

25th Edition

FJOH 2019

Karlsruhe, Germany
August 21 > 30 2019

Frédéric JOLIOT
& Otto HAHN



SUMMER SCHOOL
ON NUCLEAR REACTORS
"Physics, Fuels and Systems"

Innovative Reactors: Matching the Design to Future Deployment and Energy Needs



LECTURERS

J. Guidez
CEA, France

S. Monti
IAEA

F. Morin
CEA, France

D. Delmastro
CNEA, Argentina

A. Schaffrath
GRS, Germany

T. Abram
UMAN, UK

E. Merle
INP Grenoble, France

V. Ignatev
Kurchatov Institute, Russia

W. Emrich Jr.
NASA, USA

J. Witter
BWXT, USA

K. Weaver
INL, USA

Y. Decarlan
CEA, France

J. L. Kloosterman
TUD, The Netherlands

X. L. Yan
JAEA, Japan

S. Hirschberg
PSI, Switzerland

PROGRAMME OUTLINE

- > Introduction: Various Innovative Reactor Concepts for Various Missions > 4 h
- > Near-term-deployment Power-to-grid Integrated LWR Technology > 7 h
- > Multi-purpose Molten Salt Reactors > 7 h
- > Nuclear Technology for Space Propulsion and Manned Space Exploration > 5 h
- > Minimum-intervention Long-life Breed-and-burn Fast Reactors > 6 h
- > Reactor Concepts for Process Heat and Power-to-gas Applications > 4 h
- > Group Reflection on Selected Topics > 6 h
- > Seminar > 2 h

Extra-curricular activities and a weekend programme will be organized.
Full registration fees including lodging and food : € 2000.
Reduced fees: € 1000 for fellowship recipients.



School jointly by CEA and KIT
For any information, visit our web site: www.fjohss.eu
or contact the FJOH school secretariat at ingeborg.schwartz@kit.edu



Application
deadline:
May 18,
2019

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 online at:
<http://www.fjohss.eu>

Should there be any problems with the online registration, please contact Mrs Ingeborg Schwartz at:
ingeborg.schwartz@kit.edu

Deadline for application: May 18, 2019

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, excursions, meals and lodging at the Akademie Hotel Karlsruhe from August 20 evening to August 30, 1 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. Information for payment of the fees will be provided upon review of applications.

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

The FJOH School considers that the 2019 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 **Karlsruhe, Germany**
August 21 > 30, 2019

INFORMATION

Key dates

May 18, 2019: Deadline for application

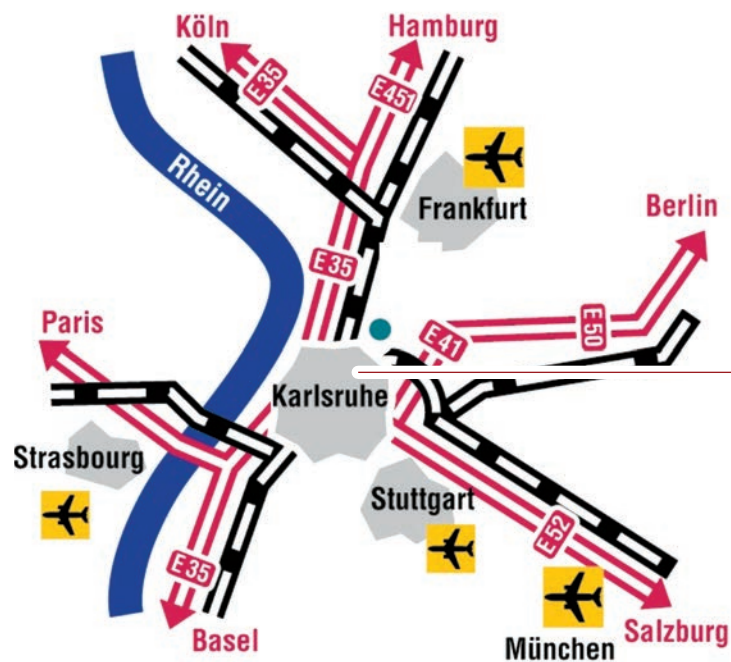
June 9, 2019: Notification to applicants

August 20, 2019, 7 pm: Welcome to participants with a get-together-dinner at the Akademie Hotel Karlsruhe

August 21, 2019, 9 am: Start of the school lectures.

