



- Second Circular -

ENSAR-ECOS Workshop on FUTURE SuperHeavy Element Strategy FUSHE 2012 will be held at the [Conference&Sports Hotel Erbismühle](#) in Weilrod, Germany, in the Taunus hills north of Frankfurt from

Sunday, May 13th 2012 to Wednesday, May 16th 2012.

ENSAR (European Nuclear Science and Applications Research) is an initiative of the European nuclear-science community, funded by the European Commission within the Seventh Framework Programme (FP7) (<http://www.ensarfp7.eu/>). **ECOS** (<http://www.nupec.org/ecos/ECOS-Final.pdf>) is a European initiative for high-intensity stable-beam facilities, participating in the ENSAR FP7 program with a Network Activity (NA). It has a specific objective (Task 2) to promote synergies in the field of Super-Heavy Element (SHE) research, described as follows:

"For this task ECOS is aiming for bringing together the groups with research activities on SHE using high-intensity ion beams for an exchange of new ideas and techniques related to the use of very high intensity stable beams. In particular, Task 2 will propose an optimisation of resources (beam time, target technology, detectors) in the field of SHE research among TNA facilities."

The **ENSAR-ECOS** Workshop on **FUTURE Super-Heavy Element Strategy – FUSHE 2012** is one very important milestone in this process. It will provide a forum for the SHE community to discuss and define the future strategy to reach the common goal – the establishment and investigation of the region of spherical shell-stabilised super-heavy nuclei – the so called "Island of Stability".

The present situation in the field of SHE is characterised by many experimental and theoretical achievements, along with a number of technical developments. Burning questions still remain open, for example the Z and A identification of nuclides observed in ^{48}Ca induced reactions on actinide targets, or the development of single particle states towards the shell gap expected for the next closed proton and neutron shells after ^{208}Pb . Synthesis efforts have reached a cross section regime in the sub-pico barn region, a vast amount of decay data has been obtained in ^{48}Ca induced reactions – the so called "hot fusion" scheme. In-beam spectroscopy and direct mass measurements with Penning traps have advanced beyond $Z=100$, and in decay spectroscopy features such as K-isomers have been observed up to darmstadtium. Moreover, basic chemical properties have been established for elements up to $Z=108$, and 112. Advanced theoretical models – macroscopic-microscopic as well as self-consistent microscopic approaches are getting closer and closer to pin down the region of the next shell gap in the structure of neutron and proton single particle levels. Considerable progress in the understanding of fusion dynamics of two colliding nuclei leading to SHE formation has been made by various dynamical models. On the instrumentation side, the development of accelerator, target, separator and detection technology is starting new promising concepts in terms of high-beam intensities, better and more efficient separation, and much more detailed spectroscopy with advanced particle and photon detection set-ups, and new instrumentation such as traps.

In this situation we feel that time is ripe for the SHE community to come together and define the strategy to attack the open questions and challenges. This workshop can be a valid tool to achieve these objectives.

The workshop will be a working meeting. It will be organised in a specific session structure which favours discussion as outlined in the following.

<http://www.ensarfp7.eu/workshops/fushe2012/>

Topics and goal of the workshop

The workshop will have the three main categories:

1. Experiment

2. Theory

3. Instrumentation

The topics are listed in the following:

Experimental

- Z- and A identification of the isotopes produced in ^{48}Ca -induced reactions on actinide targets
- Single particle trends towards the gap of the spherical SHE
- Ground state properties (e.g. masses)
- Decay properties (fission barriers, lifetimes) of SHE
- Chemical properties
- Reaction mechanism
- Collective properties/in beam spectroscopy

Theory

- Spherical and deformed shell gaps, density profiles, stabilization mechanisms (shell, vibrational etc.).
- Structure of ground and low-lying excited states of SHN: energies, spins, parities, transition strengths, isomerism
- Evolution of ground state shapes and fission barriers as function of Z and A, and limits of the region of SHE
- Excitation energy dependence of fission barriers
- Evolution of di-nuclear systems: contact to capture, fusion-fission, deep-inelastic collision etc.
- Energy transfer, dissipation-fluctuation dynamics in nuclear reactions.
- A review of the relevant models and guidance for future experiments.
- SHE quantum chemistry
- Astrophysical relevance for SHE

