10th Euro-Mediterranean Symposium on Laser-Induced Breakdown Spectroscopy

EMSLIBS 2019

Brno | Czech Republic
8th – 13th September

SYMPOSIUM BOOKLET

Table of contents

EMSLIBS 2019

10TH EURO-MEDITERRANEAN SYMPOSIUM ON LASER-INDUCED BREAKDOWN SPECTROSCOPY

Welcome words

Dear colleagues,

welcome and thank you for joining us at the 10th Euro-Mediterranean Symposium on Laser-Induced Breakdown Spectroscopy!

We are excited to get the possibility to organize the jubilee, 10th EMSLIBS here in Brno, in the heart of the South Moravian region of the Czech Republic. With more than 200 registered attendees, we believe that this symposium will be not only the biggest but also the most remarkable event dedicated solely to LIBS this year.

First, let us express our gratitude to everyone who contributed to the organization of EMSLIBS 2019. The list is long and we would not like to forget anyone. The organizers of the previous symposiums have continuously provided valuable collaboration and friendly advice. The international scientific committee members, the sessions chairs and all the authors of workshops, talks and posters have significantly contributed to the scientific soundness of the whole symposium. We are delighted that throughout EMSLIBS 2019, every morning we can honor our award-winning colleagues and listen to their heritage or keynote presentation.

Especially, we would like to cordially acknowledge the support of numerous partners and sponsors of the symposium. Special thanks goes to the members of the local organizing committee, particularly to Pavel Pořízka and his team that made not only the symposium but all the connected activities possible. We should also express our thanks to Jakub Vrábel and Erik Képeš who have the biggest credits for organizing the LIBS CONTEST.

Finally, yet importantly, we express our gratitude to all invited and regular presenters and all attendees of EMSLIBS 2019. Your contribution and presence changes EMSLIBS from a regular symposium to THE LIBS EVENT OF 2019. We hope that this symposium fulfills all your expectations and that you will depart not only with a significant amount of new, practical information but also with great memories.

Sincerely,

Prof. Jozef Kaiser
EMSLIBS 2019
conference chair

Prof. Viktor Kanický
head of Ioannes Marcus Marci
Spectrocopic society

Prof. Vincenzo Palleschi
EMSLIBS 2019
conference co-chair

Organizers

To organize the EMSLIBS symposium, we have established a team from LIBS groups based at the Brno University of Technology, Masaryk University and the Central European Institute of Technology. Our leaders are Prof. Jozef Kaiser and Prof. Viktor Kanický, both of them possess considerable expertise in the laser-based spectroscopy and are also members of international committees. This symposium is also co-organized by the Ioannes Marcus Marci Spectroscopic Society, the spectroscopic society of the Czech Republic.

LOCAL ORGANIZING COMMITTEE

Jozef Kaiser – Conference Chair
Viktor Kanický – Conference co-Chair
Pavel Pořízka – Event coordinator
Karel Novotný – Poster session coordinator
Kateřina Kočendová – Participant coordinator
Andrea Chyťová – Catering & Social Event coordinator
Zuzana Chládová – Marketing and graphical interface
Jan Novotný – Design and operation of the website
Zita Salajková – Sponsors coordinator
Petra Bláhová – Symposium trips coordinator
Pavlína Modlitbová – Feel-good manager
Tomáš Zikmund – Feel-bad manager
Jakub Vrábel – EMSLIBS contest coordinator

Ioannes Marcus Marci Spectroscopic Society

BRNO UNIVERSITY OF TECHNOLOGY

MUNI

CEITEC
Central European Institute of Technology
BRNO | CZECH REPUBLIC

EMSLIBS Committee

CHAIR

Jozef Kaiser – Czech Republic

CO-CHAIRS

Viktor Kanický – Czech Republic
Vincenzo Palleschi – Italy

INTERNATIONAL SCIENTIFIC COMMITTEE

Demetrios Anglos – Greece
Alessandro De Giacomo – Italy
Yoshihiro Deguchi – Japan
Roberta Fantoni – Italy
Mohamed Abdel Harith – Egypt
Russell Harmon – USA
Yu Jin – China
Javier Laserna – Spain
Andrzej W. Miziolek – USA
Vincent Motto-Ros – France
Reinhard Noll – Germany
Nicoló Omenetto – Italy
Vincenzo Palleschi – Italy
Ulrich Panne – Germany
Johannes David Pedarnig – Austria
Rick Russo – USA
Mohamad Sabsabi – Canada
Alexandre Semerok – France
Israel Schechter – Israel
Jean-Baptiste Sirven – France
Şerife Yalçın – Turkey

Partners

South Moravian Region

B R N O

CZECHINVEST
Investment and Business Development Agency

SPECTROCHIMICA ACTA PART B: ATOMIC SPECTROSCOPY

Gold Sponsors

LUMIBIRD
MORE THAN LASER

FEMTONIKA
QLI and Avantes partner

SOL instruments®

imagine optic™

DTE DYNAMIC TECHNOLOGY EQUIPMENT

Silver Sponsors

Litron Lasers

Montfort Laser™ GmbH
Uniquely Compact Pulsed Lasers

VM-TIM Optomechanische Werke

Ibsen photonics

Platinum Sponsors

LTB LASERTECHNIK BERLIN

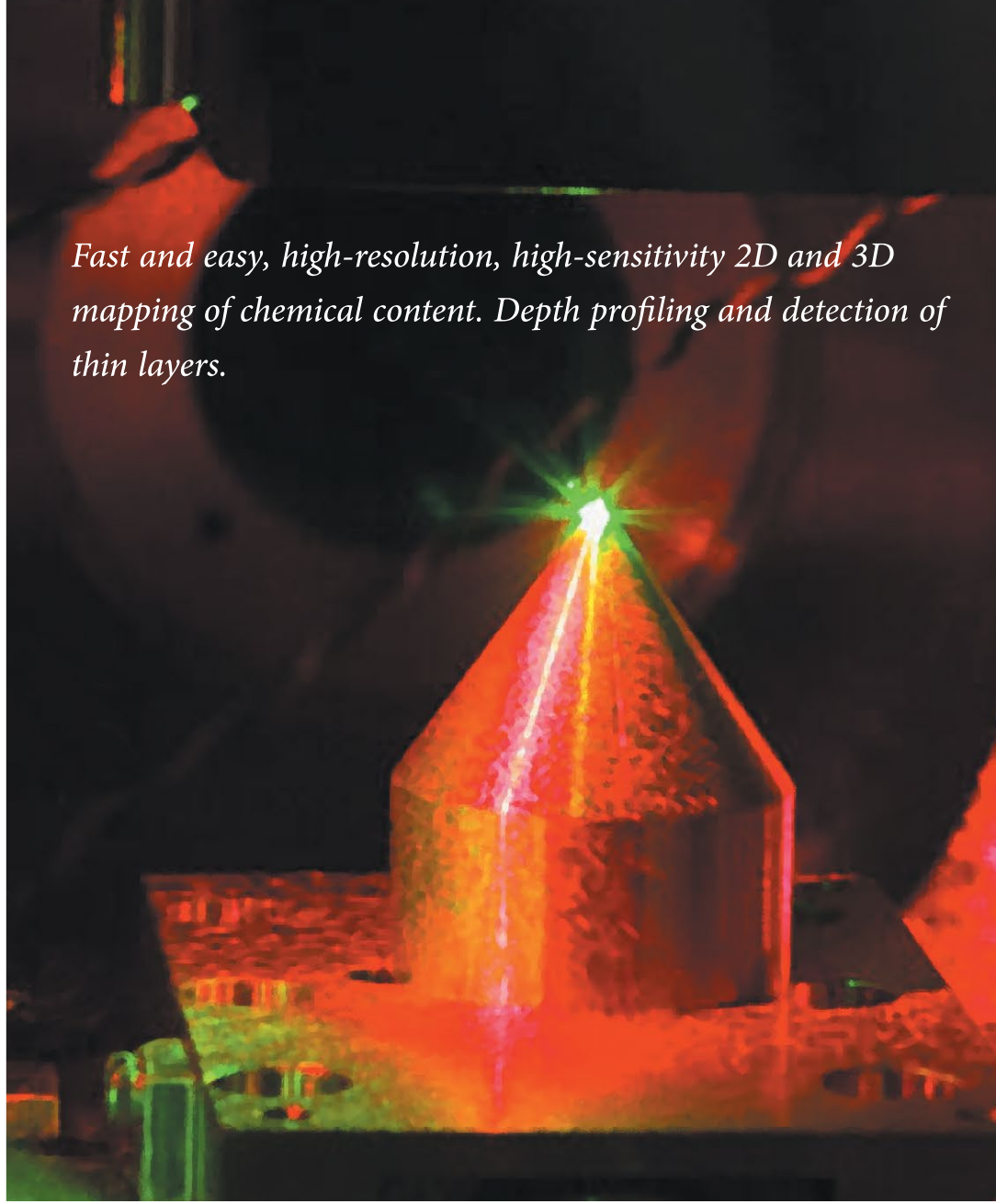
AtomTrace®

SciAps
ANALYZE YOUR WORLD

AtomTrace:

Evolution in Multi-Elemental Chemical Analysis

Fast and easy, high-resolution, high-sensitivity 2D and 3D mapping of chemical content. Depth profiling and detection of thin layers.



AtomTrace®

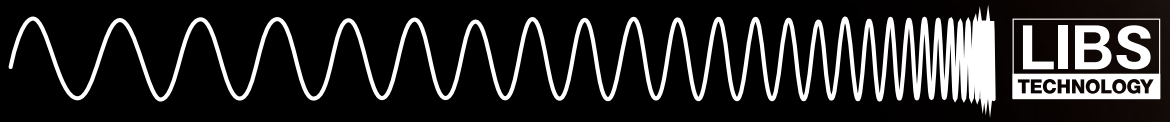
Enjoying the Spotlight

The most widely used handheld LIBS by universities and research institutes globally.

Dozens of publications based on data collected with the SciAps Z-300. Hundreds of units used in the field, daily, for geological studies, art and artifacts, forensics, even lunar, martian soil samples and meteorites.

Wide Spectrum

full spectral range of 190 – 950 nm



Desktop Suite

Great benchtop software to make your own calibrations and spectral pre-processing, set up your own time gating, rastering, cue cleaning vs data shots, etc. All the geeky stuff you're going to love.

Multigas Operation

Freely switch between argon, helium or just plain air with low cost compressed gas micro cylinders. Note: Helium provides aproximatly 2x better performance for halogens.

