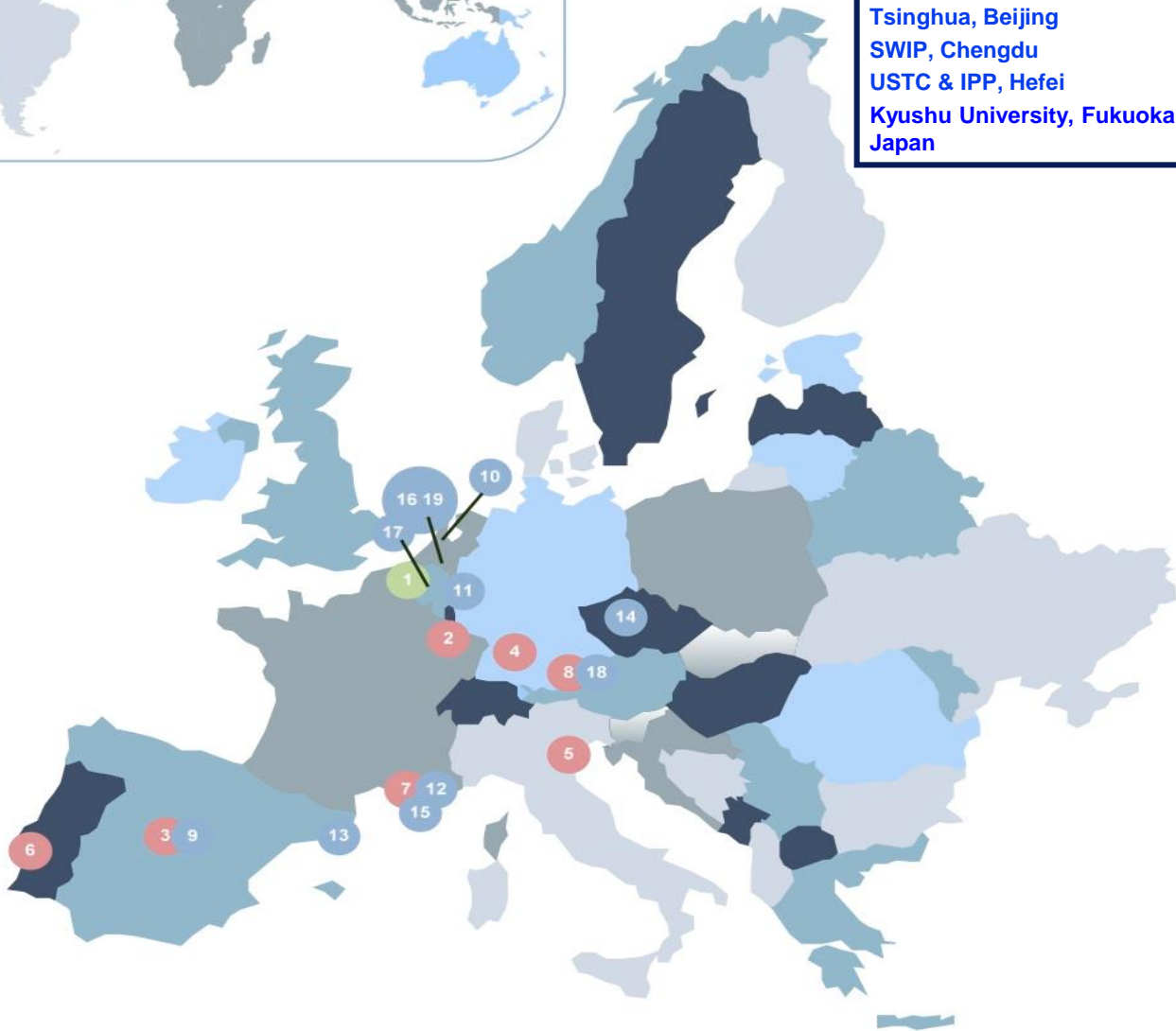
- Other European Academic institutions**
- ULB Brussels
  - TU/e Eindhoven
  - AIX-Marseille Universities

