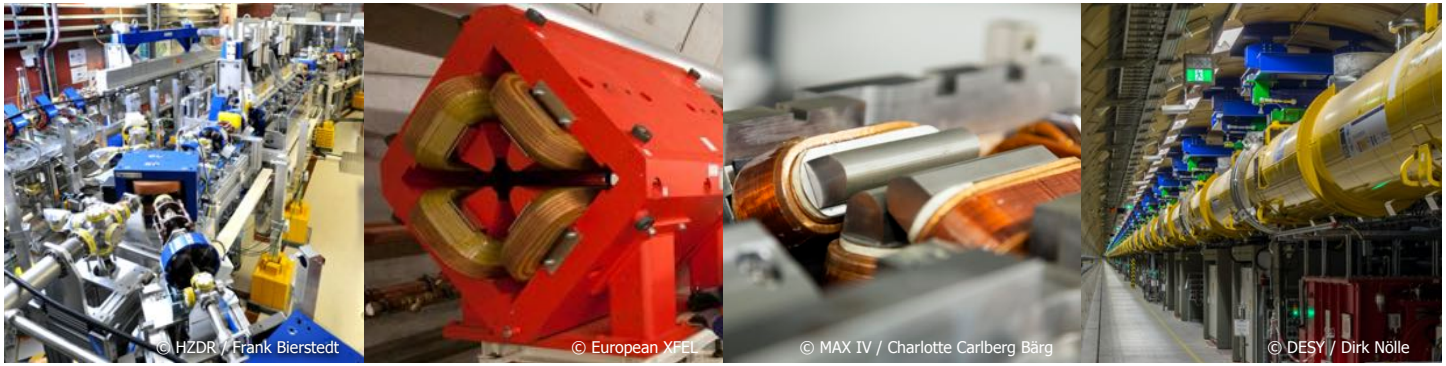


CALIPSO^{plus} HIGHLIGHTS 2017-2019

www.calipsoplus.eu

Publishing & Contact Information

Published by
Helmholtz-Zentrum Dresden–Rossendorf e.V. (HZDR)
Bautzner Landstr. 400
D-01328 Dresden

Editors:

Dr. Barbara Schramm
Dr. Mandy Grobosch
Dr. Katrin Schultheiss

Printing: Druckerei Missbach

Print run: 1000 copies
Last amended: September 2020

Contact:

Prof. Manfred Helm | Dr. Barbara Schramm
Helmholtz-Zentrum Dresden–Rossendorf e.V. (HZDR)
Bautzner Landstr. 400
D-01328 Dresden

Further information:

www.calipsoplus.eu

Table of Contents

PREAMBLE

CALIPSO^{plus}
– an EU project, an Integrating Activity for Advanced Communities –
Why this brochure?

May I introduce myself? My name is CALIPSO^{plus} – Convenient Access to LIght sources oPen to innovation, Science, and to the wOrld. I'm an EU project, funded from Horizon 2020, the European Framework Programme for Research and Innovation. To be more specific: I'm not just one of these standard collaborative projects, no, I'm an Integrating Activity for Advanced Communities, maybe even one of the last ones ever.

Well, my antagonist replies, and so what? EU projects, there are many of them, aren't there? That's a way for researchers to acquire money for funding basic research, activities nobody apart from them is interested in.

And Integrating Activities, they are the former I3-projects from the 7th framework programme of the EU – or aren't they even dating back to FP6? And "Advanced Communities" – doesn't that speak for itself? So, what justifies yet another brochure? This hypothetic debate reflects the conflicting thoughts a reader might have when opening this brochure.

Nonetheless, the CALIPSO^{plus} consortium decided to compose this brochure and has arguments for that.

The funding scheme supporting provision of trans-national access to national and European research infrastructures and funding joint research and networking activities with the sole aim to improve the quality of support provided to users is undoubtedly one of the big success stories of EU research funding.

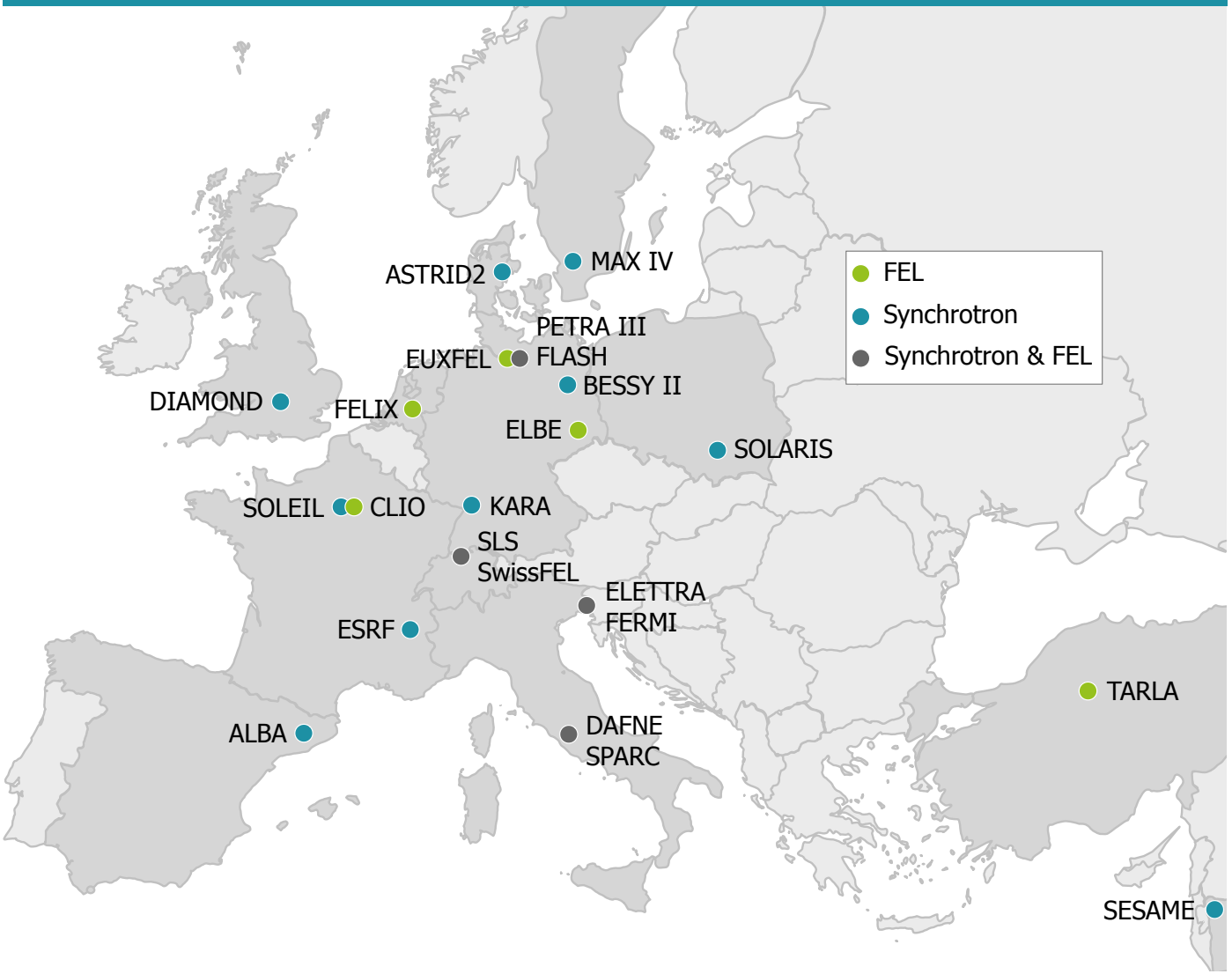
Still, the goals have not been reached yet. The striking imbalance between the number of users from the various countries in Europe persists, even though we talk about one European Research Area (ERA). Facilities continue to be competitors when it is about technological upgrades, and viewed up closely, there are as many access procedures to the big user facilities as there are facilities in Europe. The present political landscape of Europe suggests that there is a pressing need for collaboration, mutual trust, and further integration. So, there are still challenges to be tackled and it is time for smart new approaches. CALIPSO^{plus} has embarked on some new avenues without abandoning what has proven to be successful.