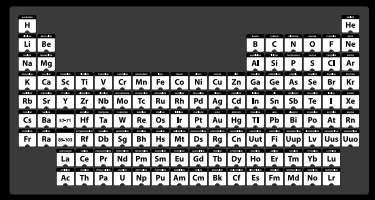
Gated or Ungated

Anaylsis may be performed in gated or ungated mode.

3D Beam

X|Y & Depth laser control with 3D pattern control. Test the way **you** want to test.

Analyze every element in the periodic table.



Atomic numbers of 1 to 99

Analyze every element in the periodic table

SciAps

7 Constitution Way,
Woburn MA USA 01801
+1 (339) 927-9455
sciaps.com

www.ltb-berlin.de

LTB LASERTECHNIK BERLIN

LIGHT. PRECISION. ANALYTICS.

Applications

- *Particle Analysis*
- *Technical Cleanliness*
- *Forensics*
- *Gemology; Mineralogy*

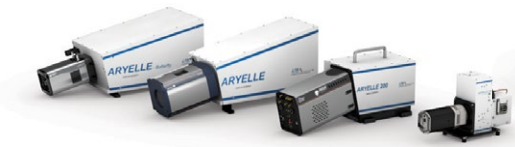
CoRaLIS

Combined Raman LIBS System

- *Elemental composition or chemical structure*
- *Material identification, classification or quantification*
- *High quality sample imaging with micrometer resolution*
- *Particles or surfaces*
- *Solid or liquid samples*
- *Single spots or area scans*

LTB Lasertechnik Berlin GmbH • Am Studio 2c • D-12489 Berlin • Germany
+49.30.91 20 75 - 100 • +49.30.91 20 75 - 199 • info@ltb-berlin.de • www.ltb-berlin.de

ARYELLE



Compact and high-resolution echelle spectrometer series for scientific and industrial applications

- *f/7-f/10*
- *5,000-50,000 (λ/ΔλFWHM)*
- *50-5pm (λ/ΔR) at 250nm*
- *175-1,100nm (λmax range)*
- *max. 740nm (λsimul)*

DEMON

Very high-resolution and optical throughput echelle spectrometer for isotope spectroscopy and laser quality control

- *f/10*
- *60,000-200,000 (λ/ΔλFWHM)*
- *3.3-1.3pm (λ/ΔR) at 250nm*
- *190-1,700nm (λmax range)*
- *1-13.5nm (λsimul)*

LIBSlab

Chemical multi-elemental analysis in modular benchtop design

- *Customized setup: spectrometer, laser, LIBSpector sample chamber, PC*
- *Chemical analysis by means of laser-induced breakdown spectroscopy (LIBS)*
- *For solid, liquid and gaseous samples*
- *Sample mapping with short measurement times*
- *Flexible range of applications in industry and science*

Q-SMART
flashlamp-pumped
Nd: YAG

EVERBRIGHT
double pulse Nd: YAG

VIRON & MERION C
diode-pumped
Nd: YAG

PULSED SOLID-STATE LASERS
FOR LIBS APPLICATIONS

- 1064, 532, 355, 266 nm and 1.57 µm available
- High focusability
- Portable and rugged lasers

LEA-S500®

LASER ELEMENTAL ANALYZER

Innovative in spectroscopy, laser technologies, and software, LEA-S500 is capable of performing unique measurements of elements from H to U in a sample. Our instrument can solve both routine tasks and most challenging research projects.

www.solinstruments.com

LGP2

ADVANCED
ENERGETIC Q-SWITCH LASER FIBER INJECTOR

FLEXIBLE
PROGRAMMABLE BEAM SHAPING

SECURED
SECURED BY SOFTWARE & HARDWARE

EASY TO USE
ROBUST and EASY FIBER REPLACEMENT

Deploy the benefits of energetic laser processing everywhere

Applications

- **Laser Shock Peening**
- **Ultrasonic Laser**
- **Laser Cleaning**
- **LIBS**

- **Up to 500 mJ**
  10 times more energy than standard single core fiber injector
- **Patented technology**
  To secure air-silica interfaces and reduce non-linear effects
- **Single core SMA fiber**
  Compatible with standard components
- **On-demand beam shaping**
  working distance, shape & dimension

imagine optic

Spectrochimica Acta
Part B: Atomic Spectroscopy

We are pleased to announce that the Elsevier, respectively the editorial board of the Spectrochimica Acta Part B: Atomic Spectroscopy journal will significantly contribute to our symposium. First, the best student talk will be awarded; second, a special issue will be published.

BEST STUDENT TALK AWARD

Under the auspices of the editorial board of Spectrochimica Acta Part B: Atomic Spectroscopy, we will award one of the best student talks.

SPECIAL ISSUE

Selected contributions presented at the symposium and accepted after peer-review will be published in a special issue of Spectrochimica Acta Part B: Atomic Spectroscopy. It is mandatory that your abstract was accepted prior the symposium and that you have actively participated during the EMSLIBS 2019 symposium and presented your original scientific work in the form of talk or poster.

This special issue is planned to be virtual only; accepted manuscripts will be continuously published in various regular issues of the Spectrochimica Acta Part B: Atomic Spectroscopy journal and then collected in the virtual one.

Editor: Prof. Alessandro De Giacomo
Guest editor: Prof. Jozef Kaiser

Submission opened: September 8th, 2019
Submission deadline: December 31st, 2019

Prof. Dr. Kay Niemax is Wilhelm-Ostwald-Fellow at the Department of Analytical Chemistry and Reference Materials of the Federal Institute for Materials Research and Testing (BAM) in Berlin, Germany.

He studied physics at the University of Kiel (Germany) and received his Ph.D. in physics from the Institute of Experimental Physics at the Kiel University in 1972. In 1984 he became a professor of physics in Kiel. From 1979 to 1980 he was a Visiting Fellow at JILA in Boulder (Colorado, USA), a joint institute of NIST and the University of Colorado. In 1985 he became the head of the Department of Elemental Analyses at Institute of Spectrochemistry and Applied Spectroscopy (ISAS) in Dortmund (Germany) and moved to Stuttgart (Germany) in 1993 where he became the chair at the Department of Physics at the University of Hohenheim. From 1997 until his retirement in 2010 he was the director of ISAS-Institute for Analytical Sciences with departments in Dortmund and Berlin and a full-professor at the Faculty of Physics of University of Dortmund.

Prof. Niemax has published over 230 papers, presented more than 100 invited talks at conferences, and served in advisory boards of major analytical chemistry journals. In 2000 he received an Honorary Doctorate of the University of Constanta (Romania) and in 2010 the Lester W. Strock Award of the Society of Applied Spectroscopy (USA). He is also a fellow of the Society of Applied Spectroscopy and of the Royal Society of Chemistry (UK).

HERITAGE SPEAKER:

Prof. Kay Niemax

TITLE OF THE LECTURE:

The arduous way of LIBS becoming an established technique

From 1970 to 1985 his major research interests were plasma, atomic and molecular physics. With his move to Dortmund in 1985 he changed to spectrochemistry and analytical chemistry. Since 1985, Prof. Niemax significantly contributed to the development and scientific reputation of LIBS technique.

We are honored to present Prof. Kay Niemax as a heritage speaker of our symposium. We were also granted to continue with the tradition of the LIBS award started by prof. Vincenzo Palleschi at the EMSLIBS 2017 in Pisa, Italy and awarded for the first time to Prof. Nicoló Omenetto. Thus, we are pleased to announce that under the auspices of the EMSLIBS scientific committee we are going to award Prof. Kay Niemax with the next LIBS award.

Prof. Niemax will present his heritage talk entitled **The arduous way of LIBS becoming an established technique** on **Monday, September 9th at 8:45** in the presentation room. This presentation will comprise a brief history of LIBS based on prof. Niemax' personal experience starting in 1985.

KEYNOTE SPEAKER:

Prof. Nicoló Omenetto

TITLE OF THE LECTURE:

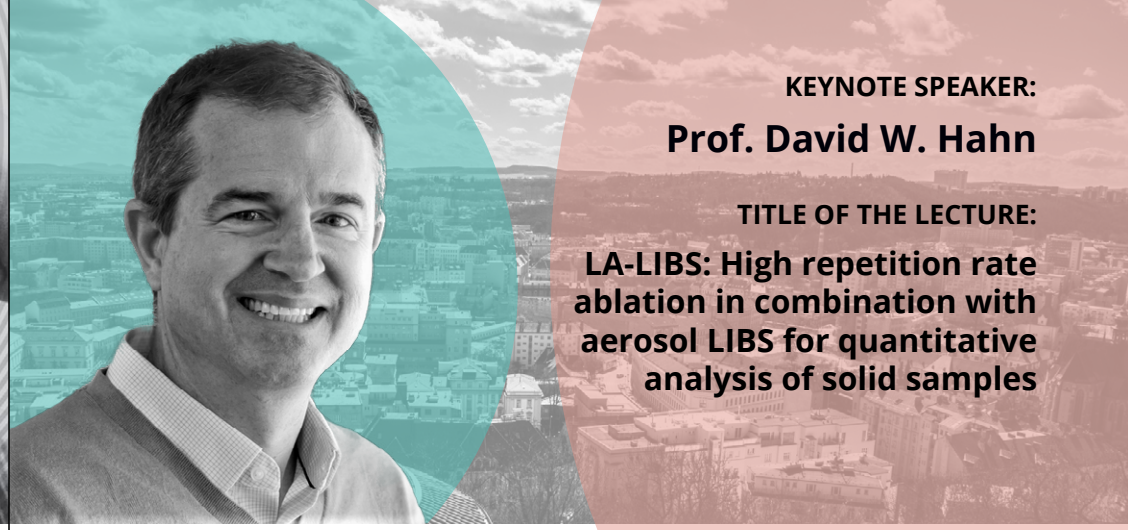
Critical considerations on the use of several experimental methodologies to evaluate self-absorption effects in atomic emission spectroscopy

Prof. Nicoló Omenetto earned his Doctor degree in Chemistry from the University of Padua (Italy) in 1964 and became Professor of Spectrochemistry at the University of Pavia (Italy) in 1971. In 1979, he was appointed at the Joint Research Centre of the European Community. At the end of 2001, he joined the Faculty of the University of Florida in Gainesville (USA), where he is currently a Research Professor. From 1994 until 2018, he was a Co-editor of the journal "Spectrochimica Acta, Part B: Atomic Spectroscopy" (Elsevier Science, The Netherlands). He is also a Honorary Member of the Society for Applied Spectroscopy, and was the recipient of the Lester Strock award (2009), the CSI Award (2011), the Winter Conference Award in Plasma Spectrochemistry (2016) and the first LIBS award (2017).

