# APPLICATION

The target participants are junior as well as experienced scientists and engineers in the broad field on nuclear sciences, engineering and technologies.

The application form should be filled out **on-line** at **www.fjohss.eu**

Should there be problems with the on-line application, please contact the FJOH secretariat at **fjoh@cea.fr**.

**Deadline for application:** **May 15, 2018**

**Full Registration fees:** **€ 2000**

Reduced Fees: € 1000 for fellowship recipients,

Information for payment of the fees will be provided upon review of applications.
The fees cover: lectures, class notes, meals and accommodations at the Hotel Novotel Pont-de-l'Arc from August 21 evening to August 31, 2:00 pm.

**The fees do not cover travel expenses.**

A small number of "fellowships" will be available for qualified candidates. The fellowship covers the amount of € 1000, the same amount of € 1000 having to be financed by the applicant or his/her employer. These fellowships are primarily "intended for candidates from developing countries". Requests should be motivated.

All applicants are required to provide a short curriculum vitae, which will be used for selection purposes.

The FJOH School considers that the 2018 programme corresponds approximately to 3-4 ECTS credits of post graduate-level course work in Nuclear Engineering.

Selection by the FJOH School Organizers is final.

***School place and date:***
**Aix-en-Provence, France**
**August 22-31, 2018**

# INFORMATION

## Key dates

**May 15**, 2018: Deadline for **application**

**June 8,** 2018: **Notification** to applicants

**August 21,** 2018, 7:00 pm: **Welcome** to participants with a get-together-dinner at the Hotel NOVOTEL Pont-de-l'Arc,

**August 22,** 2018, 9:00 am: Start of the school´s **lectures**

**August 31,** 2018, 2:00 pm: **End** of school

Partial participations are not accepted.

## Deadline

Deadline for application: **May 15**, 2018

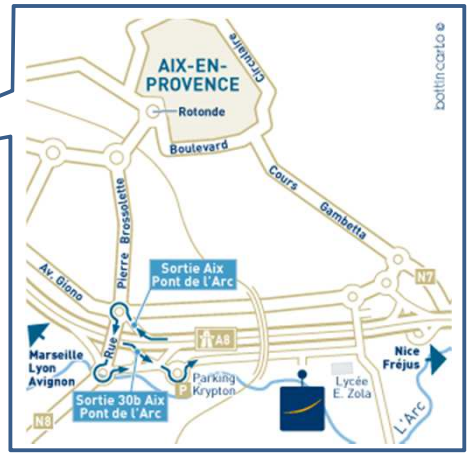

# INFORMATION

## Venue

The School will be held at the Hotel Novotel Pont-de-l'Arc, located in Aix-en-Provence, France, 30 km from the Marseille-Provence airport and 40 km from the CEA Cadarache Research Centre.
Bus transportation (free of charge) will be provided from Marseille airport, and from Aix-en-Provence TGV railway-station, on August 21 pm.
Return transportation will be provided on August 31 at 2 pm.

## Registration fees

The fees cover: lectures, class notes, excursions, meals and lodging at the Hotel Novotel Pont-de-l'Arc
The fees do not cover travel expenses.




**For Questions ? Please contact the FJOH Secretariat at :**
**fjoh@cea.fr**

**FOR MORE INFORMATION AND FOR APPLICATION PLEASE VISIT OUR WEB SITE:**
**www.fjohss.eu**

# Frédéric JOLIOT & Otto HAHN

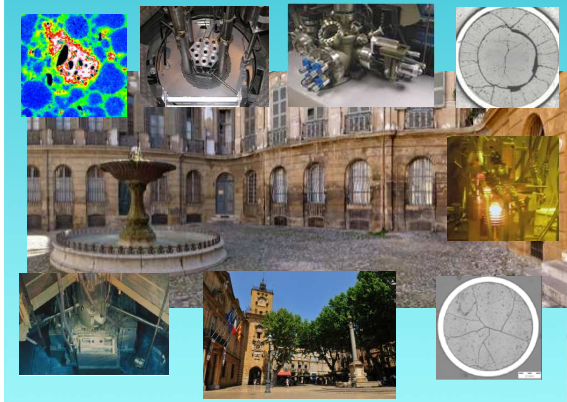
# SUMMER SCHOOL ON NUCLEAR REACTORS

"Physics, Fuels and Systems"