The aim of this brochure is to provide a kaleidoscope of glimpses of the multiple activities, successes, and achievements which constitute the CALIPSO^{plus} project.

Enjoy reading or flicking through!

CALIPSO^{plus}
PROJECT MANAGEMENT

CALIPSO^{plus} – THE CONSORTIUM



Members of the CALIPSO^{plus} consortium which brings together 19 partners, including 14 synchrotrons and 9 FELs in Europe and in the Middle East.

A Bit of History

CALIPSO^{plus} is an Integrating Activity for Advanced Communities proposed at the time of the call INFRAIA-01-2016 (Material Sciences and Analytical Facilities / Synchrotron Radiation Sources and Free Electron Lasers) of Horizon 2020, the European Framework Programme for Research and Innovation. The project receives funding under Grant Agreement No 730872.

For many areas of cutting-edge research and technology, access to synchrotrons and free-electron laser (FEL) facilities is vital and cannot be replaced by the use of smaller and less-expensive laboratory-scale radiation sources.

A strength of Europe is the unique density of these research infrastructures creating an excellent environment for disruptive research and ground-breaking technological developments. However, the substantial investments required to build these facilities and the continuously high operation costs have resulted in their unequal distribution in Europe, with a high concentration in western Europe, rapidly fading away towards the newer member states. Realisation of the European Research Area (ERA) requires not only opening these facilities for all European users from academia and industry, but also removing all barriers for access and realising equal use by researchers from all regions of Europe. At present, the potential of accelerator-based light sources is still largely underexploited, in particular, by users from newer member states, from new research fields, and from industry and small and medium enterprises (SMEs).

The aim of CALIPSO^{plus} is to leverage the potential that accelerator-based light sources represent for Europe. To this end, CALIPSO^{plus} brings together all major synchrotrons and FELs in Europe, also reaching out to neighbouring countries by including the TARLA FEL in Ankara, Turkey, and the synchrotron facility SESAME in Allan, Jordan, to offer trans-national access to their facilities free of charge and even covering the travel expenses of the users.

The provision of trans-national access is complemented by strong activities aiming at creating a most favourable user environment at the facilities and by awareness-raising campaigns as well as support and training measures, tailor-made to specific target groups.

In addition, recent challenges facing Europe are tackled in the framework of CALIPSO^{plus} such as the management of the exponentially increasing amount of data, the need to boost innovation in order to sustain the economic competitiveness of Europe, and investigating routes to ensure sustainability of the achievements resulting from European-funded projects.

To cope with the ever-increasing amount of data resulting from experiments at modern research infrastructures, a demonstrator for remote data analysis using most common software tools is being developed. In collaboration with European manufacturers of ultra-high quality X-ray mirrors, metrology of surface roughness of those mirrors is being pushed to the limits set by nature, to enable the production of mirrors that meet the highest requirements of today. In parallel, procedures to monitor the X-ray beam with a correspondingly high resolution are being established.

CALIPSO^{plus} – Facts & Figures

The aim of the CALIPSO^{plus} project is to remove barriers for access to world-class accelerator-based light sources in Europe and in the Middle East. To this end, more than 82,500 hours of trans-national access to these research infrastructures are provided in the framework of this project and specific programmes are in place to teach new users how to successfully work at synchrotrons and free-electron lasers. Dissemination activities targeting industry are complemented by tailor-made support and access programmes for this user group. In parallel, the consortium is collaborating on constantly developing technologies to keep the facilities at the cutting edge.

Project funding

The CALIPSO^{plus} consortium involves 19 partners and collaborates on four networking and two joint research activities. The project is coordinated by HZDR (Germany) and funded with 10 M€ over a period of four years.

Trans-national access

After two years, by midterm, CALIPSO^{plus} has already provided more than 150 % of the promised trans-national access. More than 1900 user visits from over 40 countries worldwide have been supported in this way.

Support programmes

CALIPSO^{plus} offers different support programmes for users such as a Twinning Programme and an Open Access Publication Support Programme. In addition, CALIPSO^{plus} has piloted a trans-national access programme solely dedicated for small and medium enterprises.

Dissemination, Training & Twinning

Research, development, and higher education as motors for a socially and economically balanced Europe

The last decades have been marked by a steep increase in integration and cooperation between members of the EU. As a whole, the region has benefitted from more evenly distributed participation and economic growth, both cause and consequence of a tightening of European ties. Despite tremendous achievements, the fragility of these ties and the complexity of the regional challenges affecting Europe have been made very clear in the wake of recent events. Regions in the south-eastern parts of Europe seem particularly vulnerable to threats of economical nature, which tend to spill over and create social unsettlement and exacerbate social inequalities.