The research interests of Prof. Omenetto have been directed towards the theory and applications of atomic and molecular spectroscopic methods of analysis, with a particular emphasis to the use of laser excitation.

Prof. Omenetto has published over 250 papers in international peer-reviewed journals. He also co-authored 5 Book Chapters, edited two books and co-authored two monographs.

The keynote talk of prof. Omenetto entitled **Critical considerations on the use of several experimental methodologies to evaluate self-absorption effects in atomic emission spectroscopy is scheduled** on **Tuesday, September 10th at 8:45** in the presentation room.



KEYNOTE SPEAKER:

Prof. David W. Hahn

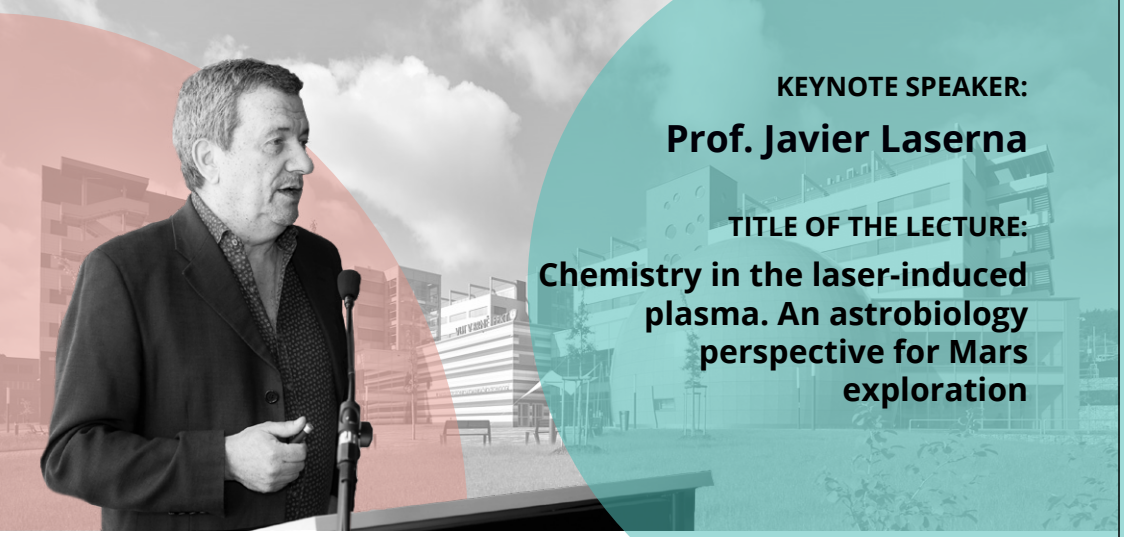
TITLE OF THE LECTURE:

LA-LIBS: High repetition rate ablation in combination with aerosol LIBS for quantitative analysis of solid samples

Prof. David W. Hahn received his BSME (1986) and PhD (1992) degrees from Louisiana State University in Baton Rouge (Louisiana, USA). Following graduation, he was a National Research Council Research Associate at the US Food and Drug Administration (1992-1994) where he worked on laser-tissue interactions, and then he was a member of the technical staff at Sandia National Laboratories (1994-1998), in the Combustion Research Facility and in the Exploratory Systems Group, where he first worked on LIBS. David joined the University of Florida (Gainesville, FL) in 1998, was promoted to Professor in 2007, and since June 2011 he has served as Department Chair of the Department of Mechanical and Aerospace Engineering. Recently David W. Hahn has been named the dean of the University of Arizona College of Engineering.

His research and teaching interests are in the general area of transport, optical-based sensing and diagnostics, with applications to laser-material interactions. He has published over 100 journal papers and book chapters and has 10 US patents.

The keynote talk of Prof. Hahn entitled **LA-LIBS: High repetition rate ablation in combination with aerosol LIBS for quantitative analysis of solid samples is scheduled** on **Wednesday, Sep 11th at 8:45** in the presentation room.



KEYNOTE SPEAKER:

Prof. Javier Laserna

TITLE OF THE LECTURE:

Chemistry in the laser-induced plasma. An astrobiology perspective for Mars exploration

Prof. Javier Laserna graduated in chemistry at the University of Granada (Spain), and received a PhD in Analytical Chemistry at the University of Malaga (Spain). He then joined the faculty at the University of Malaga as an assistant professor and became a professor in 1999.

He is a co-inventor of 6 patents held by the University of Malaga and has published over 300 papers plus 5 books and book chapters. Under his direction, 33 students received doctorates and many others received master degrees.

Professor Laserna's current research interests include the investigation of novel measurement principles based on the atomic emission, absorption and molecular scattering and mass spectrometry and the understanding of the fundamental phenomena governing the analytical measurements. He is also interested in the development of analytical instrumentation for laser-induced breakdown spectroscopy, time-of-flight mass spectrometry, laser remote chemical analysis and on-line and fieldable analytical measurements. Application areas comprise analysis of energetic materials, development of sensors for CBNRE threats, lasers for cultural heritage, and LIBS and Raman spectroscopy for space exploration.

The keynote talk of Prof. Hahn entitled **Chemistry in the laser-induced plasma. An astrobiology perspective for Mars exploration is scheduled** on **Thursday, September 12th at 8:45** in the presentation room.

Scientific sessions

We have been striving to deliver a balanced program of the symposium, with rich scientific and social events. The scientific program is divided into three main sessions: oral, poster, and workshops. In general, the sessions are related to current topics and applications that are of paramount interest to the LIBS community (from plasma fundamentals, through bio-applications and chemometrics, to industry and applications with great expectations in the future).

ORAL SESSION

Going swiftly around Sunday workshops, we get to the main scientific session. We have selected 55 oral presentations that will be extended with 8 vendor presentations. All presentations are going to take place in the presentation room (see the map of EMSLIBS venue). **All speakers are requested to deliver their presentations in powerpoint or pdf format beforehand, no later than during the last break (coffee, lunch) before their dedicated session. Please, deliver your presentations to the presentation room.**

POSTER SESSIONS

We are happy about the number of submitted posters, which is 130 in total. However, their number led us to the decision to make two separate poster sessions instead of a permanent one. Both poster sessions will take place in the Aula.

Posters in the first session may be displayed from Monday after lunch until Tuesday evening. From Wednesday morning until Thursday afternoon, the second poster session will take place. Be aware of your particular poster session, the distribution is given below.

Both poster sessions will be spiced up with social events on Monday and Wednesday evening, starting at 18:00.

STUDENT AWARDS

We appreciate the participation of young researchers and we support their further research endeavours. We have selected 12 students' talks and included them in the main session. Moreover, we have highlighted 63 students' posters.

Please, note that it is mandatory to present your talk/poster in person in order to win the prize. We will present the best students and award their research during the gala dinner on Thursday.

The best students' contributions will be selected by a scientific committee which was established for this purpose:

Karel Novotný – Czech Republic
Saara Kaski – Finland
Madhavi Martin – USA
Johannes Pedarnig – Austria
Pavel Veis – Slovakia

Workshops

In order to get a swift start of our symposium, we will organize two workshops on Sunday, September 8th, prior to the scientific program. Each session will reflect up-to-date literature and trends in the field of analytical chemistry and chemometrics. Good practices and advice will be given to help you to master the complexity of LIBS analysis. After the workshops, you are most welcome to the icebreaker party.

Duration of each workshop: 90 min
Workshops' chairman: Dr. Pavel Pořízka

WORKSHOP #1
FROM QUALITATIVE TO QUANTITATIVE LIBS USING UNIVARIATE ANALYSIS

Presented by: Dr. Bruno Bousquet and Dr. Vincent Motto-Ros
Start: Sunday, Sep 8th, 14:00

The outline of the first workshop is designed to establish a solid background which should be of paramount interest for any chemist and spectroscopist.

Topics to tackle:

- spectral features, line identification and line selection
- signal extraction
- standardization
- signal-to-noise ratio and limits of detection
- calibration models, limit of quantification and error of prediction
- quantitative analysis: case-study of homogeneous glass samples
- quantitative mapping

WORKSHOP #2
MULTIVARIATE DATA ANALYSIS

Presented by: Dr. Josette El Haddad
Start: Sunday, Sep 8th, 16:00

The second workshop will focus on multivariate data analysis which becomes an essential part of contemporary scientific work. Moving from linear to non-linear methods, the talk will circle around unsupervised and supervised methods, dimensionality reduction, and model robustness.

Topics to tackle:

- data pretreatment and dimensionality reduction
- linear and non-linear methods
- visualization and clustering
- classification and quantification
- model robustness and figures of merit

Scientific program

EMSLIBS 2019 will take place at the Faculty of Social studies of Masaryk University in Brno.

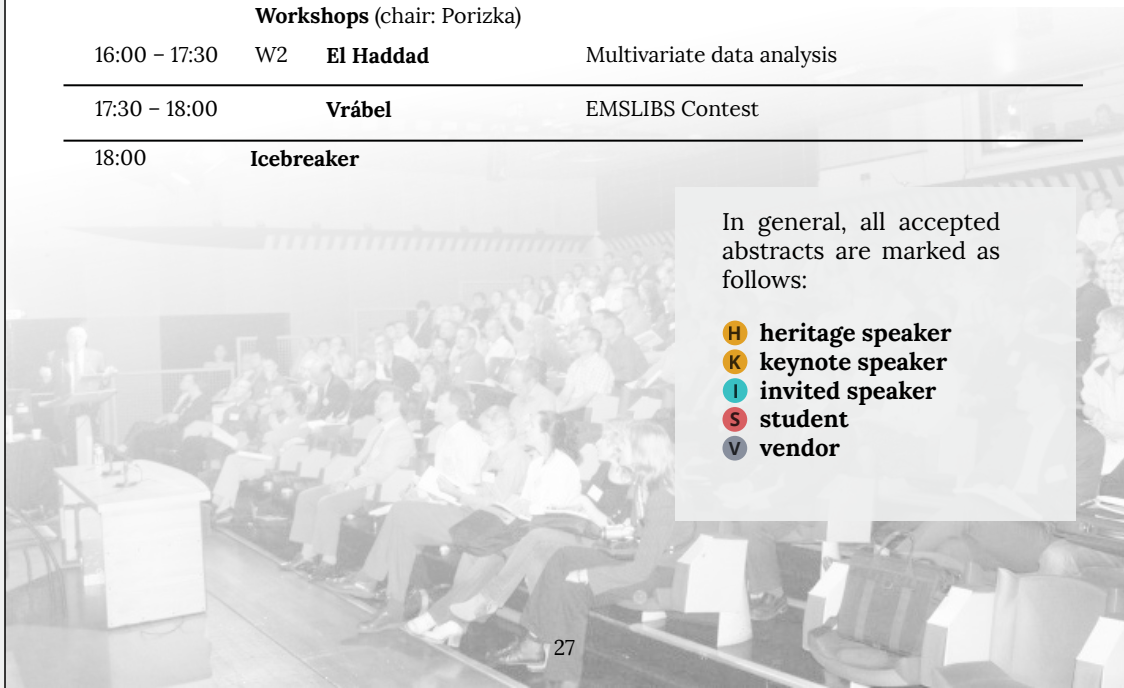
Permission to Scientific session is only with your badge. To receive your badge you have to visit our registration booth first.