# 2018

## Maximizing the Benefits of Experiments for the Simulation, Design and Analysis of Reactors

**Jointly organized by the Commissariat à l'Energie Atomique et aux Energies Alternatives (France) and the Karlsruhe Institute of Technology (Germany)**



*Credit Photos: Aix-en-Provence*

**Aix-en-Provence, France** **August 22 > 31, 2018**

# PROGRAMME OUTLINE

## Maximizing the Benefits of Experiments for the Simulation, Design and Analysis of Reactors

| | | |
|---|---|---|
| **1 - Introduction** | | ***1 h*** |
| | The Key Role of Experiments to Address Validation and Safety-related Challenges | **J.Gulliford** (OECD) |
| **2 - Experiments for Improved Nuclear and Neutron Physics Models** | | ***8 h*** |
| 2.1. | From Experimental Data to Evaluated Cross Section Files (2h) | **P. Schillebeeckx** (JRC/IRMM) |
| 2.2. | Experiments for Improved Modelling of Fission Observables (2h) | **O. Serot** (CEA) |
| 2.3. | From Traditional to Advanced Neutron Physics Validation Experiments (2h) | **A. Kochetkov** (SCK/CEN) |
| 2.4. | High-resolution Detection Techniques in Nuclear Reactor Environments (2h) | **C. Destouches** (CEA) |
| **3 - New Experiments for Scale-bridging Thermo-hydraulics** | | ***9 h*** |
| 3.1. | Multiscale Methodology with Various Experiments: Applications to Loss of Coolant Accidents and Critical Heat Flux (3h) | **D. Bestion** (CEA) |
| 3.2. | Scaling Methods to Design Experiments, Extrapolation Issues, Applications (2h) | **J.L. Muñoz-Cobo** (UPV) |
| 3.3. | High-Resolution Flow Measurement Techniques for the Generation of Validation Data (2h) | **U. Hampel** (HZDR) |
| 3.4. | Challenging Experiments for Validating Advanced Two-Phase Flow Analysis Codes and their Constitutive Laws (2h) | **C.H. Song** (KAERI) |
| **4 - Experiments for Fuel and Material Multiscale Modelling** | | ***10 h*** |
| 4.1. | Overview on Key Needs, for Operation, Design and Licensing: Fuel and Material Performance under Irradiation (2h) | **N. Waeckel** (EdF) |
| 4.2. | From Traditional to Advanced Characterization Techniques: What we Have Learned and Have yet to Learn (5h) | **S. Zinkle** (Knoxville Univ.) & **J. Noirot** (CEA) |
| 4.3. | In-pile Experiments in MTRs, Experimental Fuel Assemblies and On-line Instrumentation (3h) | **S. Holcombe** (Halden) & **D. Parrat** (CEA) |
| **5 - Experiments for Improved Safety Demonstration and Operational Support** | | ***6 h*** |
| 5.1. | Assessing Confidence in Nuclear Safety (2h) | **G. Bruna** (IRSN) |
| 5.2. | A Data-driven Approach to Validation of Advanced Thermal-hydraulics Models (2h) | **N. Dinh** (NCSU) |
| 5.2. | The Validation of High Fidelity Reactor Simulations (2h) | **T. Downar** (Univ. of Michigan) |
| **Group Reflection on Selected Scientific Topics** | | ***6 h*** |
| **Seminar** | | ***2 h*** |
| | The Challenge of Competence Building for Emerging Nuclear Energy Countries | **E. Gilad** (Ben-Gurion Univ.) |