In "Europe 2020 – A strategy for smart, sustainable and inclusive growth", released in 2010, the European Commission showed that the EU had the capability to "deliver smart, sustainable and inclusive growth, to find the path to create more jobs and to offer a sense of direction to our societies". Nevertheless, overcoming the challenges that the financial crisis has brought forth would depend on collective action.

Smart growth, one of three mutually reinforced priorities of Europe 2020, called for the development of an economy based on knowledge and innovation as a motor for future growth, for quality jobs and for successfully addressing global societal challenges. Nevertheless, the asymmetry across the EU in terms of research and development (R&D) has not subsided. Consequently, there is a higher concentration of employment opportunities and human resources in science and technology in north-west Europe. Fostering knowledge and resource transfer throughout the territory and levelling access to research infrastructures and to scientific opportunities is key to boosting human capital and education in the EU regions that still exhibit growth potential. This will remain a challenge in years to come.

CALIPSO^{plus} focuses particularly on improving transnational cooperation and distribution of knowledge. Targeting EU members with an underdeveloped research infrastructure landscape, project aims at raising awareness of the scientific opportunities available to all researchers on a European rather than solely national level. Direct action is taken by visiting major universities and research institutes, where seminars, lectures, and topic-tailored tutorials are given in person. Stars on the map indicate universities and research institutions that were visited in this context.

A further instrument of integration is the Twinning Programme. Analysing the fraction of users of large research infrastructures by country of affiliation reveals a striking imbalance between the older EU member states and the newer ones, often referred to widening countries. This not at all originates form a lower scientific performance of researchers from these countries but, to a large extent, from the lack of knowledge on how to get access to the infrastructures. CALIPSO^{plus} strives to counteract this imbalance and has set up the Twinning Programme by which newcomers to the research facilities have the opportunity to shadow an experienced group which hosts them during one experimental campaign at a large scale facility. The guest researcher enjoys a first-hand experience that has proven invaluable when venturing into these facilities with their own scientific projects. The costs for travel and accommodation of the trainee are covered from the project and, as an incentive, equally for one of the scientist from the hosting team. Up to now, more than 15 teams from 7 countries have participated in the Twinning Programme.

Stars indicate visits at universities and research institutions in the framework of CALIPSO^{plus} to present the European light source infrastructure and its possibilities.

Twinning – Why I Applied For it And What My Expectations Were

Interviews with Cristina Coman and Leandar Litov, both from the Balkan region, who were among the first ones to participate in the Twinning Programme. They shared their experience at the International Day of Light event at the first CALIPSOplus Annual Meeting in 2018.


© Cristina Coman

Cristina Coman, post-doctoral researcher at the University of Agricultural Sciences and Veterinary Medicine in Cluj-Napoca, Romania.


© Leandar Litov

Leandar Litov, full professor in the Atomic Physics Department at the University "St. Kl. Ohridski" in Sofia, Bulgaria, and member of the CERN council.

Please introduce yourself. What is your professional background? What did you study and where?

Cristina:

My areas of interest are life sciences and chemistry. I hold a lecturer position at the Faculty of Food Science and Technology at the University in Cluj-Napoca. I earned a BA in chemistry, a MSc. in applied chemistry, and a master in food science. Later my background became more and more interdisciplinary. I started a PhD in Lund, Sweden, where I was introduced to the world of synchrotron radiation science, nanoscience, and surface science.

Leandar:

I am a physicist. My scientific work is concentrated in the field of particle physics. I worked at different locations, including CERN, carrying out several experiments in the field of physics that tries to answer two very simple but quite fundamental questions: What are the basic constituents of matter? What are the interactions that control their behaviour at the most fundamental level? My fields of expertise are the design and construction of experimental equipment, Monte Carlo simulations and data analysis, theoretical research in the field of quantum physics, and computer drug design.

You spent a lot of time abroad. What motivated you to go back to your respective home countries?

Cristina:

I have always had a strong connection to my home country. When I left, I knew I would go back at some point. Of course, in the end, I was lucky to get a post-doctoral position in my home country.

Leandar:

The main idea has always been to establish a group at the University of Sofia, and this is what happened.

How did you learn about the Twinning Programme? Why did you join?

Cristina:

CALIPSO^{plus} members presented the programme at my university. I heard about it from my colleagues who attended the presentation. It all sounded very interesting and I put myself in contact with the team.

Leandar:

Free electron lasers allow us to study molecules, which is what we are working on now.

Senior scientists in eastern European countries frequently complain about the lack of students and young scientists as many students leave the country to study abroad but do not come back afterwards. Would you confirm this observation from your own experience?

Cristina:

Yes, many young Romanian scientists end up staying abroad. Unfortunately, I do not have any official statistics to share with you. However, in my personal opinion, there are still very dedicated and hardworking scientists who decide to stay in Romania. Some are lucky enough to be part of competitive groups with good infrastructures and internationally visible results. Many others, however, lack the financial support to be able to prove what they are capable of.

Leandar:

Unfortunately, this is true. From my personal experience, I can tell you that out of 45 students, that I supervised for their master thesis, only 6 are currently working in Bulgaria. The reason could be the lack of attractive working conditions.

In my opinion, three very important situations enable people to stay: You have to create the environment for complete realisation of their potential, which is especially important for scientists, you have to work at the cutting edge of most interesting research and, finally, you have to be able to provide a decent salary.

We are trying to do our best to improve the situation but the main issue is that there is no infrastructure facility. Therefore, we are looking at the possibility to build international research infrastructures in the Balkan region. For example, a project to build a hadron therapy centre for biomedical research has recently been approved.

Do you already have a strategy on how to share your newly acquired knowledge with students or senior scientists in your university or even beyond? Could you imagine acting as a contact person or consultant for new Romanian / Bulgarian synchrotron users?

Cristina:

I would like to share this experience with the people at my university and other collaborators.

Leandar:

Yes, of course, we will share this experience in Bulgaria. What I particularly like about this project is that you can start from zero as the hosting facilities provide complete training.

One of the treasures of Europe is its diversity in landscapes and cultures. What would be your personal recommendation to a tourist travelling to Romania / Bulgaria? Which regions or sites should he or she absolutely visit?