Registration booth will be open:

Sunday 8th, 12:00 – 21:00
Monday 9th, 7:30 – 18:00
Tuesday 10th, 8:00 – 18:00
Wednesday 11th, 8:00 – 18:00
Thursday 12th, 8:00 – 16:30

SUN 8TH SEPTEMBER

12:00	**Registration open**		
	Workshops (chair: Porizka)		
14:00 – 15:30	W1	**Bousquet & Motto-Ros**	From qualitative to quantitative LIBS using univariate analysis
15:30 – 16:00	**Coffee break**		
	Workshops (chair: Porizka)		
16:00 – 17:30	W2	**El Haddad**	Multivariate data analysis
17:30 – 18:00		**Vrábel**	EMSLIBS Contest
18:00	**Icebreaker**		



In general, all accepted abstracts are marked as follows:

- H **heritage speaker**
- K **keynote speaker**
- I **invited speaker**
- S **student**
- V **vendor**

MON 9TH SEPTEMBER

	08:30 – 08:45		**Opening**	
			Heritage (chair: Kaiser)	
H	08:45 – 09:30	H1	**Niemax**	The arduous way of LIBS becoming an established technique
			Fundamentals I (chair: Kaiser)	
I	09:30 – 09:50	FU21	**Gornushkin**	Equilibrium chemistry in laser induced plasmas and plasma chemical reactors
I	09:50 – 10:10	FU2	**Vadillo**	Femtosecond laser ablation: as fun as it gets
S	10:10 – 10:30	FU3	**Roldan**	Quantitative analysis of Indium in sphalerites by CF-LIBS using pre-classification by PCA
	10:30 – 11:15		**Coffee break**	
			Fundamentals II (chair: Gornushkin)	
I	11:15 – 11:35	FU4	**Labutin**	Application of spectra modeling for Laser-Induced Breakdown Spectroscopy
	11:35 – 11:55	FU5	**Skočić**	Model function for Optical Time of Flight signal in Laser Induced Plasma
	11:55 – 12:15	FU6	**Yu**	Physical and Statistical Studies of the Influence of Minor Elements on Plasma Temperature and Emission Intensity in LIBS Measurements
I	12:15 – 12:35	FU7	**Veis**	Fundamentals of simultaneous Vacuum UV - UV LIBS for quantification
	12:35 – 14:10		**Lunch**	
			Mapping (chair: De Giacomo)	
I	14:10 – 14:30	MA1	**Motto-Ros**	LIBS-based Imaging: critical focus on current status and future directions
S	14:30 – 14:50	MA2	**Dietz**	LIBS Microscopy for Elemental Imaging of Heterogeneous Samples
S	14:50 – 15:10	MA3	**Müller**	Detection of REE-rich areas in Storkwitz drill cores using LIBS and a combination of normalization, clustering and spatial raster analysis
S	15:10 – 15:30	MA4	**Leprince**	In situ, quantitative, elemental imaging of lung tissues
	15:30 – 16:15		**Coffee break**	
			Biology (chair: Motto-Ros)	
I	16:15 – 16:35	BI1	**Rehse**	Bacterial Limit of Detection Reduction Utilizing A Novel Sample Preparation Protocol
I	16:35 – 16:55	BI2	**Martin**	Switchgrass and Woody Biomass Elemental characterization using Laser-induced Breakdown Spectroscopy
I	16:55 – 17:15	BI3	**Melikechi**	Classifying diseased and healthy biomedical samples one laser pulse at a time
I	17:15 – 17:35	BI4	**Boyaci**	LIBS Applications for Food Safety and Quality
	18:00		**Poster session I. / beer tasting**	

TUE 10TH SEPTEMBER

			Key note (chair: Niemax)	
K	08:45 – 09:30	K1	**Omenetto**	Critical considerations on the use of several experimental methodologies to evaluate self-absorption effects in atomic emission spectroscopy
			Quantification I (chair: Niemax)	
I	09:30 – 09:50	QA1	**Palleschi**	Self-absorption is your friend: exploiting self-absorption for improving the accuracy of Laser-Induced Breakdown Spectroscopy analysis
I	09:50 – 10:10	QA2	**Deguchi**	Improvement of LIBS Quantitative Capability for Remote Elemental Detection Using Collinear Long and Short DP Laser
S	10:10 – 10:30	QA3	**Touchet**	Direct isotopic analysis of solids by laser-induced breakdown self-reversal isotopic spectrometry (LIBRIS)
	10:30 – 11:15		**Coffee break**	
			Quantification II. (chair: Palleschi)	
I	11:15 – 11:35	QA4	**Bousquet**	Advanced data processing to improve the analytical performance of LIBS
I	11:35 – 11:55	QA5	**Wang**	Origin of Measurement Uncertainty and its Reduction methods
	11:55 – 12:15	QA6	**Pelascini**	Calibration-free laser-induced breakdown spectroscopy for industry
S	12:15 – 12:35	QA7	**Rollin**	A standard methodology for characterization of matrix effects in laser-induced breakdown spectroscopy
	12:35 – 14:10		**Lunch**	
			Chemometrics (chair: Bousquet)	
	14:10 – 14:30	CH1	**El Haddad**	Mineral Quantification by Laser-Induced Breakdown Spectroscopy for In-Field Rock Characterization
	14:30 – 14:50	CH2	**Jorge**	Self-Learning Artificial Intelligence Methodology for the Accurate Quantification and Classification of Laser Induced Plasma Breakdown Spectroscopy applied to Geological Lithium Surveys in Portugal
	14:50 – 15:10	CH3	**Sun**	Machine Learning for Classification and Regression of LIBS Spectra from ChemCam Calibration Targets
	15:10 – 15:30	CH4	**Duponchel**	Embedded k-Means Clustering for a deep exploration of megapixel LIBS imaging data sets
	15:30 – 16:15		**Coffee break**	
			Mining (chair: Kaski)	
I	16:15 – 16:35	MI1	**Sabsabi**	A look at LIBS instrumentations as an emerging tool for mining applications
	16:35 – 16:55	MI2	**Cousin**	New quantification of Barium for MSL/ChemCam Mars data, and implications for geological interpretations
	16:55 – 17:15	MI3	**Forni**	Fluorine detection on Mars: experiments and geological interpretation
S	17:15 – 17:35	MI4	**Schmitt**	Quantification of Lithium in pegmatites using handheld Laser Induced Breakdown Spectroscopy : a new approach for mining exploration
	19:00		**Mendel museum / wine tasting**	

WED 11TH SEPTEMBER

Key note (chair: Noll)

K	08:45 – 09:30	K2	**Hahn**	LA-LIBS: High repetition rate ablation in combination with aerosol LIBS for quantitative analysis of solid samples

Hyphenated systems (chair: Noll)

I	09:30 – 09:50	HY1	**Kaski**	LIBS, Raman and LIF in analysis of rocks containing rare earth elements
S	09:50 – 10:10	HY2	**Marmatakis**	Coupling LIBS to SSI-MS. Interference of plasma formation with mass analysis
I	10:10 – 10:30	HY3	**Zheng**	Development of in-situ spectroscopy and its ocean applications
	10:30 – 10:50	HY4	**Fantoni**	Complementary characterization of ancient Roman frescoes by PIXE and LIBS techniques
	10:50 – 11:35	**Coffee break**		

Molecular (chair: Martin)

	11:35 – 11:55	MO1	**Gaft**	Molecular LIBS and Plasma Induced Luminescence of BaF2:Tm3+
S	11:55 – 12:15	MO2	**Yang**	Double-pulse laser synchronization aimed at simultaneous detection of intensified atomic and molecular signals for space exploration
	12:15 – 12:35	MO3	**Bordel**	Evaluation of the spatial and temporal distribution of atomic and molecular species at different LIBS plasma conditions
I	12:35 – 12:55	MO4	**Samek**	Analysis of biological samples combining data from LIBS, Raman spectroscopy and LA-ICP-MS
	12:55 – 14:30	**Lunch**		

Vendor (chair: Novotný)

V	14:30 – 14:45	V1	**Pfeifer**	LTB Lasertechnik Berlin GmbH
V	14:45 – 15:00	V2	**Mandel**	AtomTrace a. s.
V	15:00 – 15:15	V3	**Machaqueiro**	SciAps
V	15:15 – 15:30	V4	**Colin**	Lumibird
V	15:30 – 15:45	V5	**Dubouski**	SOL Instruments
V	15:45 – 16:00	V6	**Hubert**	Femtonika s.r.o.
V	16:00 – 16:15	V7	**Leosson**	DT-Equipment & Innovation Center Iceland
V	16:15 – 16:30	V8	**Gorju**	Imagine Optic

16:30 – 16:45	**Symposium photo**	**MEETING POINT – REGISTRATION BOOTH**
18:00	**Poster session II.**	
19:00	EMSLIBS committee meeting	

THU 12TH SEPTEMBER

Key note (chair: Pedarnig)

K	08:45 – 09:30	K3	**Laserna**	Chemistry in the laser-induced plasma. An astrobiology perspective for Mars exploration

Nanoparticles (chair: Pedarnig)

I	09:30 – 09:50	NP1	**De Giacomo**	NELIBS vs LIBS: dealing with outstanding advantages and real limits
	09:50 – 10:10	NP2	**Novotný**	LIBS assessment of spatial photon-upconversion nanoparticle distribution in model plants (R. sativus and L. minor)
S	10:10 – 10:30	NP3	**Salajková**	Nanoparticle Enhanced Laser Induced Breakdown Spectroscopy (NELIBS) as a technique for elemental analysis of microdrops at sub ppm level
	10:30 – 11:15	**Coffee break**		