August 30, 2019: 1 pm: End of school

Partial participations are not accepted



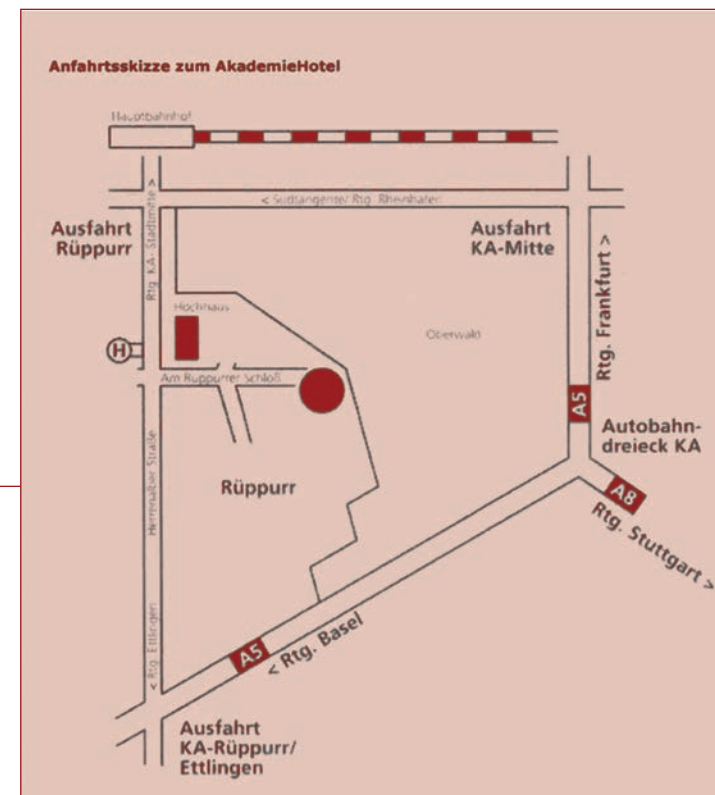
INFORMATION



Venue

The School will be held at the Akademie Hotel Karlsruhe, located about 4 km from downtown Karlsruhe, Baden-Württemberg, Germany.

The Akademie Hotel is conveniently accessible by tram from the Karlsruhe central train station.



Frédéric JOLIOT & Otto HAHN

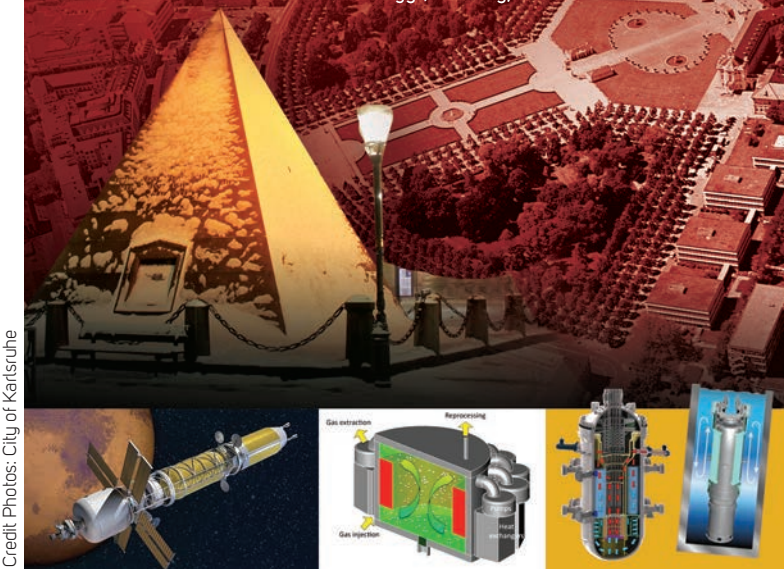
FJOH 2019

SUMMER SCHOOL ON NUCLEAR REACTORS

"Physics, Fuels and Systems"