Cristina:

In the northern region of Romania, close to the border to Hungary and Ukraine, tourists are attracted by the many traditional wooden churches. The Danube delta offers a great biodiversity. Nature lovers will find a variety of hiking itineraries, while history lovers will love the many castles, including the well-known Dracula Castle in the Transylvanian region.

Leandar:

Definitely the Black Sea in summer; in winter, there are several beautiful ski resorts in the mountains. Culturally, Bulgaria has many archaeological sites and a great number of castles.

Curious about the Twinning Programme?

More information can be found at

www.helmholtz-berlin.de/user/prepare-your-beamtime/access-and-support/support-programmes/index_en.html

HERCULES SCHOOL AT SESAME

Higher European Research Course for Users of Large Experimental Systems

For two weeks in late October 2019, SESAME hosted the OPEN SESAME HERCULES School. Its objective was to give a comprehensive overview on the broad basics and techniques of synchrotron radiation as well as applications in the fields of materials science, cultural heritage, physics, chemistry, biology, biomedicine, structural biology, and environment.

Organised by SESAME in cooperation with ESRF and the Université Grenoble Alpes, this school was funded by the EU within the OPEN SESAME project (Horizon 2020 project under grant agreement n.730943).

The programme, following the principles of the HERCULES schools, included detailed tutorials about theoretical and experimental aspects of X-ray absorption spectroscopy, infrared spectroscopy, soft X-ray spectroscopy, powder and single crystal diffraction, macromolecular crystallography, small-angle X-ray scattering, and X-ray imaging and tomography. In small groups, the participants also got first hands-on experience in practical sessions at the SESAME beamlines. The lectures were given by leading scientists working at SESAME, European synchrotrons and international research institutes.

The school provided an excellent occasion for transferring knowledge to the user communities emerging around SESAME to fully exploit the brightest X-rays of the Middle East. It was also a good opportunity for the young scientists to mingle together and exchange ideas. All participants actively participated, not only during the lectures but also in extra-curricular social events.

During the final evaluation session, a very positive feedback has been received. All students agreed that the school gave them the opportunity to improve their knowledge about synchrotron techniques, that the learning and teaching methods encouraged participation, and that the overall environment of the school was conducive to learning.

Some thoughts of the participants:

- It was a good thing having participants from different research fields and different nationalities. This inspired me to think out of the box and consider different techniques for my experiments.
- This was a well-organised training that would need to be organised on a yearly basis to help our young scientific community to grow!
- Thank you for the essential financial support and for bringing together the best speakers from different synchrotron facilities worldwide!
- Participants were from different research areas. Therefore, we will have the opportunity to collaborate with each other in the future for multidisciplinary research plans.

All of the students expressed the wish for more schools like this and commented that the event represented a good occasion to meet and network with researches coming from different cultures and backgrounds as well as with the scientists that form part of the staff of SESAME. Indeed, the school provided an excellent platform to discuss new ideas and future research collaborations. The participants stated their firm intention to participate in SESAME's future calls for proposals for beamtime in order to return to SESAME to profit from the high-performance synchrotron techniques for their research plans.

This format of the "HERCULES School on tour" has likewise been adopted by CALIPSO^{plus}. A first school of this format took place in Krakow, Poland at the synchrotron facility SOLARIS. Additional schools will be organised in the Balkan region as well as at the TARLA facility in Ankara, Turkey.

Why Having Your Head in the Clouds Could be a Really Good Thing

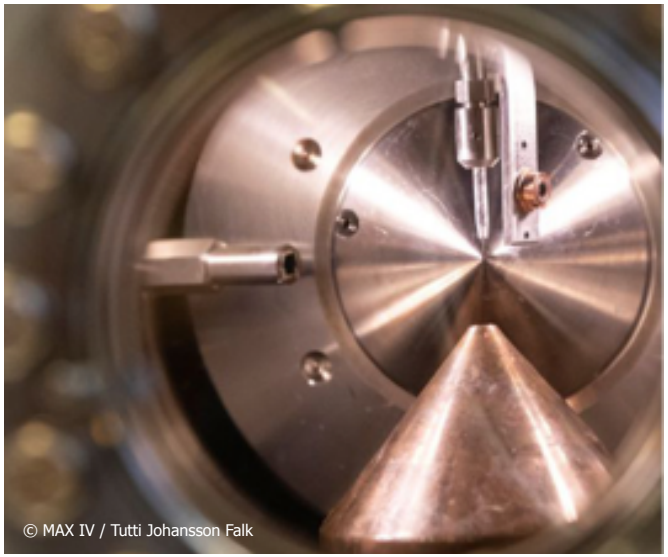
Science at MAX IV

When simulating the climate, scientists use theoretical models. For these to be accurate, they need to know many parameters, among them the cooling effects of clouds. The ATMOS research group, led by Nønne Prisle, studies the chemical composition and atmospheric effects of nanoparticles that lead to the formation of clouds.

Using a liquid jet at the beamline HIPPIE, the team around Nønne Prisle measures the composition and structure of nano-size aerosol particles that are everywhere in the air. When water in the gas phase condenses on the surface of these particles, tiny droplets form and give rise to clouds. The diameter of the jet is 20 micrometres, which is 20 to 200 times thicker than the droplets that are found, but still only about a quarter of the diameter of a single hair. HIPPIE acts as a super microscope enabling the identification of every single molecule.

The only thing that can slow climate change down is to stop the emission of CO_2, Nønne Prisle is very clear on that. If we want to counteract climate change, we need to know what's going on in the clouds since these processes could be critical. Clouds screen the earth from sunlight and, thus, have a cooling effect. Thereby, they generally counteract global warming induced by CO_2. But clouds are short-lived, whereas CO_2 and other greenhouse gases stay in the atmosphere for decades or centuries. If the cooling effect of clouds had been estimated wrongly, the impact of CO_2 could be even stronger than scientists currently believe.

To get a more holistic view of nanoparticles and clouds, which so profoundly impact the climate of our planet, the ATMOS team plans to do more experiments at several beamlines at MAX IV – FinEstBeAMS (XPS), HIPPIE (XPS), Veritas (RIXS), Species (AP-XPS) and FlexPES (XPS).



Liquid jet at the beamline HIPPIE.

Nønne Prisle, associate professor of Nanoparticle Physics and Surface Chemistry at the University of Oulu, Finland.