Industry (chair: Galbács)

I	11:15 – 11:35	IN1	**Noll**	Challenges and perspectives of inverse production for sustainable material recycling – what LIBS can contribute
I	11:35 – 11:55	IN2	**Pedarnig**	Quantification of the vulcanizing system of rubber in industrial tire rubber production by laser-induced breakdown spectroscopy
S	11:55 – 12:15	IN3	**Smetaczek**	Investigating the Li+/H+ exchange in garnet-type solid electrolytes using LIBS
	12:15 – 12:35	IN4	**Wilsch**	Mobile LIBS-System for evaluation of concrete structures on-site
	12:35 – 12:55	IN5	**Lednev**	Laser induced breakdown spectroscopy for in-situ multielemental analysis during metal additive manufacturing
	12:55 – 14:30	**Lunch**		

Future LIBS (chair: Veis)

I	14:30 – 14:50	FT1	**Galbacs**	Exploring the potential of LIBS for the in-field analysis of nuclear samples
I	14:50 – 15:10	FT2	**Grisola**	LIBS developments for fusion applications
S	15:10 – 15:30	FT3	**Purohit**	Polydispersity and fractionation in laser ablation studied by LIBS in an optical trap
	15:30 – 15:50	FT4	**Alwahabi**	Enhancement Limitations of Microwave-assisted LIBS: Application to Sulphur Detection
	15:50 – 16:10	FT5	**Fricke-Begem**	LIBS for robotic alloy sorting
	16:10 – 16:30	**Last coffee**		
	16:30	**Free time**		
	17:00	Registration closing		
	19:00	**Gala dinner**		

Poster session I.

PI_001 Simulation of the Dynamics of Laser-Induced Plasmas out of Local Thermodynamic Equilibrium
Arnaud Bultel, Vincent Morel, Aurélien Favre

PI_002 Laser-induced plasma with a variable optical path length: a novel approach for absolute measurement of the atomic number densities in the plasma
Sergey M. Zaytsev, Timur A. Labutin, Andrey M. Popov

PI_003 S Estimate of the departure from excitation equilibrium of a laser-induced plasma obtained in Argon-Hydrogen mixtures
Aurélien Favre, Arnaud Bultel, Vincent Morel, Stevica Djurovic, Zoran Mijatovic

PI_004 S Self-absorption in laser-induced plasmas in simulated Martian atmospheric conditions
Peder Hansen, Susanne Schröder, David Vogt, Simon Kubitza, Kristin Rammelkamp, Heinz-Wilhelm Hübers

PI_005 S Determination of Plasma Temperature in Laser-Induced Breakdown Spectroscopy Using Columnar Density SahaBoltzmann Plot
Ali Safi, Seyyed Hassan Tavassoli, Gabriele Cristoforetti, Stefano Legnaioli, Vincenzo Palleschi, Fatemeh Rezaei, Elisabetta Tognoni

PI_006 S Experimental characterization of double pulse laser-induced plasmas on Aluminum and Tungsten targets
Aurélien Favre, Vincent Morel, Arnaud Bultel

PI_007 Triple pulse LIBS: Laser-induced breakdown spectroscopy signal enhancement by combination of pre-ablation and reheating laser pulses
David Prochazka, Pavel Pořízka, Jan Novotný, Sára Střítežská, Jozef Kaiser

PI_008 S Development of a fs-LIBS system and study of its analytical performance using simple or double (fs/ns) pulse
Cristina Méndez, Luis Javier Fernández, Ana Méndez, Jorge Pisonero, Nerea Bordel

PI_009 Laser-Induced Breakdown Spectrometry with Laser Pulses in Femtosecond to Picosecond Regime and their Influence on Ablation Quality
Sadia Manzoor, José Miguel Vadillo, Javier Laserna

PI_010 S Optical modelling of spectroscopic characteristics of a dualgrating tunable spatial heterodyne LIBS spectrometer
Dávid Jenő Palást, László Himics, Tamás Váczi, Miklós Veres, Igor Gornushkin, Gábor Galbács

PI_011 S Design of an optomechanical module for laser-induced plasma imaging
Jakub Buday, Pavel Pořízka, Erik Képeš, Jan Novotný, Jozef Kaiser

PI_012 S Tomography of asymmetrical laser-induced plasmas
Erik Képeš, Igor Gornushkin, Pavel Pořízka, Jozef Kaiser

PI_013 Improvement in analytical performance of underwater LIBS signal by using the plasma image information
Qingyang Li, Ye Tian, Boyang Xue, Nan Li, Yuan Lu, Ronger Zheng

PI_014 S LIBS as versatile tool for characterization of LLZO garnets
Maximilian Weiss, Stefan Smetaczek, Daniel Rettenwander, Jürgen Fleig, Andreas Limbeck

PI_015 S Use of picosecond laser in Laser Induced Breakdown Spectroscopy of tungsten and tungsten based mix layers for diagnostics of relevant fusion wall materials
Matej Pisarcik, Shamaila Manzoor, Alicia Marín Roldán, Milan Držík, Pavel Veis

PI_016 Spectra modeling to choose an analytical line for determining niobium traces in ferromanganese nodules by LIBS
Andrey M. Popov, Nikolay A. Dontsenko, Sergey M. Zaytsev, Timur A. Labutin

PI_017 Influence of laser ablation-induced sample surface asperities on LIBS spectrum intensity
Liang Gao, Sahar Shaabir, Zengqi Yue, Yuqing Zhang, Chen Sun, Jin Yu

PI_018 Enhancement of laser-induced plasma emission intensity by cylindrical spatial confinement in neon
Stefan Karatodorov, Valentin Mihailov

PI_019 Spark discharge assisted Laser-induced Breakdown Spectroscopy for Signal Enhancement of Cu-Fe alloy
Stefan Karatodorov, Shamaila Manzoor, Pavel Veis

PI_020 Detection improvement of laser-induced breakdown spectroscopy using the flame generated from alcoholsolution mixtures
Yunjiao Lan, Yuan Lu, Xinyun Dong, Wangquan Ye, Ronger Zheng

PI_021 Diode-pumped Nd:YAG/V:YAG composite microchip 1338 nm laser source for LIBS
Jan Šulc, Helena Jelínková, Karel Nejezchleb, Václav Škoda

PI_022 S Pulse Design with a Fiber Laser for Laser-Induced Breakdown Spectroscopy
Miguel Ferreira, Diana Guimarães, Rui Martins, Pedro Jorge

PI_023 S Ultrasound-Assisted Underwater Laser-induced Breakdown Spectroscopy with High Repetition-Rate µJ-DPSS laser
Boyang Xue, Jens Riedel, Igor Gornushkin, Ronger Zheng, Yi You

PI_024 Laser focusing geometry effects on underwater single- and double-pulse laser-induced breakdown spectroscopy
Ye Tian, Boyang Xue, Lintao Wang, Yuan Lu, Ying Li, Ronger Zheng

PI_025 S Sample temperature influence on laser induced breakdown spectroscopy analysis results
Vasily N. Lednev, Pavel A. Sdvizhenskii, Roman D. Asyutin, Roman S. Tretyakov, Mikhail Ya. Grishin, Anton Ya. Stavertiy, Sergey M. Pershin, Mikhail A. Davydov

PI_026 Spectroscopic study of orange bands of FeO in laserinduced plasma
Andrey M. Popov, Timur A. Labutin, Sergey M. Zaytsev

PI_027 LIBS mapping reaching high performances: from the acquisitions to the treatments
Damien Devismes, Frédéric Pelascini

PI_028 S Femtosecond LIBS imaging with micrometer spatial resolution and femtogram mass detection
Anna Haider, Michael C. Bayer, Christoph M. Ahamer, Stefan Trautner, Johannes D. Pedarnig

PI_029 S LIBS assessment of spatial cadmium distribution in white mustard
Sára Střítežská, Pavlína Modlitbová, David Prochazka, Štěpán Zezulka, Marie Kummerová, Karel Novotný, Pavel Pořízka, Jozef Kaiser

PI_030 Characterization of mineralized drilling cores using LIBSbased imaging
Jeannette Meima, Dieter Rammlmair

PI_031 S Quantitative micro-imaging of carbon and trace impurities: A breakthrough for refining industry?
Lina Jolivet, Vincent Motto-Ros, Loïc Sorbier, Tiago Sozinho, Charles-Philippe Lienemann

PI_032 S Chemical imaging and analysis of metals by optical emission spectroscopy methods LIBS and LA-SD-OES
Stefan Grünberger, Stefan Trautner, Norbert Huber, Simon Eschlboeck-Fuchs, Josef Hofstadler, Andreas Pissenberger, Hubert Duchaczek, Johannes D Pedarnig

PI_033 S Detection of minerals in Cancer patients' blood serum using LIBS technique
Elshaimaa Mohamed Emara, Haiying Song, Shibing Liu

PI_034 S Implementation of laser spectroscopy in skin tumor analysis
Kateřina Kubíčkova, Pavel Pořízka, Milan Kaška, Jozef Kaiser

PI_035 S Accurate recognition of glioma border tissue based on laserinduced breakdown spectroscopy
Geer Teng, Qianqian Wang, Hongwei Zhang, Kai Wei, Wenting Xiangli, Xutai Cui, M. Nouman Khan, Bushra Sana Idrees

PI_036 S Methodology for the optimization of LIBS analysis of soft tissues
Anna Šindelářová, Pavel Pořízka, Sára Střítežská, Pavlína Modlitbová, Lucie Vrlíková, David Prochazka, Marcela Buchtová, Kateřina Kubíčková, Jozef Kaiser

PI_037 S Optimizing the Laser Ablation of Soft Tissues
Kristína Virostková, Pavel Pořízka, Lucie Vrlíková, Marcela Buchtová, Jozef Kaiser

PI_038 S Nanosecond Laser Induced Breakdown Spectroscopy for Biofouling Analysis and Classification of Fouling Constituents
Della Thomas, S Surendran, Nilesh J Vasa

PI_039 S LIBS for real-time monitoring of laser-induced thermal damage in laserosteotomy: from dehydration to full carbonization
Hamed Abbasi, Georg Rauter, Raphael Guzman, Philippe C. Cattin, Azhar Zam

PI_040 S Lithium from breast milk of medicated mothers affects the thyroid and kidney functions of infants
Irfan Ahmed, Condon Lau

PI_041 S Characterization of LIBS as the distribution of Lithium and elements throughout the Body
Muhammad Shehzad Khan