- Research Institutes (EURATOM Associations)**
- IRFM-CEA
  - IPP-Max-Planck institutes
  - TEC (B-D-NL)
  - CIEMAT
  - IPP-CR Prague

**ITER Organization**

**FUSENET Association**

- Industry**
- ITER Belgium Industry platform
  - Deutsches ITER Industrie Forum (Germany)
  - ITER-NL
  - Siemens (Germany)
  - NRI (Czech Republic)
  - Tecnatom (Spain)
  - ELYTT ENERGY (Spain)
  - IBERDROLA (Spain)
  - edp-Inovação (Portugal)



# ***FUSION-DC: objectives***

- Joint selection of students
- Joint selection of doctoral thesis topics
- Relations with participating home institutions and supervisors; **Multiple Doctorates (co-tutelle)**
- Organization of education and training activities in close link with FUSENET
- **Contacts with other doctoral initiatives aiming at establishing a unique European Doctoral network in fusion science**



# Erasmus Mundus Joint Doctorate Programme

## FUSION-DC

**Based on existing Doctoral Networks: Padova/Lisbon/Munich *and* FUSION-EDF (French Universities  $\cup$  FUSION-EP networks)**

- ~ 8 bourses Erasmus mundus/an (5 A + 3 B) → salaire net (contrat de travail) pour l'étudiant 1400-1600€/mois + 600€ pour 'la home institution'
- ~ 8 financements locaux (engagement des partenaires)
- Co-tutelle obligatoire → double diplôme
- Training:
  - transferable skills (6 ECTS); - specialized research related courses (12)
  - 2 PhD events + 2 conf. Internationales
- Suivi du doctorant: Doctoral Guidance Committee

# *Research fields*

- Tokamak physics for ITER and beyond
- Technology for ITER and beyond
- Stellarator and reversed field pinch research and advanced concepts
- Plasma-wall interaction and materials research
- Plasma theory and computational plasma physics
- Diagnostics, plasma control and data analysis



# *Yearly PhD event*

## Proposed and Organized in the framework of FUSENET

- **Aim:** bonding between generation of PhD students. Build community. Enlarge the scope of the academic training. Attendance required to get the PhD certificate.
- **Duration:** 2-3 days
- **First events:**
  - 2011: October, München, organized by IPP-Garching+Padova
  - 2012: October, organized by FUSION-EDF in Lorraine → about 100 PhD students
  - 2013: June, organized by York University

# *Financial means*

- **ERASMUS MUNDUS II**

- The Home Institutions of the doctoral students are committed to finance the participation of their students in the education activities organized by the College.

- The College will seek complementary financing necessary for its operation, for the organization of the education and training activities, and for doctoral fellowships.