Fast Current-Induced Dynamics of Skyrmions in an Ultrathin Pt/Co/MgO Film

Science at ALBA

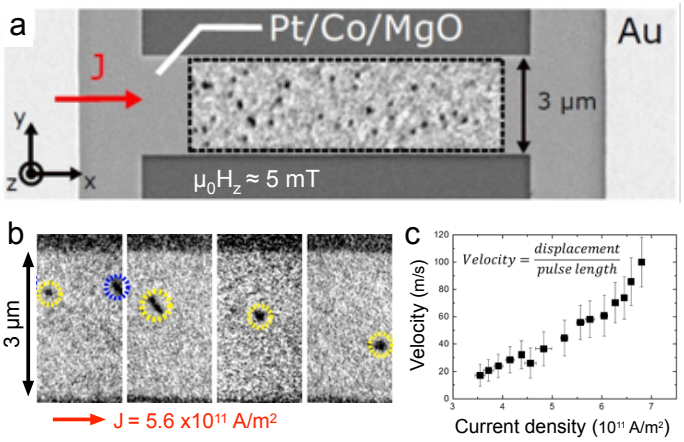
Magnetic skyrmions are fascinating spin textures which have recently attracted considerable attention. Their peculiar topology and nanometre size conferring them quasiparticle-like properties combined with their ability to be moved by means of an electrical current make them promising candidates to store and manipulate information.

Magnetic skyrmions are envisaged to be information carriers in racetrack memories and logic devices, combining high density, thermal stability and high data flow.

Among the different types of materials hosting skyrmions, ultrathin sputtered films composed of heavy metal/ferromagnet multi-layered stacks combine the most interesting features. Their structural inversion asymmetry associated with the large spin-orbit coupling of the heavy metal is a key ingredient for skyrmions to be stable and ensure their homo-chirality. In addition, the current-induced spin-orbit torques in these systems are expected to provide an efficient way to drive skyrmions.

Photoemission electron microscopy combined with x-ray magnetic circular dichroism (XMCD-PEEM) is a unique technique for the observation of magnetic skyrmions due its combination of high lateral spatial resolution (down to 30 nm) as well as element and surface sensitivity. In a recent beamtime, the team around Olivier Boulle studied in detail the dynamics of magnetic skyrmions induced by current pulses in a track geometry. They demonstrated that fast (>100 m/s) current-induced motion can be achieved in these stacks. The experiments also show that the dynamics of skyrmions is significantly affected by local defects in the materials, such as grain boundaries, leading to non-deterministic dynamics.

The results shed light on current-driven skyrmion dynamics in ultrathin films and pave the way for the development of low-power skyrmion-based applications.



a. Scanning electron micrograph (SEM) of the studied device which consists of a 3-µm-wide Pt/Co/MgO track contacted with Au pads for current injection. A XCMD-PEEM image (black dashed rectangle) is superimposed on the SEM with black dots showing isolated skyrmions in the track. b. Sequence of XCMD-PEEM images showing the movement of a skyrmion (yellow circle). Each image was acquired after a single, 11-ns-long current pulse. c. Skyrmion velocity as a function of the current density.

R. Juge et al. Phys. Rev. Appl. 12, 044007 (2019)

Olivier Boulle, research scientist working in the Spin Orbitronics group at CNRS, Spintec in Grenoble, France.

Nanoscale Structural Evolution in Electrochemical Energy Storage

Science at ELETTRA

Elettra Sincrotrone Trieste

© Elettra Sincrotrone Trieste / Gabriele Crozzoli

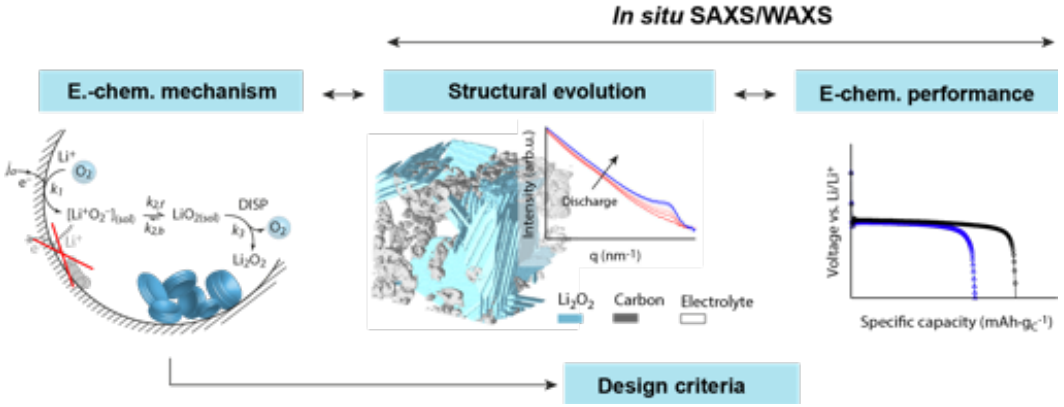
Reducing the ecological and economic footprint of electrochemical energy storage requires storage concepts beyond classical intercalation-type Li-ion batteries.

Among the possible alternatives, supercapacitors and conversion-type batteries (Lithium-air and Lithium-sulfur) are of great interest due to the wide range of covered energy and power densities as well as the environmental friendliness, abundance, and low cost of the involved materials.

The properties and function of these increasingly complex electrochemical systems are not only rooted in the chemistry but at least as much in their structure all the way from atomic to micron scales. Currently, the lack of suitable in situ methods for characterisation impedes progress in these emerging energy storage systems. In his research, Christian Prehal tries to tackle this gap by developing in situ scattering methods, synergistically combined with atomic/nanoscale modelling to visualise and quantify the structural evolution upon electrochemical cycling.

Key contribution of Christian Prehal's PhD thesis in the group of Oskar Paris at Montanuniversität Leoben, Austria, was to establish in situ small angle X-ray scattering and X-ray transmission to elucidate processes central for capacitive energy storage in supercapacitors: ion exchange, structural rearrangement, and interactions with nanoporous carbon hosts.

As a postdoc, he is currently expanding this method to lithium-air batteries. He is studying the reversible structural evolution of lithium peroxide crystallites (the active material) and its relation to underlying mechanisms and properties: "Results of our previous works demonstrate the necessity of demanding in situ experiments only available at international large-scale research facilities, such as synchrotron radiation sources."



Quantification of relations between structure, performance and mechanisms in emerging electrochemical energy storage systems, such as lithium-air batteries or supercapacitors.