Instrumentation

- High intensity stable beam accelerator
- High current/low energy target development
- New separators (S3, M/Q- or other mass selection/spectroscopy)
- Detector development
- Inbeam spectroscopy/target (gammas, electrons,...)
- Decay spectroscopy/after separation (ERs, alphas, gammas, electrons, X-rays)
- Electronics (digital, pulse shape analysis,...)
- Ion traps
- Laser spectroscopy
- Chemistry instrumentation (gas-jet transport system; ion-exchange, solvent extraction, electro-chemistry apparatuses; gas-chemistry apparatuses; chemistry apparatus coupled to recoil separators, detectors coupled to chemistry apparatus)

Workshop Structure

The workshop will be organised in 7 x ½-day sessions (adjusted to accommodate the final list of topics) with a strong emphasis on discussions:

- The sessions will be organised with a combination of invited talks followed by a topical discussion. There will be no call for contributed talks. However, (short) contributions will be encouraged for the topical discussion.
- The workshop will be guided by a number of convenors (3) and discussion leaders for each session
- The convenors will produce a paper for their topic from
 - i. Summary documents produced by the speakers beforehand
 - ii. Summary and synthesis of the discussion
- The Chair and co-chair (+OC volunteers) will prepare a recommendation paper (RP) from the convenor reports
- The AC and OC will correct and comment on the RP
- The RP will finally be published on the FUSHE and ENSAR/ECOS websites

The sessions will be organised in such a way that contributions to these three main categories will be combined under various topics such as nuclear structure or synthesis, which will be wrapped up in a final discussion for each “theme”. These “themes” should, where possible, consist of contributions from the three main categories. The sessions will be guided by discussion leaders who will extract strategic ideas, milestones etc. The outcome of the various sessions and the final discussion will be put together in a final strategy paper representing the basis for the common strategy of the SHE community brought together in the workshop. The paper will be produced by a writing group consisting of the convenors, discussion leaders, and the organising committee. The paper should have the format of a scientific article. It will be published in an international peer-reviewed scientific journal.

Time Schedule

Sunday, May 13 th		Monday, May 14 th	Tuesday, May 15 th	Wednesday, May 16 th
09:00		SHE Synthesis	SHE Structure II	SHE as a Unified Picture
09:50		Experiment: Synthesis – Methods and Requirements	Experiment: Decay Properties of SHE	Novel Aspects: New Observables, Methods and Ideas from Adjacent Fields
10:40		Experiment: Reaction Mechanism Studies	Theory: Ground State Properties and the Limits of the Region of SHE	New Projects: Separators, Spectrometers and more
11:10		<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>
12:00		Theory: Fusion, Fission and Multi-nucleon Transfer	Experiment: Ground State Properties	Understanding SHE: Relevant Model Developments
13:00	Wrap up discussion	Wrap up discussion	Wrap up discussion	
13:00	<i>lunch</i>	<i>lunch</i>	<i>lunch</i>	
14:00	Introduction Intro Experiment + Instrumentation	SHE Structure I	Chemistry	Summary, Final Discussion and Conclusions
14:50	Intro Theory	Experiment: Collective Properties/inbeam spectroscopy	Theory: SHE Quantum Chemistry	Summary: Theory
15:40	Experiment: Chemical Properties	Theory: Structure of Low-lying States	Summary: Experiment	
16:10	<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>
17:00	Intro Strategy	Experiment: Single Particle Trends towards the Next Shell Gap	Chemistry Instrumentation	Summary: Instrumentation
18:00	Wrap up discussion	Wrap up discussion	Wrap up discussion	Wrap up discussion
				<i>end of the workshop</i>

Convenors

Theory

W. Nazarewicz Knoxville, U.S.A.
D. Vretenar Zagreb, Croatia

Experiment

R.-D. Herzberg Liverpool, U.K.
C.E. Düllmann Mainz/Darmstadt, Germany

Instrumentation

J. Uusitalo Jyväskylä, Finland
C. Stodel Caen, France

Discussion Leaders

D. Ackermann Darmstadt, Germany
K. Morita Tokyo, Japan
P. Greenlees Jyväskylä, Finland
K. Hauschild Orsay, France
A. Türler Bern, Switzerland
J. Roberto Oakridge, U.S.A.
H. Nitsche Berkeley, U.S.A.