- **Strong link with EU industry**

- FUSENET





# FUSENET

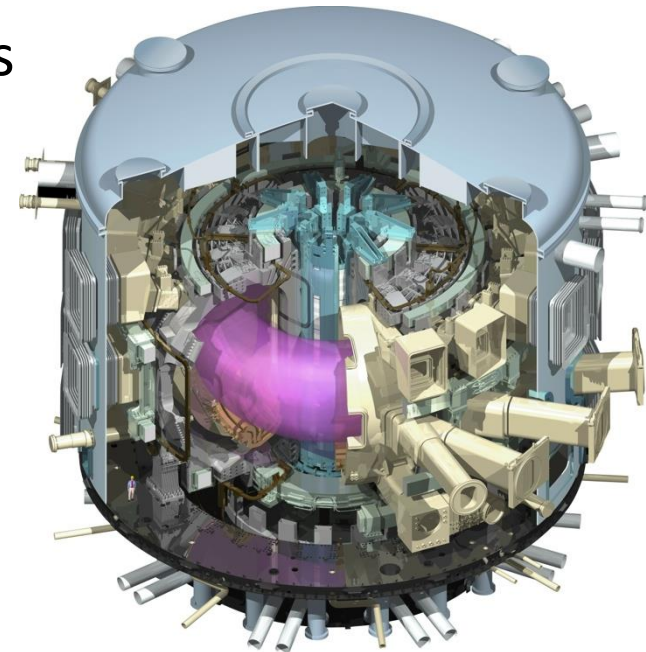
The European Fusion Education Network

36 members, 19 countries

## FUSENET = EU network for Fusion education

36 members: 22 universities,  
14 EURATOM associations

Aim: coordinate actions  
increase, enhance, broaden  
fusion education in EU





## Three main elements of the FUSENET strategy

**Critical mass.** As the number of students in fusion subjects in most countries is not large enough to support specialised Master or PhD degrees, [actions need to be coordinated and initiated on a European scale](#), in order to reach sufficient critical mass.

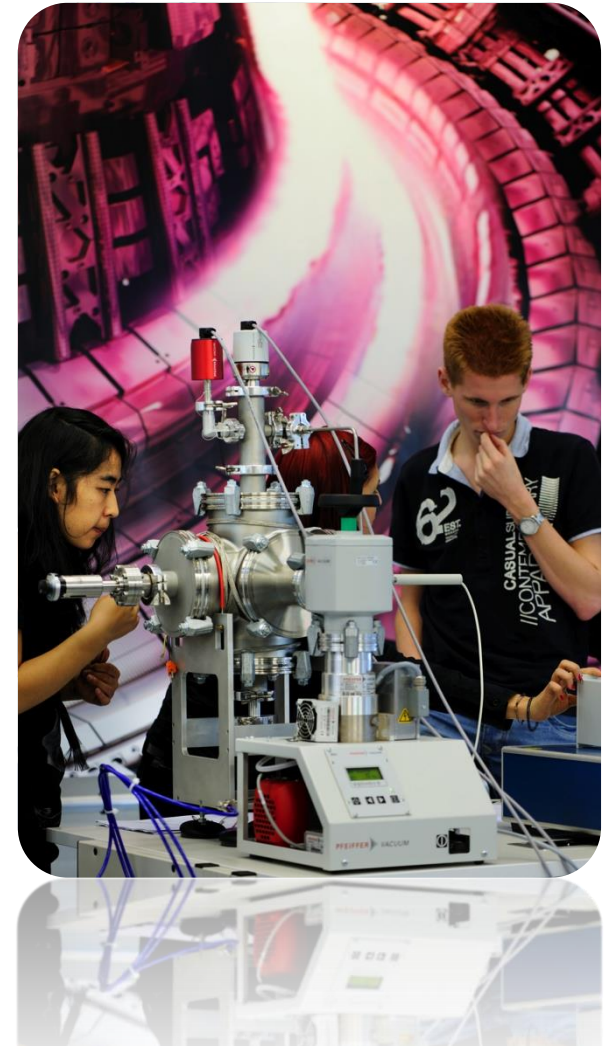
**Coherence.** To optimise the flow of students through the system, [better links are needed between the different education layers and industry](#). This means both a focus on secondary school teachers and good connections between higher education institutes and fusion institutes.

**Transparency.** [Learning opportunities need to be more accessible to students across Europe](#), through dissemination of information, and improvement of mobility. The educational goals of bachelor/master and doctoral level courses need to be more aligned, to make it easier for students to navigate the fusion system.

## FUSENET Activities:

- Develop teaching materials:  
textbook, plasma labs, online tools
- Define master/ PhD criteria  
Awarding FUSENET certificates
- Coordinate joint educational events  
Summer schools, workshops
- Support individual educational activities  
Traineeships
- Website : communication platform

[www.fusenet.eu](http://www.fusenet.eu)





## FUSENET & Industry:

- Traineeships in industry
- Education
- Develop Fusion Technology programme
- Early access to talented students

→ Industry can become  
Associated members in  
**FUSENET Association**

More Info: [www.fusenet.eu](http://www.fusenet.eu)