C. Prehal et al. Nat. Commun. 9, 4145 (2018)

Christian Prehal, postdoc in the young investigator group of Stefan Freunberger at the Graz University of Technology, Austria.

Infrared Ion Spectroscopy – New Possibilities for Molecular Level Insights in Health

Science at FELIX

FELIX
Free Electron Lasers for Infrared eXperiments

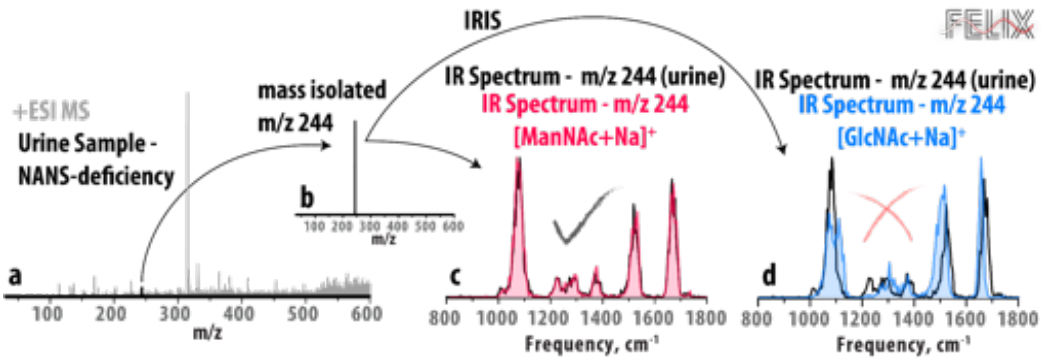
© Radboud University / Joeri Borst

The human metabolome is an extremely complex collection of tens of thousand types of small molecules in the body. It includes both endogenous (naturally occurring, such as vitamins, sugars, amino acids, etc.) as well as exogenous compounds (arising from drug treatment, food consumption, environmental exposure, etc.). The characterisation of the human metabolome is a challenging and extremely complex analytical task. Its successful interpretation opens the possibility to obtain a fingerprint on the clinical state of an individual at a specific point in time and bears enormous potential for improved diagnostics and novel treatment strategies for hundreds of genetic diseases. The approach to decipher the human metabolome, that is discussed here, can easily be applied for all kinds of diagnostics, e.g., for screening newborns.

At FELIX, Jonathan Martens and colleagues developed a technology that combines the extreme sensitivity of mass spectrometry with the ability to spectroscopically identify molecular structures – a novel workflow integrating a chromatographic separation method, mass analysis and detection and, ultimately, spectroscopic structural identification. In recent years, this technique of infrared ion spectroscopy (IRIS) has emerged as the missing link between metabolite profiling and the identification of molecules.

Using a tuneable infrared laser, the IR fingerprint of chromatographically and mass-separated ions are measured directly inside a mass spectrometer. Since the molecular vibrations, that give rise to the infrared spectrum of a compound, can be accurately and readily calculated using well-established quantum chemistry software, there is no need for physical reference standards making infrared spectroscopy particularly appealing. Due to the inherent complexity of organic chemistry, the number of structural isomers that must be considered often stretches well beyond the availability of commercially or synthetically available reference compounds.

Combining the best of two worlds to get a deeper understanding of metabolic diseases, the researchers at FELIX aim at transferring their knowledge to diagnostics and patient care in clinics.



Experimental approach combining mass spectrometry with infrared laser spectroscopy (IRIS). Full +ESI mass spectrum of a urine sample from a patient with NANS-deficiency. The IR spectrum measured for mass isolated m/z 244 is (black) overlaid with two reference measurements (red and blue) giving a clear molecular ID.

J. Martens et al. Analytica Chimica Acta 1093, 1-15 (2019)

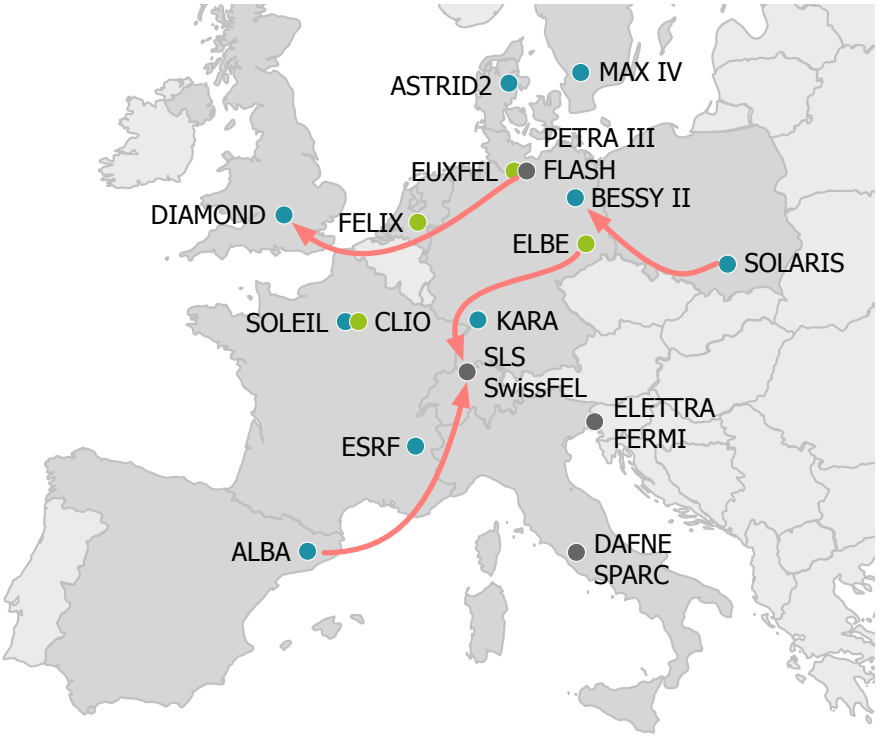
Jonathan Martens, research scientist at the FELIX infrared free electron laser laboratory and at Radboud University, Netherlands.

Empowering Users and Staff Members to Exploit the Full Potential of Research Infrastructures

The technical installations and the staff running the machines are equally important when it comes to assessing the quality of research infrastructures. A facility at the technological cutting edge will never exhibit the best performance, if it is not operated by well-trained and motivated staff.

