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Dear Readers,

Welcome to our second issue of the ASCIMAT newsletter, where you will find all the details of the ongoing research collaboration in the field of advanced scintillation materials between the Institute of Physics of the Czech Academy of Sciences (FZU) and its Twinning partners: the European Organization for Nuclear Research (CERN), Institut Lumière Matière - Université Claude Bernard Lyon 1 (ILM- Université Lyon 1), Università degli Studi di Milano - Bicocca (UNIMIB), and Intelligentsia Consultants. The aim is to provide you with recent events information and upcoming activities.

ASCIMAT is funded by the European Commission's Horizon 2020 programme, with an overall aim to boost the scientific excellence and innovation capacity in advanced scintillation materials of the Institute of Physics of the Czech Academy of Sciences (FZU) which will be achieved by implementing a research and innovation strategy focused on three sub-topics:

- 1. Radiation damage and timing characteristics of scintillation materials*
- 2. Material dimensionality influence and characteristics under different excitation modes*
- 3. Defect influence on the transfer stage of scintillation mechanisms.*

During the last few months the ASCIMAT partners have been intensively collaborating and sharing their knowledge through many successful events such as staff exchanges, summer schools, workshops as well as the acclaimed international conference SCINT held in France.

The ASCIMAT project is soon reaching its second anniversary and we are very proud to have the opportunity to share this scientific innovation journey with you.

We hope that you continue to keep up with our updates by subscribing to our website [h2020-ascimat](http://h2020-ascimat).

#### ASCIMAT Team



# SCINT

The ASCIMAT twinning partner CERN (the European Organization for Nuclear Research) organized the [14<sup>th</sup> International Conference on Scintillating Materials and their Applications](#) which was held between the 18<sup>th</sup> and 22<sup>nd</sup> September 2017 in Chamonix, France. For the past 25 years, SCINT has brought together more than 300 experts in inorganic scintillators and their applications, from both industry and academia.

The three day conference covered the following research topics:

- ❖ **Novel scintillators**, including new possibilities offered by the development of nanotechnologies;
- ❖ **Scintillator characterization**, with a special consideration for ultra-fast transient phenomena;
- ❖ **Scintillation mechanisms**, including non- proportionality and new phenomena leading to fast luminescence;
- ❖ **Defect and radiation damage**, in connection with the recent upgrade of particle accelerators;
- ❖ **Scintillator growth and production**. It also includes new structured materials such as eutectic as well as hybrid materials;
- ❖ **Applications of scintillators**: all perspective ones are welcome;
- ❖ **Scintillation detectors and read out systems**, including new technologies.



The exciting scientific program was matched with an equally outstanding social program offered to the participants. Events ranging from tasting regional products to a mountain hike in the *Balcon du Mont Blanc* trail, an art exhibition in the city of Martigny in Switzerland, a guided excursion in the picturesque *Mer de Glace* ice cave and glacier valley of Chamonix and a closing banquet offered the participants a once in a lifetime experience.

- ✓ The [2<sup>nd</sup> summer school](#) on “Advanced scintillating materials” also took place in Chamonix, France between the 14<sup>th</sup> and 17<sup>th</sup> of September as a satellite event within SCINT 2017. During 3 full days, the school gathered experienced lecturers and attendees for talks and open discussions which included:
  - a general introduction to the mechanisms of scintillation with practical aspects
  - an introduction to Photon-Tracking Simulations and some tutorials on Geant4.
  - an overview of photodetectors and an address of the challenges in fast timing and medical applications.

Participants were also encouraged to present their current research and findings to a panel of experts and received supportive feedback.





In its second year, the ASCIMAT project has completed several long term as well as short term staff exchanges between the consortium partners. The results of these activities have been outstanding and the partners will continue to achieve further goals with their collaborations in the final year.

## Staff Exchanges

FZU



CERN



Researchers from FZU spent 82 days in the facilities of their partner CERN receiving training on topics such as: experiments of timing coincidence resolution and ps scintillation decay focused on fast timing applications, light yield measurement at samples of new halides brought from home lab, R&D trends of scintillation materials for calorimetric detectors for future accelerators, radiation damage characterization and related experiments focused on perovskite scintillators etc.

Researchers from CERN on the other hand spent 48 days in the Czech Academy of Sciences and closely worked with their guests in order to plan experiments and samples to be used and evaluate outputs. Some of them received in depth training in diamond layer preparation for photonic crystals, luminescence and radiation damage experiments at low temperatures focused on applications in the field of calorimetric detectors at future colliders, correlation of scintillation characteristics with PET performance etc.



Advanced timing coincidence resolutions set up in CERN laboratory.



New set up for the measurement of temperature dependence of light yield of bulk scintillators in FZU laboratory.

The staff exchanges between these two partners in their second year of collaborations were mainly focused on the following three aspects:

- Education in R&D trends of scintillation materials for calorimetric detectors for future accelerators and medical imaging
- Training in radiation damage and fast timing related experiments for perovskite scintillators
- Knowledge exchange concerning the physical mechanisms and application-focused parameters of the education and training program of Year 2



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## Staff Exchanges (2)

FZU ↔ UCBL-ILM



Secondees V. Jarý and T. Hubáček from FZU at picosecond X-ray set up in UCBL-ILM laboratory.

Researchers from FZU spent 55 days in the facilities of their partner UCBL-ILM receiving training on topics such as: measurements of ps scintillation decay and cathode-luminescence at GaN-GaN nanostructures (multiple quantum wells) prepared in Prague lab as well as scintillation characteristics measurement and techniques for crystal growth from the melt and inspection of their quality.