Innovative Reactors: Matching the Design to Future Deployment and Energy Needs

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



Credit Photos: City of Karlsruhe

Karlsruhe, Germany August 21 > 30, 2019

Questions? Please contact: Mrs Ingeborg Schwartz at ingeborg.schwartz@kit.edu

For more information, please visit our web site:
www.fjohss.eu



PROGRAMME OUTLINE



Innovative Reactors: Matching the Design to Future Deployment and Energy Needs

- 1. Introduction: Various Innovative Reactor Concepts for Various Missions**  **4 h**
- 1.1 The Deciding Factors in Opting for a Particular Reactor Technology (2h) **J. Guidez** (CEA, France)
- 1.2 Promising Reactor Concepts for Multiple Applications (2h) **S. Monti** (IAEA)
- 2. Near-term-deployment Power-to-grid Integrated LWR Technology**  **7 h**
- 2.1 From Specific Design Criteria to an Advanced Modular LWR Concept: Approach, Methods, Validation (3h) **F. Morin** (CEA, France)
- 2.2 The Challenges of Designing and Licensing a First-of-a-kind Reactor Prototype, even a Small One! (2h) **D. Delmastro** (CNEA, Argentina)
- 2.3 The Reliability and Safety Case of a Reactor Equipped with Passive Systems (2h) **A. Schaffrath** (GRS, Germany)
- 3. Multi-purpose Molten Salt Reactors**  **7 h**
- 3.1 MSR Design Principles, Concepts, Modelling Approaches, and Methods (3h) **T. Abram** (Univ. of Manchester, UK)
- 3.2 From the MSR Physics Principles to a Plant Layout (2h) **E. Merle** (Grenoble INP & CNRS, France)
- 3.3 Fuel Salts Chemistry and Materials Compatibility (2h) **V. Ignatiev** (Kurchatov Institute, Russia)
- 4. Nuclear Technology for Space Propulsion and Manned Space Exploration**  **5 h**
- 4.1 Nuclear Rocket Propulsion: Background, Physics and Methods, Design and Tests (3h) **W. Emrich Jr.** (NASA, USA)
- 4.2 The Challenge of Fuelling a Nuclear Engine for Space Exploration (2h) **J. Witter** (BWXT, USA)
- 5. Minimum-intervention Long-life Breed-and-burn Fast Reactors**  **6 h**
- 5.1 Physics of Breed-and-burn Reactors, Optimized Core and Fuel Design, Licensing Case (3h) **K. Weaver** (INL, USA)
- 5.2 Cladding and Structural Materials for Very Long In-core Residence Times (3h) **Y. Decarlan** (CEA, France)
- 6. Reactor Concepts for Process Heat and Power-to-gas Applications**  **4 h**
- 6.1 Designing a Small Reactor to Bring Power to Remote Areas or to Produce Process Heat (2h) **J.L. Kloosterman** (Delft Univ., The Netherlands)
- 6.2 Developing High-temperature Reactors for Hydrogen Production and Other Advanced Applications (2h) **X. L. Yan** (JAEA, Japan)
- Group Reflection on Selected Scientific Topics**  **6 h**
- Seminar**  **2 h**
- Public Acceptance of Energy Technologies (2h) **S. Hirschberg** (PSI, Switzerland)

Technical Visits

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Dr. Christophe Schneidesch (Tractebel Eng., Belgium)

Dr. Walter Tromm (KIT, Germany)

Dr. Harri Tuomisto (Fortum Power, Finland)

Dr. Nicolas Waeckel (EdF)

DESCRIPTION

The 25th session of the Frédéric Joliot/Otto Hahn (FJOH) Summer School on “Nuclear Reactors Physics, Fuels, and Systems” will be held in Karlsruhe, from August 21 to 30, 2019. This session is entitled “Innovative Reactors: Matching the Design to Future Deployment and Energy Needs”. 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 objective of the FJOH-2019 edition is to give the participants an extended insight into different innovative reactor concepts intended for various missions, with a near-term licensing horizon. The programme includes topics on (i) Power-to-grid integrated LWR technology, (ii) Multi-purpose molten salt reactors, (iii) Nuclear technology for space propulsion and space exploration, (iv) Minimum intervention breed-and-burn fast reactors, (v) Reactor concepts for process heat and power-to-gas applications. Each type of system poses particular design challenges in terms of basic data, modeling, validation, safety demonstration, nuclear “footprint”, etc. The various lectures will show the steps leading from the intended service to viable concepts, emphasizing the key scientific and technical ingredients in design trade-offs, as well as the implied limitations.

FJOH-2019 includes plenary lectures, group discussions, seminars, and technical visits. The speakers are internationally recognized experts from leading universities, research and development laboratories and industry.

The FJOH-2019 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.