Sadly, this is often neglected. CALIPSO^{plus} has initiated a programme for staff exchange, inviting technicians, engineers, IT-experts, user office staff, and other employees involved in operating a user facility to identify a suitable partner from within the consortium and to visit the colleague holding a position similar to his or her own. The visit provides the opportunity to share best practices, to exchange knowledge and experience, and to meet colleagues in similar positions in other places. The costs for travel and accommodation for a visit of around three days is covered by the project.

Up to now, four visits have taken place as indicated by arrows on the map. After their return, the participants were asked to provide short reports, which are published on the CALIPSO^{plus} website. The reports illustrate the enthusiasm of all four beneficiaries about their stay. A particularly nice report shall be shared with the reader of this brochure.



Arrows indicate visits in the framework of the CALIPSO^{plus} staff exchange.

BESSY II – The Big Sister

Do you sometimes wish to have a big sister? A sister who fought the battles with the parents? An intimate, non-snitching friend? For a light source, it is not so much different than it is for you! Some light sources have gathered experience over the years and some are still youngsters. They need to find their own way but sometimes it is a good idea to take a peek.

As a large scale facility, we at BESSY II serve scientific communities and provide expensive infrastructure to a huge number of international researchers. We welcome more than 3000 guests per year and our experience dates back to BESSY I, which started in the 1980ies. We provide 38 experimental stations to our users. Sure enough, there is never sufficient beamtime to accommodate the demand, at none of the light sources in Europe. Hence, a selection has to be made, solely based on the scientific merit of the proposed experiment. This is done by an international committee of reviewers in a Scientific Selection Panel (SSP). The entire selection procedure is rather complex, starting from choosing the reviewers, over organising the review process, to holding the panel meetings, collecting the results and, finally, making a beamtime calendar. 600 proposals, 60 reviewers, 400 beamtime campaigns – all this needs to be administered twice a year.

Playing the role of the big sister, BESSY II was delighted when the youngest sibling, the light source SOLARIS in Krakow, Poland, joined the party. Solaris started user operation with two beamlines in 2018 and is growing ever since. So why not copy the good things, improve the not so good ones and adapt proven methods? In the spirit of exchange programmes within CALIPSO^{plus}, Alicja Górkiewicz, the user coordination officer at SOLARIS, joined the SSP at BESSY II for one and half days in October 2018.


© Helmholtz-Zentrum Berlin

There was time to discuss procedures before and after the SSP, to talk about the role of user coordination, duties, tasks, and the fun of it. During the SSP, Alicja joined the general parts with all reviewers and the social events. But even more importantly she participated in one of the colleges, discussing and assessing the beamtime proposals. There are eight colleges, each one dedicated to a scientific field or group of fields to facilitate an intense and profound discussion of every proposal. This gave Alicja the possibility to follow discussions, see the recording of the results and familiarise herself with the whole sequence of the proposal process; especially since she chose the college closest to the expected science at SOLARIS.

Except from gaining experience and learning-by-doing, networking plays an important role, too. The wonderful news is that some of the reviewers stated that they are happy to contribute to a panel at SOLARIS as well, in particular, since the work of a reviewer is on a voluntary basis and unpaid.

Another delightful outcome of this exchange is an intensified cooperation between BESSY II and SOLARIS, which manifested itself in a return visit to discuss administrative procedures and their implementation, bringing together IT staff and programmers from both facilities.

SOLARIS - The Little Sister

SOLARIS is the youngest synchrotron in Europe. You can easily imagine how hard it was at the beginning when all the adult synchrotrons looked down on it and took it with a pinch of salt. It is not so easy to prove that we are growing up when we only have two beamlines in operation and our older siblings have many more.

At the very beginning, we were lucky to have an older brother – Max IV – who instructed us how to play with the new synchrotron toys which were built in Poland in 2015.

On the other hand, being the youngest sibling also brings about precious privileges: You can ask simple questions about basic stuff and the adults try not to laugh and calmly explain. I (Alicja Górkiewicz) must confess that when I became project manager for establishing the User Office in the first Polish synchrotron in 2017, I felt a little bit lost, so being the youngest turned out to be very helpful.

Not only our synchrotron was built from scratch but also all the procedures of applying for beamtime at SOLARIS needed to be compatible and fitted to the new research infrastructure. Also, in this case, cooperation with older siblings has been priceless. Joining the CALIPSO^{plus} programme was a real milestone for SOLARIS – I received a lot of advice, templates of many useful documents and support. Thinking about people from all Europe, working within the CALIPSO^{plus} project, I feel like they are all my fellow workers.

Also thanks to CALIPSO^{plus} I got the possibility to visit BESSY II, our big sister in Berlin, Germany. I was lucky to come there during the Scientific Selection Panel (SSP) Meeting in October 2018. I not only got the chance to talk to people from the user office but also to

participants of the SSP, who are very experienced, and luckily also very talkative, synchrotron users. Thanks to them I learned about the basic needs of an average user coming to synchrotron to perform an experiment.

I was especially amazed by the GATE system which not only allows users to submit their proposals, but also supports the whole process of the evaluation, informing of the results and establishing the calendar for each beamline. Users from BESSY II confirm that the GATE system is one of the best online platform for synchrotron users. At SOLARIS, we also have a similar toy called DUO (Digital User Office) but it is much smaller than GATE and does not have as many features. I think it is not fair that only the older sibling gets to have the best toys! That's why I invited the IT specialists from BESSY II, who are responsible for GATE, to SOLARIS. They came to Kraków in April 2019 and taught us how to improve our toys.

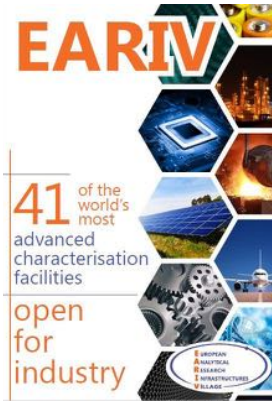
The European synchrotron family is a strong group of high-tech research infrastructures, helpful and supportive to one another. Sometimes there are fights and misunderstandings, like in an ordinary family, but the most important is the fact that we are still learning to cooperate for the development of science.

Catalysing Engagement with European Industry

Industry is a central target for CALIPSO^{plus} – from raising awareness of material characterisation using light sources over catalysing commercial access to building a strategic long-term view, everything to secure more and better industrial engagement for the network to foster European innovation.