Invited Speakers:

A. Afanasjev Mississippi State, U.S.A
M. Bender Bordeaux, France
M. Block Darmstadt, Germany
Rod Clark Berkeley, U.S.A.
P. van Duppen Leuven, Belgium
H. Feldmeier Darmstadt, Germany
P.H. Heenen Brussels, Belgium
F.P. Heßberger Darmstadt, Germany
M. Leino Jyväskylä, Finland
A. Lopez-Martens Orsay, France
W. Loveland Oregon State, U.S.A.
Y. Nagame Tokai, Japan
Yu.Ts. Oganessian Dubna, Russia
V. Pershina Darmstadt, Germany
H. Savajols Caen, France
M. Stoyer Livermore
A. Yakushev Darmstadt, Germany
V. Zagrebaev Dubna, Russia

Venue

The [Conference&Sports Hotel Erbismühle](http://www.erbismuehle.de/e/) (in English: <http://www.erbismuehle.de/e/>) is located in a nice valley, the *Weital*, in the *Taunus hills* about 50 km north of Frankfurt (50 km to Frankfurt main station and 55 km to Frankfurt airport) close to the *village Weilrod* in the centre of Germany. The hotel itself offers a discrete wellness installation with among others an indoor pool, finish sauna, vapour sauna, fitness room. Apart from various sport activities possible at the hotel, the surroundings of the hotel are ideal for shorter and longer hiking tours in the natural environment of forest, hills, the little river *Weil* with its meadows and panoramic views.

The *Taunus hills* have formed the northern border of the Roman Empire and traces of it can still be visited today like the rebuilt Roman Castle *Saalburg* together with a few meters of the *limes*, the Roman border installations and defence line against the barbarians north of it. The hills form the central area of the state of *Hessen* and close to the workshop site the open air museum *Hessenpark* presents more than 400 years of rural life in *Hessen*.

Registration and Room Reservation

Registration will open on the 1st of March **2012** on the FUSHE 2012 webpage:

<http://www.ensarfp7.eu/workshops/fushe2012/registration>

There is no registration fee. Full board food will be provided. The cost for the lodging has to be paid by the participants directly to the hotel at the workshop. The cost per person, room and night are:

Single occupation:	€ 90,95
Double occupation:	€ 58,85

Rooms are available for about 50-70 participants and have to be booked via the registration form (see above).

Registration deadline: Sunday, April 15th

Support

A contribution to the travel expenses will be available for a limited number of for students and people in need of support. The respective request can be stated in the registration form. People in need of support should send an informal request by email to the conference email address: fushe2012@ganil.fr.

Travel information

By plain:

You arrive at **Frankfurt International Airport Rhein-Main**. From there you take a Taxi (see taxi information below) or use the shuttle service provided by the workshop organisation.

By train:

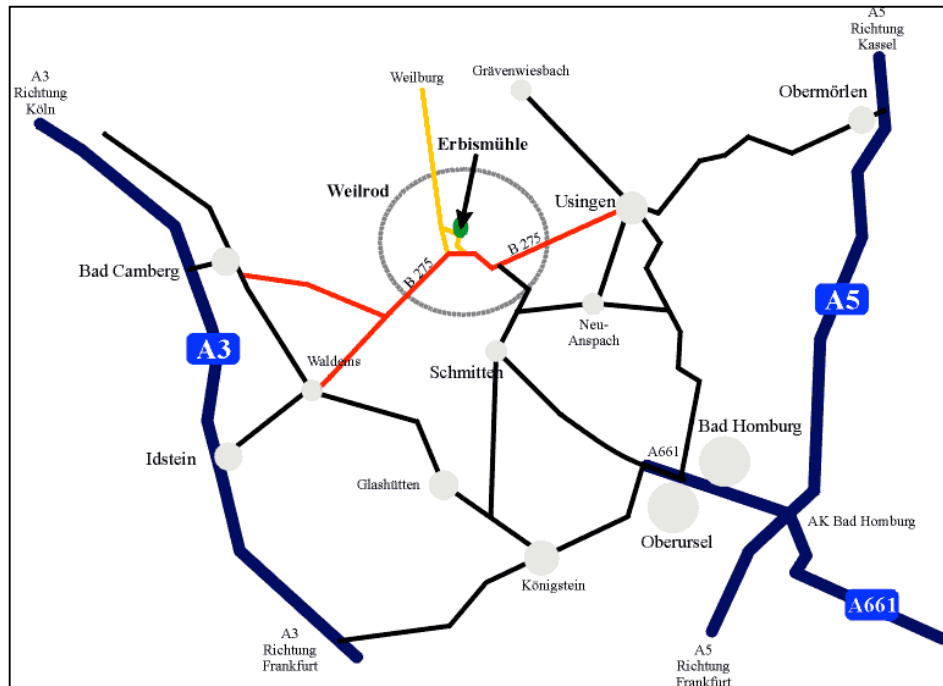
Arriving at Frankfurt main station you take a taxi (see taxi information below) or take the train S8 or S9