PI_042 S The use of laser spectroscopy techniques in studying zooplankton
Nikolai Sushkov, Patrick Janovszky, Dávid Palásti, Gábor Galbács, Timur Labutin, Nikolai Lobus, Krisztián Fintor

PI_043 S A comparison of calibration-based and calibration-free analysis of zooplankton by LIBS
Nikolai Sushkov, Sergey Zaytsev, Timur Labutin, Nikolai Lobus

PI_044 Double-pulse LIBS spectrometer LEA-S500 for quantitative analysis of the materials of different origin
Valery Kapacheusky, Vitali Dubouski, Vladimir Baikou, Liudmila Babrova, Galina Astrouskaya

PI_045 S Critical review on the use of normalization in LIBS
Julian Guézénoc, Anne Gallet-Budynek, Bruno Bousquet

PI_046 Application of laser induced breakdown spectroscopy for stainless steel alloys quantification
Sabrina Messaoud Aberkane, Kenza Yahiaoui, Karim Nait Achour, Riadh Chahdane

PI_047 Quantification of binary alloys used in prosthetic implants by laser-induced breakdown spectroscopy
Maripaz Mateo, Ginés Nicolás

PI_048 S LIBS: A potential tool for accurate quantification of precious elements
Vishal Dwivedi, Pavel Veis, Vayakkara Kolaprath Unnikrishnan

PI_049 Quantitative Analysis Of Low Atomic Number Elements By Laser Induced Breakdown Spectroscopy Technique
Arif Demir, Emrah Burak Kaya, Kaan Turan, Ilknur Baldan Isik, Hasan Huseyin Isik

PI_050 Application of CF-LIBS for the detection of trace elements in metallic samples
Francesco Colao, Luisa Caneve, Salvatore Almaviva, Giorgio Maddaluno, Pawel Gasior, Monika Kubowska, Wojciech Gromelski

PI_051 S Experimental design: a helpful tool before LIBS on-site analyses of agricultural soils
Julian Guézénoc, Anne Gallet-Budynek, Bruno Bousquet

PI_052 S Evaluation of portable LIBS and portable XRF in the frame of multi-elemental analysis of agricultural soils and plants
Julian Guézénoc, Anne Gallet-Budynek, Etonam Tete Kondo, Thomas Guzmann, Alain Mollier, Pierre Masson, Bruno Bousquet, Thierry Dalix, Martine Peypelut, Hugues Roussarie

PI_053 On-site chlorine determination with a mobile LIBS systém
Tobias Günther, Cassian Gottlieb, Tobias Völker, Gerd Wilsch

PI_054 Boosting plasmas of low energy lasers with electrical discharge
Tobias Günther, Cassian Gottlieb, Gerd Wilsch

PI_055 Analysis of harmful species in concrete with LIBS and electrical spark discharge
Tobias Günther, Cassian Gottlieb, Gerd Wilsch

PI_056 Alternative standards for Laser Induced Breakdown Spectroscopy analysis of asphalts
Aleš Hrdlička, Jitka Hegrová, Eva Havrlová, David Prochazka, Jan Novotný, Karel Novotný, Viktor Kanický, Jozef Kaiser

PI_057 S Quantification of Zn in aqueous solution by laser induced breakdown spectroscopy and liquid-solid matrix conversion
Peter Gschwandtner, Stefan Trautner, Georg Hölzl, Christoph Ramsauer, Thomas Röder, Johannes D Pedarnig

PI_058 S Elemental Analysis of Aqueous Samples: Challenges and Counter Experimental Strategies for LIBS Measurements
Sahithya Atikukke, Vishal Dwivedi, Santhosh Chidangil, Pavel Veis, Vayakkara Kolaprath Unnikrishnan

PI_059 S Detection of heavy metals in urea by surface-assisted LIBS method
Geovanna Elizabeth Vasquez Lara, Alicia Marin Roldan, Michaela Horňáčková, Julia Mišković, Jin Yu, Pavel Veis

PI_060 Analysis of TiB2 and Al2O3 thin films by LIBS
Arif Demir, Emrah Burak Kaya, Kaan Turan, Mehmet Egilmez, Ali Alnaser

PI_061 Analysis of Indium Tin Oxide thin films by using Laser Induced Breakdown Spectroscopy (LIBS) in the Vacuum Ultraviolet
Pavel Veis, Michal Angus, Michaela Hornackova, Alicia Marin Roldan, Vayakkara Kolaprath Unnikrishnan, Demetrios Anglos

PI_062 S UV-Femtosecond Double-Pulse LIBS for the in-situ characterization of ITO-based thin films
Nikolaos. Giannakaris, P. Siozos, S. P. Banerjee, M. Sentis, Demetrios Anglos

PI_063 S Depth profiling of tungsten layer on molybdenum substrate by Calibration free LIBS analysis
Júlia Miškovičová, Pavel Veis

PI_064 Data signal fusion LIBS – LA-ICP-MS for thin film samples
Matthias Trottmann, Adrian Wichser, Nico Zwahlen, Davide Bleiner

PI_065 Microscopic depth profiling of layered structures by combined application of Raman spectroscopy and LIBS
Lutz Pfeifer, Saskia Damaske, Tino Seger, Dominik Schiller, Christoph Scholz, Wolfgang Werncke

PI_066 Advances in Thin-Film Microextraction - Laser-Induced Breakdown Spectroscopy methodology for trace elemental analysis in liquid matrices
Montserrat Hidalgo, Laura Ripoll, Youssef Oulad-Zian, Stefano Legniaioli

Poster session II.

PII_067 S Restricted Boltzmann Machine Method for Dimensionality Reduction of Spectroscopic Data
Jakub Vrábel, Pavel Pořízka, Jozef Kaiser

PII_068 S Investigation on Feature Selection and Extraction applied in Laser Induced Breakdown Spectroscopy
Xutai Cui, Qianqian Wang, Geer Teng, Kai Wei, Wenting Xiangli, M. Nouman Khan, Bushra Sana Idrees

PII_069 Multivariate models for data library transfer in laser spectroscopy
Pavel Pořízka, Erik Képeš, David W. Hahn, Jozef Kaiser

PII_070 An Artificial Neural Network Software Package for LIBS Data Modeling
Xiaofeng Tan

PII_071 Chemometrics for the analysis of cement-based materials
Cassian Gottlieb, Tobias Günther, Gerd Wilsch, Christian Bohling

PII_072 Application of laser-induced breakdown spectroscopy for proximal soil sensing in precision agriculture
Alexander Erler, Daniel Riebe, Toralf Beitz, Hans-Gerd Löhmannsröben, Robin Gebbers

PII_073 S Multivariate Analysis of Moon Rocks using Laser Induced Breakdown Spectroscpy(LIBS) Spectra
Syedah Sadaf Zehra, Paola Zupella, Piergiorgio Nicolosi

PII_074 S Spectral fingerprint analysis of forensic glass microsamples by LIBS
Dávid Jenő Palásti, Anikó Metzinger, Gábor Galbács

PII_075 S Classification of Archaeological Samples using Supervised Machine Learning Algorithms
Veronika Dillingerová, Tomáš Vaculovič, Kateřina Tomková, Viktor Kanický

PII_076 S Cluster analysis of spectroscopic data in the principal component space_
Daniel Holub, Pavel Pořízka, Jozef Kaiser

PII_077 S Rapid identification of the plastics using laser-induced breakdown spectroscopy
Rajendhar Junjuri, Manoj kumar Gundawar

PII_078 S Quantitative determination of lithium in granite rockforming minerals by laser-induced breakdown spectroscopy (LIBS)
Krisztián Jancsek, Patrick Janovszky, Gábor Galbács, Tivadar M.-Tóth

PII_079 Lithium bearing minerals differentiation using LaserInduced Breakdown Spectroscopy
Diana Guimarães, Miguel Ferreira, Cátia Dias, Ricardo Ribeiro, Alexandre Lima, Rui Martins, Pedro Jorge

PII_080 Quantification of minerals and valuable metals in complex drill cores from finnish orogenic gold deposits
Marko Hornschu, Jeannette Meima

PII_081 Classification of copper-containing minerals by combined laser-induced breakdown and Raman spectroscopy
Pia Brinkmann, Daniel Riebe, Toralf Beitz, Hans-Gerd Löhmannsröben, Michał R. Wójcik, Arkadiusz J. Antończak

PII_082 On the use of laser-induced breakdown spectroscopy for analysis of metals in ores
Daniel Diaz, David W Hahn

PII_083 Characterisation of iron type meteorites using simultaneous broadband and narrow- high- resolution laser induced breakdown spectroscopy (LIBS)
Michaela Hornackova, Vayakkara Kolaprath Unnikrishnan, Milan Gargulák, Pavel Veis

PII_084 Towards Real time ore grading in ¡VAMOS! Underwater Robotic Mining systém
Pedro Jorge, Rui Martins, Miguel Ferreira, Diana Guimarães, José Almeida, Alfredo Martins, Stef Kapusniak, Eduardo Silva

PII_085 A combined LIBS/Raman underwater system and its sea trial in the South China Sea
Wangquan Ye, Chunhao Liu, Qingsheng Liu, Jinjia Guo, Ronger Zheng

PII_086 Developing LIBS applications for the mining and minerals industry
Marinus Dalm

PII_087 S LIBS methodologies for the determination of halogen molecular species in gypsum from thermal power plants
Luis Javier Fernández-Menéndez, Cristina Méndez, César Álvarez-Llamas, Jorge Pisonero, Nerea Bordel

PII_088 Considerations on the formation mechanisms of emitting species from organic and carbon-containing inorganic compounds in CO2 atmosphere using LIBS
Luisa María Cabalin, Tomás Delgado, Laura García, Patricia Lucena, Javier Laserna

PII_089 S A non-calorimetric study of hygrothermal aging of pyrotechnic material by using laser-induced breakdown spectroscopy
Ji-Hoon Ryu, Jun-Ho Yang, Jack J. Yoh

PII_090 Effect of IR laser energy on several polymers using LIBS analysis
Kenza Yahiaoui, Sabrina Messaoud Aberkane, Sylia Banoun, Roufaida Belala, Amira Bendjaballah

PII_091 Analysis of HPHT diamonds by laser-induced breakdown spectroscopy during the laser-induced graphitization proces
Vyacheslav Fedorovich Lebedev, Kirill Vladimirovich Pavlov, Alexander Vladimirovich Koliadin