Targeting access, the pilot programme Tailor-made for SMEs Trans-national Access (TamaTA) supports small and medium enterprises (SMEs) to access the facilities within CALIPSO^{plus}. Using a single entry portal on wayforlight.eu, SMEs apply for beamtime with a simple form. Applications are assessed rapidly with external experts for scientific feasibility and impact. If a positive review is made, access is granted as fast as possible to one of the participating light sources. So far, a wide range of SMEs have used the support for their R&D needs, from food security detectors over new electronics to high-performance adhesives. TamaTA is supported by networking of the light sources in and beyond their regional innovation ecosystems to promote their capacities for commercial R&D.

In its goal to increase collaborations with industry, CALIPSO^{plus} is far from alone. Bridges to other research infrastructures have been created, paving the way for collaborative initiatives, including a joint Industry Advisory Board and joint outreach. In particular, this has led to the formation of the European Analytical Research Infrastructures Village (EARIV, www.eariv.eu). EARIV is a joint initiative which is led by a team of trans-national Horizon 2020 projects and regional initiatives and promotes opportunities for industry to interact with European large scale analytical research infrastructures. EARIV is a network of eight projects, with 30 analytical research infrastructures spread across Europe, working together to develop a stronger regional integration with industry.



The EARIV initiative brings together a team of research infrastructures that work together to promote industrial R&D using the advanced characterisation, far beyond lab techniques, available at the facilities.

Measures Taken to Unravel the Potential of Light Sources to Industry

CALIPSO^{plus} is dedicating a multi-scale effort to raise awareness among small and medium enterprises (SMEs) and large industries about EU synchrotrons and free electron lasers:

Industrial Liaison Offices Network

Creation of Industrial Liaison Offices at all facilities, to share best practices and face common challenges.

Single Multi-language Portal

Informing industries about the tools available with a multi-language environment in a single portal at www.wayforlight.eu/en/industries

TamaTA Voucher

Lowering access barriers for SMEs by offering free and fast access to the facilities through the TamaTA voucher, including experiment design and data analysis assistance.

Industrial Advisory Board

Taking advantage of an Industrial Advisory Board in collaboration with the neutron sources community.

Xnext, an Italian SME, tested and characterised its new-generation multi-scale detector for quality control in food production at the ESRF using the support of the TamaTA access programme.

Synchrotron Light for Analysing the Amount of Selenium and its Oxidation

TamaTA at ALBA



Samtack, founded in 1988 and based in Esparreguera near Barcelona, Spain, is a manufacturer of glues and adhesives specialised in the sector of graphic arts and packaging. Samtack has developed a new flexible multilayer system, in collaboration with the University of Zaragoza, Spain, and the Complutense University of Madrid, Spain, that contains selenium nanoparticles and is capable to increase food shelf life.

Free radicals are formed spontaneously from oxygen, moisture, and UV radiation and initiate oxidation reactions quickly. As free radicals are very small, they are capable of traversing the plastic layers.

The new multilayer system developed by Samtack contains selenium nanoparticles in one of the layers. These selenium nanoparticles are capable to absorb free radicals and, therefore, to prevent food from oxidation.

However, not all selenium oxidation states are equally capable to absorb free radicals: while selenium nanoparticles in their elemental state (Se0) have a high capacity, other oxidation states (SeIV or SeVI) are not so effective.

The samples studied at the ALBA synchrotron consisted of plastic laminates and solutions with different preparations of selenium nanoparticles to check the amount of elemental selenium and other selenium oxidation states in each sample. The outcome provided Samtack with valuable information to improve the synthesis and production of this new flexible packaging.

THE EUROPEAN SYNCHROTRON AND FEL USER ORGANISATION

ESUO
EUROPEAN
SYNCHROTRON
AND FEL USER
ORGANISATION

The European Synchrotron and FEL User Organisation (ESUO) represents all European photon science users of these facilities.

ESUO's vision is a thriving user community of European synchrotrons and free-electron lasers with equal opportunities of access and participation for all scientists, solely based on the scientific merit of their ideas.

Reaching out to scientists from eastern Europe, ESUO held a first regional workshop in Belgrade, Serbia, on August 28th, 2019. The event was organised as a satellite meeting of the conference Photonica2019.

The aims were to introduce ESUO, to establish contacts with existing and possible future users of synchrotrons and FELs in Europe and to present research studies conducted at these state-of-the-art facilities. In addition, the agenda included scientific talks on research carried out at synchrotrons as well as a presentation of the Twinning Programme of CALIPSO^{plus}.

Two sessions were offered, a first session targeted the conference participants and was held at the Serbian Academy of Sciences and Arts, a second session took place at the Faculty of Physics of the University of Belgrade and was open to the public.

The organisers, in particular Bratislav Marinkovic from Belgrade University, managed to create a welcoming atmosphere, reflecting the attitude of ESUO to any user of the rich offer of accelerator-based light sources in Europe.

www.esuo.eu

Related Initiatives

LEAPS – the League of European Accelerator-based Photon Sources – is a strategic consortium initiated by the directors of the synchrotron radiation and free-electron laser user facilities in Europe. Its primary goal is to actively and constructively ensure and promote the quality and impact of the fundamental, applied and industrial research carried out at their respective facility to the greater benefit of European science and society.

https://leaps-initiative.eu

FELs OF EUROPE is a collaboration of all free-electron laser facilities in Europe, with the goal to meet the technological and scientific challenges of these novel and rapidly developing technologies and to provide a worldwide unique, pan-European research infrastructure that enables exploiting the full scientific potential of these unique accelerator-based short-pulse light sources. The collaboration is an initiative of the ESFRI projects EuroFEL and European XFEL and includes 14 facilities in 10 countries.

www.fels-of-europe.eu

umbrellaID is the federated identity system for the users of the (European) large neutron and photon facilities. Umbrella allows providing these users with a unique, persistent identity which is valid at all partner facilities. It enables users to log in at any of the participating facilities and access the services offered. Once defined, this identity will be valid for the rest of the academic life.

www.umbrellaid.org

wayforlight.eu was created during the FP7 funded project CALIPSO, to offer a single entry point for information about the European synchrotrons and free electron lasers. It was equipped with standardised facilities and beamline data sheets and with a pilot standardised proposal format. During CALIPSO^{plus}, wayforlight is being boosted with an industry dedicated section, an interactive user forum and a standardised proposal format 2.0. Moreover, a new section will offer an overview of the upcoming training possibilities at the European light sources.

www.wayforlight.eu

www.calipsoplus.eu