Researchers from UCBL-ILM spent 68 days in Prague and reviewed the melt growth techniques installed and exploited in Prague and Lyon laboratories. Furthermore, some of them received training on the preparation of nanocrystals from solution, the influence of preparation parameters on luminescence characteristics, comparison of nano-powder, bulk single crystal and bulk ceramic materials of the same composition, photoluminescence and EPR experiments, preparation of tailored diamond films by CVD technology to obtain superfast emission centers etc.



Packed luminescence laboratory at UCBL-ILM in November 2017 after four month break and general building repair.

The staff exchanges between these two partners in their second year of collaborations were mainly focused on the following three aspects:

- Education in crystal growth from the melt, their quality inspection and characterization techniques
- Training in crystal growth and micro pulling down techniques and their characterization including comparison with ceramics and nanopowders of the same composition
- Knowledge exchange in the art of the crystal growth from melt



## Staff Exchanges (3)

FZU ↔ UNIMIB



Secondee M. Buryi from FZU (on the right) in TSL lab at UNIMIB with Anna Vedda and Mauro Fasoli

Researchers from FZU spent 145 days in the facilities of their partner UNIMIB receiving training on topics such as: experiments at low and high temperature thermoluminescence, spectroscopy and Raman spectroscopy as well as advanced chemical analysis for accidental impurities determination.

Researchers from UNIMIB spent 86 days in the Czech Academy of Sciences in Prague and closely worked with their guests in order to discuss the results of radio- and photoluminescence experiments on YAB glasses, conduct radio-luminescence experiments on nanostructured glass ceramics with gallium oxide, compare between bulk samples and thin films, investigate the role of thermal treatments, receive training of electron spin resonance experiments, radio- and photoluminescence experiments on nano-fibers functionalized with pigments, investigated for applications in photodynamic therapy etc.



Newly installed halide micropulling down technology in chemical laboratory of Dept. of Optical Materials in FZU.

The staff exchanges between these two partners in their second year of collaborations were mainly focused on the following three aspects:

- Education in advanced chemical analysis for accidental impurities determination and influence of related trapping states in scintillation mechanism
- Training in techniques for accidental impurity determination in dielectric materials
- Knowledge exchange on strategies of defect engineering for scintillator material optimization.





### **Recent publications**

In its second year, the ASCIMAT team has published 9 joint research papers in international peer-reviewed journals.

#### **FZU-UNIMIB**

- M. Buryi, V. Laguta, M. Fasoli, F. Moretti, M. Trubitsyn, M. Volnianskii, A. Vedda, M. Nikl, *Electron self-trapped at molybdenum complex in lead molybdate: an EPR and TSL comparative study*
- Z. Hu, M. Cao, H. Chen, Y. Shi, H. Kou, T. Xie, L. Wu, Y. Pan, X. Feng, A. Vedda, A. Beitlerova, M. Nikl, J. Li, *The role of air annealing on the optical and scintillation properties of Mg co-doped Pr:LuAG transparent ceramics*

#### **FZU –CERN**

- M.T. Lucchini, S. Gundacker, P. Lecoq, A. Benaglia, M. Nikl, K. Kamada, A. Yoshikawa, E. Auffray, Timing capabilities of garnet crystals for detection of high energy charged particles.
- G. Tamulaitis, A. Vaitkevičius, R. Augulis, P. Bohacek, A. Borisevich, A. Fedorov, V. Gulbinas, M. Korjik, S. Nargelas, M. Nikl, E. Auffray, *Subpicosecond luminescence rise time in magnesium codoped GAGG:Ce scintillator.*
- M.T. Lucchini, O. Baganov, E. Auffray, P. Bohacek, M. Korjik, D. Kozlov, S. Nargelas, M. Nikl, S. Tikhomirov, G. Tamulaitis, A. Vaitkevicius, K. Kamada, A. Yoshikawa, *Measurement of non-equilibrium carriers dynamics in Ce-doped YAG, LuAG and GAGG crystals with and without Mg-codoping.*

#### **FZU-ILM**

- A. Hospodková, J. Oswald, M. Zíková, J. Pangrác, E. Hulicius, K. Blažek, G. Ledoux, C. Dujardin, M. Nikl, *On the correlations between the excitonic luminescence efficiency and the QW numbers in multiple InGaN/GaN QW structure.*
- Hospodková, M. Nikl, O. Pacheroová, J. Oswald, B. Foltynski, P. Brůža, D. Pánek, A. Beitlerová, M. Oeztuerk, M. Heuken, E. Hulicius *Devices based on InGaN/GaN multiple quantum well for scintillator and detector applications*
- A. Hospodková, T. Hubáček, J. Oswald, J. Pangrác, K. Kuldová, M. Hylv, F. Dominec, G. Ledoux, C. Dujardin, *InGaN/GaN Structures: Effect of the Quantum Well Number on the Cathodoluminescent Properties*
- V. Jarý, L. Havlák, J. Bárta, M. Rejman, C. Dujardin, G. Ledoux, M. Nikl, *Circadian light source based on KxNa1-xLuS2:Eu2+ phosphor*



## **Upcoming events and activities**

The ASCIMAT team is happy to announce that a student scientific workshop will be organized on April 13<sup>th</sup> and the 10<sup>th</sup> European Conference on Luminescent Detectors and Transformers of Ionizing Radiation will be held in Prague during September 9-14<sup>th</sup>, 2018.

To learn more about the ASCIMAT project and to keep up with its activities and achievements, please visit the website:

[www.h2020-ascimat.com/](http://www.h2020-ascimat.com/)



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