<http://www.ensarfp7.eu/workshops/fushe2012/>

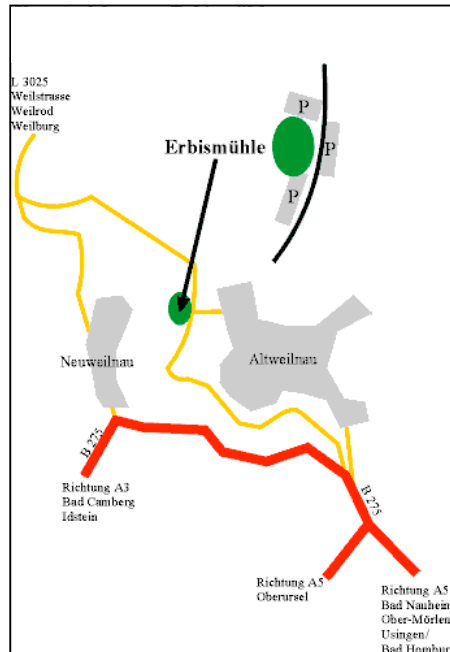
(10 min ride every 15 min) to the airport and use the shuttle service provided by the workshop organisation.

By car:

From highways A3 and A5:



More detailed view:



Shuttle service:

A shuttle service is provided from Frankfurt International Airport to the conference site. The shuttle departs from airport exit B6 on the arrival level (downstairs)

On Sunday, May 13th 2012, 12:00 h.

The return shuttle service is provided from the conference site to Frankfurt International Airport

On Wednesday, May 16th 2012, 18:00 h.

These dates might be adopted according to the information you provide us at registration.

Updated information will be posted on the workshop's webpage

Taxi:

There is a Taxi service collaborating with the hotel providing airport transfer at a cost of € 80,-:

Taxi Wolf

Tel.: +49 (0)6081/2851

Fax: +49 (0)6081/129160

You can order the taxi beforehand by phone or fax.

Organising Committee

D. Ackermann (chair – GSI)
D. Boilley (co-chair – GANIL)
Ch. Stodel (scientific secretary – GANIL)
B. Avez (CENBG)
M. Block (GSI)
O. Dorvaux (IPHC)
P. Greenlees (JYFL)
K. Hauschild (CSNSM)
D. Jacquet (IPNO)
K. Jadambaa (GSI)
E. Litvinova (GSI)
R. Lozeva (IPHC)
Yu.Ts. Oganessian (JINR-FLNR)
B. Sulignano (IRFU)

Advisory Committee

M. Bender	CENBG, Bordeaux, France
J.P. Delaroche	CEA, Bruyères le Chatel, France
A. Drouart	IRFU, Saclay, France
J. Dudek	IPHC, Strasbourg, France
K. Eberhard	U. Mainz, Germany
H. Haba	RIKEN, Wako, Japan
P.H. Heenen	U. Brussels, Belgium
R.-D. Herzberg	U. Liverpool, U.K.
F.P. Heßberger	GSI, Darmstadt, Germany
T.L. Khoo	ANL, Argonne, U.S.A
H. Koura	JAEA, Tokai, Japan
M. Leino	U. Jyväskylä, Finland
K. Morita	RIKEN, Wako, Japan
W. Nazarewicz	U. Knoxville, U.S.A.
H. Nitsche	UC Berkeley and LBNL, USA
Yu.Ts. Oganessian	JINR-FLNR, Dubna, Russia
V. Pershina	GSI, Darmstadt, Germany
H. Savajols	GANIL, Caen, France
A. Sobczewski	U. Warsaw, Poland
Ch. Theisen	IRFU, Saclay, France
A. Türler	PSI, Villigen and U. Bern, Switzerland

J. Uusitalo
A. Wieloch
A. Yakushev
V. Zagrebaev

U. Jyväskylä, Finland
U. Cracow, Poland
GSI, Darmstadt, Germany
JINR-FLNR, Dubna, Russia

Contact

Workshop email address

fushe2012@ganil.fr

Other contacts:

Dieter Ackermann (Chair): D.Ackermann@gsi.de
David Boilley (Co-chair): boilley@ganil.fr
Christelle Stodel (Scientific secretary): christelle.stodel@ganil.fr

Secretaries:

Ms. Siglind Raiß: s.raiss@gsi.de
Tel.: +49-6159-71-2412

Ms. Tatjana Litvinova: t.litvinova@gsi.de
Tel.: +49-6159-71-2047
Fax: +49-6159-71-2902.

Webpage

<http://www.ensarfp7.eu/workshops/fushe2012/>

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