PII_092 S Nanoparticle analysis by LIBS and ICP-MS in industrial and environmental samples
Dávid Palásti, Albert Kéri, Lajos Villy, Tyra Biros Ádám Bélteki, Bálint Leits, Patrick Janovszky, Attila Kohut, Éva Kovács-Széles, Zsolt Geretovszky, Zoltán Galbács, Gábor Galbács

PII_093 Application of LIBS for elemental analysis of composite nanoparticles in solutions
Vasili Kiris, Alena Nevar, Natalie Tarasenka, Mikhail Nedelko, Nikolai Tarasenko

PII_094 Evaluation of silver nanoparticles on indium-tin-oxide (ITO) type SERS substrates for nanoparticle-enhanced LIBS analysis of liquid samples
Dávid Palásti, Pawel Albrycht, Karolina Paszkowska, Gábor Galbács

PII_095 Laser-Induced Breakdown Spectroscopy as a Novel Readout Method for Nanoparticle-Based Immunoassays
Pavlína Modlitbová, Zdeněk Farka, Matěj Pastucha, Pavel Pořízka, Karel Novotný, Petr Skládal, Jozef Kaiser

PII_096 S Plasma relative emission efficiency for LIBS and NE-LIBS
Vincent Gardette, Marcella Dell'Aglio, Alessandro De Giacomo

PII_097 Double-Pulse Nanoparticle-Enhanced LIBS (DP-NELIBS)
Francesco Poggialini, Stefano Legnaioli, Beatrice Campanella, Stefano Pagnotta, Vincenzo Palleschi

PII_098 Enhancement of LIBS Signals from a Steel Sample with Au Nanoparticles on its Surface
Vassili Kiris, Evgueni Ershov-Pavlov, Nikolai Tarasenko

PII_099 Nanoparticle-enhanced laser ablation coupled with ICP-MS
Markéta Holá, Zita Salajková, Aleš Hrdlička, Jakub Ondráček, Pavel Pořízka, Viktor Kanický, Jozef Kaiser

PII_100 Study of the feeding effect on recent and ancient bovine bones by nanoparticle-enhanced laser-induced breakdown spectroscopy and chemometrics
Zienab AbdelFattah Abdel-Salam, Mohamed Abdel-Harith, Vincenzo Palleschi

PII_101 Laser-induced breakdown spectroscopy: a characterization tool in the restoration field related to protective nanobiocides
Maripaz Mateo, Javier Becerra, Ana Paula Zaderenko, Pilar Ortiz, Ginés Nicolás

PII_102 Application of LIBS in the recycling and sorting of aluminum scrap
Xue jing Shen, Jia Liu, Xiao xia Shi, Fei peng Cui, Peng Xu, Xiao peng Li

PII_103 S Advantages and limitations of Laser-induced breakdown spectroscopy (LIBS) for direct e-waste analysis
Jeyne Pricylla Castro, Edenir Rodrigues Pereira Filho, Rasmus Bro

PII_104 On-line LIBS analysis for the classification of metal alloys and plastic scrap. From lab environment to conveyor belts.
Melina Gilbert Gatty, Jonas Petersson, David Malmström, Arne Bengtson, Tania Irebo Schwartz

PII_105 Handheld LIBS Analyzer with Miniature Echelle Spectrometer for Analysis and Grade Identification of Alloys
Stanislaw Piorek

PII_106 On-line analysis of molten slag using Laser-induced breakdown spectroscopy
Jonas Petersson, Mélina Gilbert-Gatty, David Malmström, Arne Bengtson, Tania Irebo-Schwartz

PII_107 Classification of cement pastes with laser-induced breakdown spectroscopy
Tobias Völker, Steven Millar, Christoph Strangfeld, Gerd Wilsch

PII_108 Laser-Induced Breakdown Spectroscopy: An essential technique for direct analysis of refractory wastes from steelmaking processes
Javier Moros, Luisa María Cabalin, Javier Laserna

PII_109 S Copper and nickel elemental composition analysis by LaserInduced Breakdown Spectroscopy (LIBS) in metal recovery chelating resin
Marina Martínez-Minchero, Laura Ulloa, Eugenio Bringas, María Fresnedo San Román, José Miguel LópezHiguera, Adolfo Cobo

PII_110 S Analysis of major and minor elements in coal by laserinduced breakdown spectroscopy
Andreas Weninger, Stefan Trautner, Simon Eschlboeck-Fuchs, Josef Hofstadler, Andreas Pissenberger, Hubert Duchaczek, Johannes D Pedarnig

PII_111 Following the cementation in steel with LIBS
Damien Devismes, Frédéric Pelascini

PII_112 Measurement of major and minor elemental composition of exhaust emissions from in-use Diesel engine passenger vehicles by LIBS
Richard Viskup, Christoph Wolf, Werner Baumgartner

PII_113 S Laser induced breakdown spectrometry for online multielement analysis of metal powder jet during coaxial laser cladding
Pavel A. Sdvizhenskii, Vasily N. Lednev, Roman D. Asyutin, Mikhail Ya Grishin, Sergey M. Pershin

PII_114 Mechanical stirring: a novel engineering approach for in situ spectroscopic analysis of molten metals
Younes Belrhiti, Marion Serasset, Jean-Baptiste Sirven, Malek Benmansour

PII_115 S LIBS for identification of valuable materials in electronic components
Frederik Schreckenberg, Cord Fricke-Begemann, Sven Connemann, Reinhard Noll

PII_116 In situ Tungsten Inert Gas Welding Monitoring by LIBS Measurements
Ugur Alp Taparli, Axel Griesche, Katarzyna Michalik, Lars Jacobsen, David Mory, Thomas Kannengiesser

PII_117 S Absolute Depth LIBS-Stratigraphy with NoScSiSp-OCT
Fabian Kraft, Morris Jhängi Joseph Weimerskirch, Ulrich Pacher, Tristan Oliver Nagy

PII_118 Analysis of the reinforced concrete structures with various degree of deterioration by LIBS
Anna S. Bryukhova, Andrey A. Kuznetsov, Timur A. Labutin, Andrey M. Popov, Nikita B. Zorov

PII_119 S Archaeometallurgical study of the gilding technique of two iron spurs by means of LIBS depth profiling
Silvia Pérez-Diez, Beatriz García-Alonso, Luis Javier Fernández-Menéndez, Lara Lobo, Nerea Bordel, Noelia Fernández-Calderón, Alejandro García Álvarez-Busto

PII_120 S Halides detection in Pompeian wall paintings through the use of LIBS molecular emission bands
Silvia Pérez-Diez, Maite Maguregui, Iker Marcaida, Luis Javier Fernández-Ménendez, Alberta Martellone, Bruno De Nigris, Massimo Ossana, Nerea Bordel, Juan Manuel Madariaga

PII_121 S Elaboration of chemical and tomographic data by the principal component analysis method for archaeological applications
David Prokop, Pavel Pořízka, Federico Bernardini, Tomáš Zikmund, Giacomo Vinci, Jozef Kaiser, Claudio Tuniz

PII_122 Depth profiling of elemental composition of mollusk shells by Laser-Induced Breakdown Spectroscopy (LIBS)
Marina Martinez, Asier García-Escárzaga, Igor Gutierrez-Zugasti, José Miguel López-Higuera, Adolfo Cobo

PII_123 S Micro-LIBS mapping of marine mollusk shells enables reliable use of Mg/Ca as a temperature proxy
N. Hausmann, I. Malegiannaki, A. Lemonis, P. Siozos, D. Anglos

PII_124 Impact of LIBS implementation on the characterization of archaeological ferrous metals
Xueshi Bai, Hortense Allègre, Maxime Lopez, Philippe Dillmann, Vincent Detalle

PII_125 S Exploration of LIBS depth profiling of archaeological ceramics by means of X-ray computed tomography
Eva Pospíšilová, Pavel Pořízka, Tomáš Zikmund, Marie Novotná, Karel Novotný, Jozef Kaiser

PII_126 S Semi quantitative Elemental Analysis of Volcanic Ashes from Populations Surrounding the Tungurahua Volcano of the Eruptive Period 2008-2010, Using the LIBS Spectroscopy (Laser-Induced Breakdown Spectroscopy)
Geovanna Vasquez Lara, Diego Diaz Pace, Silvana Hidalgo, Cesar Costa Vera

PII_127 Optimization of DP-LIBS sensitivity for tungsten detection in the nuclear fusion applications
Pawel Gasior, Monika Kubkowska, Wojciech Gromelski

PII_128 Laser-induced breakdown spectroscopy of uranium in the vacuum ultraviolet
Edouard Rollin, Olivier Musset, Guillaume Legay, Jean-Baptiste Sirven

PII_129 S Identification of Radioactive Materials at the Site of Dirty Bomb Attack Using Laser-Induced Breakdown Spectroscopy
Hyeongbin Kim, Yunu Lee, Sungyeol Choi

PII_130 S Monitoring of Liquid Radioactive Waste Treatment Process using Laser-induced Breakdown Spectroscopy
Yunu Lee, Sungyeol Choi

Contest

LIBS classification contest *[www.contest.emslibs.com]* was organized as a part of EMSLIBS 2019. The contest started on the 8th of April and finished the 31st of July. We were very pleased with the involvement of participants as we got around 40 registrations and more than 10 active participants/groups submitting results. All results were presented at the conference and a report is available at the contest webpage.

Despite the passed deadline for the competition, you may still test your performance and compare it with other participants. Webpage will remain as it is now, serving as a benchmark for comparing the spectra classification algorithms.

INTRODUCTION

One of the most frequent applications of LIBS is material identification. Since most of these tasks are carried out based on a material library, they can be regarded as classification. Hence, the aim of this competition is to find a robust classification algorithm capable of dealing with challenging datasets.

BRIEF DESCRIPTION

The goal of the competition is to build a model on training data and correctly classify the test dataset with the highest possible accuracy. Our data are spectra belonging to 12 classes in total, originated from 138 samples. However, the number of samples varies among classes. Every sample was measured with the same conditions. The samples are OREAS certified soil samples cast into gypsum for more convenient handling.