**Technical visits of CEA Cadarache R&D facilities**

# LECTURERS

# COORDINATION

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**Prof. Dominique Bestion** (CEA/DANS, France)
**S. Mimouni** (EdF)
**Dr. Gianni Bruna** (IRSN, France)
**Dr. Paul Bryce** (EdF Energy, UK)
**Prof. Leon Cizelj** (JSI, Slovenia)
**Prof. Christophe Demazière** (Chalmers University, Sweden)
**Prof. Matthew Eaton** (Imperial College, UK)
**Prof. Michel Giot** (UCL, Belgium)
**Prof. Waclaw Gudowski** (RIT, Sweden)
**Dr. Jim Gulliford** (OECD, International)
**Dr. Kevin Hesketh** (NNL, UK)
**Prof. Jan Leen Kloosterman** (Delft Univ., The Netherlands)
**Prof. Rudy Konings** (EC/JRC & Delft Univ., Germany)
**Dr. Mathias Lamm** (AREVA, Germany)
**Prof. Emilio Minguez** (UPM, Spain)
**Dr. Daniel Parrat** (CEA, France)
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**Prof. Piero Ravetto** (Politecnico di Torino, Italy)
**Dr. Andreas Schaffrath** (GRS, Germany)
**Dr. Chirstophe Schneidesch** (Tractebel Eng, Belgium)
**Dr. Walter Tromm** (KIT, Germany)
**Dr. Harri Tuomisto** (Fortum Power, Finland)
**Dr. Nicolas Waeckel** (EdF, France)

# DESCRIPTION

2018

**The 24th session** of the Frédéric Joliot/Otto Hahn (FJOH) Summer School on *"Nuclear Reactors Physics, Fuels, and Systems"* will be held in Aix-en-Provence, France, from **August 22 to 31, 2018.** This session is entitled *"Maximizing the Benefits of Experiments for the Simulation, Design and Analysis of Reactors"*. It is an advanced post-graduate-level course aimed at junior as well as experienced scientists and engineers engaged in the broad field of nuclear sciences, engineering and technologies.

**The FJOH-2018** objective is to help the school participants broaden their knowledge of experimental methods and techniques used in conjunction with advanced models for describing nuclear reactors on multiple scales. The overall course will describe state-of-the-art methodologies and implementation practices, some challenges and limitations, expected improvements, and current R&D trends.

**The FJOH-2018** programme covers the following four topics: (1) From traditional to advanced neutron physics validation experiments; (2) New experiments for scale-bridging thermohydraulics; (3) Experiments for fuel and material multiscale modelling; (4) Experiments for improved safety demonstration and operational support. In the first three topics, traditional and advanced measurement techniques will be described. In the fourth topic, a broader perspective will be taken, showing how experimental information is integrated in global simulations and safety demonstrations. Examples will be provided throughout the course.

**FJOH-2018** includes plenary lectures, group discussions, seminars, and technical visits. The speakers invited are internationally recognized experts from leading universities, research and development laboratories and industry.

**The FJOH-2018** participants will have the opportunity to share their views on specific cross-cutting subjects and open-ended questions, as part of group reflection and critical thinking activities. Time for these group activities is reserved in the School schedule.

This course represents the continuation of the Frédéric Joliot Summer Schools *on "Modern Reactor Physics and the Modelling of Complex Systems"*, which was created by CEA in 1995 to promote knowledge in the field of reactor physics, in a broad sense, and the international exchange of teachers, scientists, engineers and researchers. Beginning in 2004, the scope of the School was extended to include scientific issues related to nuclear fuels. The venues of the FJOH School sessions alternate between Karlsruhe and Aix-en-Provence.

The School's aim is to address the challenges of reactor design and optimal fuel cycles, and to broaden the understanding of theory and experiments.
The programme of each School session is defined by the International FJOH Scientific Board (see Coordination page).
The Karlsruhe Institute of Technology and the Nuclear Energy Division of CEA jointly organize and sponsor the FJOH Summer School.