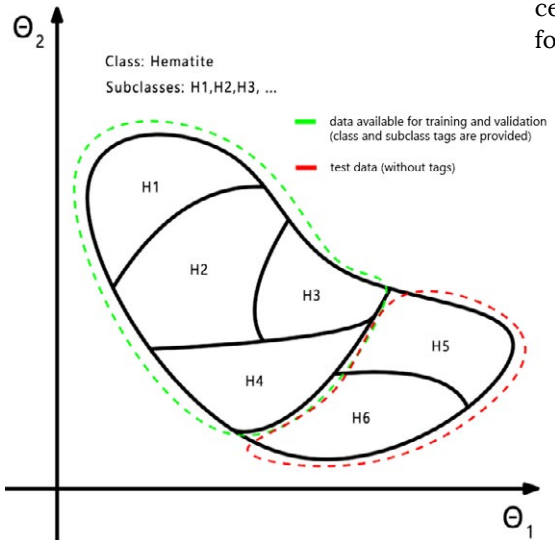
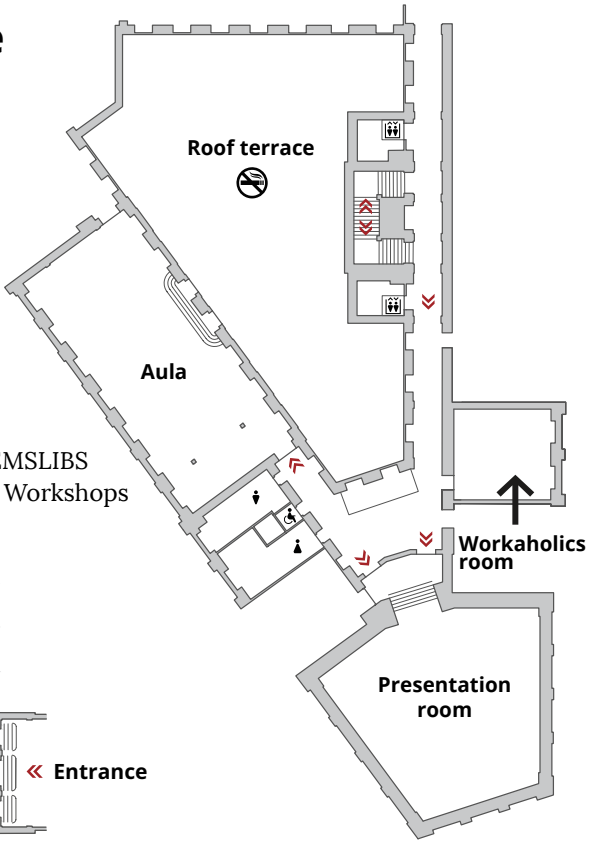


Fig. 1. Representation of an example dataset class in artificial parametric space.

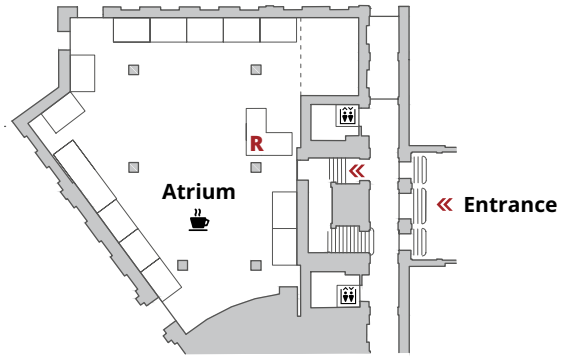
Jakub Vrábel will present on Sunday 8th, 17:30 in the presentation room. The talk will cover the basic introduction to the contest and presentation of the results.

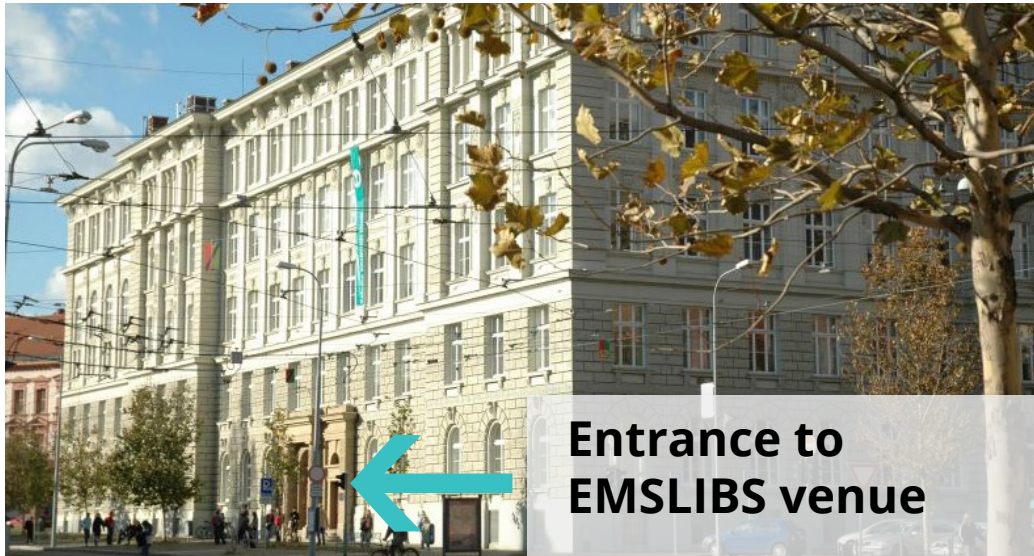
The EMSLIBS venue

EMSLIBS 2019 will take place at the Faculty of Social studies of Masaryk University in Brno. Check the end of the booklet to see detailed map of the venue.



Atrium – Vendor, Coffee breaks, Registration booth
Aula – Icebreaker, Poster session
Workaholics room – Your office at EMSLIBS
Presentation room – Presentations, Workshops





Social program and catering

We have prepared a rich social program comprising icebreaker, beer tasting during poster session, winde tasting and gala dinner.

Please note, admission to the icebreaker, wine tasting, and gala dinner is only possible if you have paid an extra fee.

CATERING
Lunches and coffee breaks are provided everyday at the venue of the symposium. The catering will also include non-alcoholic beverages and food.

COFFEE BREAKS
Monday and Tuesday: 10:30 – 11:15 and 15:30 – 16:15
Wednesday: 10:50 – 11:35
Thursday: 10:30 – 11:15 and 16:10 – 16:30

LUNCHES
Monday and Tuesday: 12:35 – 13:45
Wednesday and Thursday: 12:55 – 14:15

1 EMSLIBS venue
(symposium place, coffee breaks, icebreaker, scientific session)

2 Lunch place

HOW TO GET TO LUNCH PLACE
Organized tour from main entrance of EMSLIBS venue.
12:45 (Monday, Tuesday)
13:00 (Wednesday, Thursday)
Address:
Žerotínovo nám. 617/9, Brno

Icebreaker

Sunday – September 8th, 18:00
Aula – EMSLIBS venue

Right after the workshops, we will organize the icebreaker party.

Poster session I – Beer tasting

Monday – September 9th, 18:00
Aula – EMSLIBS venue

The Czech Republic is a beer nation. We have many kinds of beer and especially multiple small and domestic breweries. During the poster session you will be able to taste several types of special beer from the microbrewery Richard from Brno-Žebětín.

TYPES OF BEER
BITTER Světlý ležák 11° (BITTER light lager beer)
Pšeničné pivo 11° (Wheat beer)
Višňový ležák 12° (Cherry lager beer)
Medový speciál 15° (Honey special beer)
IPA 15° (India Pale Ale)

Poster session II – Raut

Wednesday – September 11th, 18:00
Aula – EMSLIBS venue

For the second part of the poster session, we plan to host you with standard catering, including various beverages and food.

Wine tasting Mendel Museum

Tuesday - September 10th, 19:00
Address: Mendel Museum – Mendlovo nám. 1a, 603 00 Brno
(see the map on the end of the booklet for a detailed localization)
Dress code: business casual

PROGRAM
Opening: from 19:00
Museum tour: 19:30 – 21:00
Banquet: 19:30
Wine tasting: 19:00

One of the main evening social events is going to take place in the Mendel Museum. This museum is not only a significant sight with regard to architecture but also with regard to science. During the event, you are more than welcome to participate in a museum tour leading you through the history of genetics and showing you the research of the founder of genetics, world-wide known scientist J. G. Mendel.

The soiree itself will be held in the adjacent abbey. The South Moravian region is well known by the high-quality wines' production. So it is no surprise that a wine tasting will be ready for the participants, including different types of wines from a local winegrower (Padalík, Dolní Věstonice). There will be a possibility to buy a bottle of wine. The wine tasting and garden banquet will be musically accompanied by a string quartet, Husákovo kvarteto.

MUSEUM TOUR, AUGUSTINIAN LIBRARY

When:	19:30 – 20:30
Capacity:	max. 25 participants/one tour
Duration:	15 min

MUSEUM TOUR, EXHIBITION IN THE MENDEL MUSEUM

When:	19:30 – 21:00
Capacity:	no limited/open access
Duration:	approx. 30 min

BUSES
The transportation from the EMSLIBS venue is free of charge for the participants of EMSLIBS, it is not necessary to register.

From: EMSLIBS venue
To: Mendel Museum
Departure: 18:45

From Mendel Museum
To: EMSLIBS venue
Departure: 23:00

Gala dinner in Fait Gallery

Thursday – September 12th, 19:00
Address: Fait Gallery, Ve Vaňkovce 465/2, 602 00 Brno(see the map on the end of the booklet for a detailed localization)
Dress code: smart casual

PROGRAM
Opening: from 19:00
Introductory word: 19:50
Dinner: 20:00
Official symposium ending: 22:00
Gala ending: 23:59

The gala dinner venue is going to take place in Fait Gallery in Gallery Vaňkovka, a place with an interesting industrial history.

Following the symposium tradition, the best student talks and posters of the symposium will be announced. We will also "pass the baton" to the hosting organization of the next symposium. The participants will have a chance to taste the real South Moravia, not only by delicious food and drinks which will be served but also by getting to know the folklore.

Dulcimer ensemble Friška from Kyjov and a presentation of local folk dances will surely liven the gala dinner up.

BUSES
The transportation from the EMSLIBS venue is free of charge for participants of EMSLIBS, it is not necessary to register.

From: EMSLIBS venue
To: Fait Gallery
Departure: 18:30

From: Fait Gallery
To: EMSLIBS venue
Departure I: 23:00
Departure II: 23:30
Departure III: 00:00

Symposium trips

Both symposium trips will take place on Friday, Sep 13th. The meeting point and time is given individually for one. You can receive more information at the registration desk during the symposium.

1/ Prague

One day city tour and a cruise around Prague's Venice – UNESCO sights.

HIGHLIGHTS/GENERAL DETAILS

Tour Prague Castle and enjoy a 3-course meal at the restaurant
Marvel at the magnificent Gothic St. Vitus Cathedral
Take a guided cruise on the Vltava River
See Lesser Town, the wonderful Valdstejn Garden, and Charles Bridge
Stop at the Old Town Hall and admire the Astronomical Clock

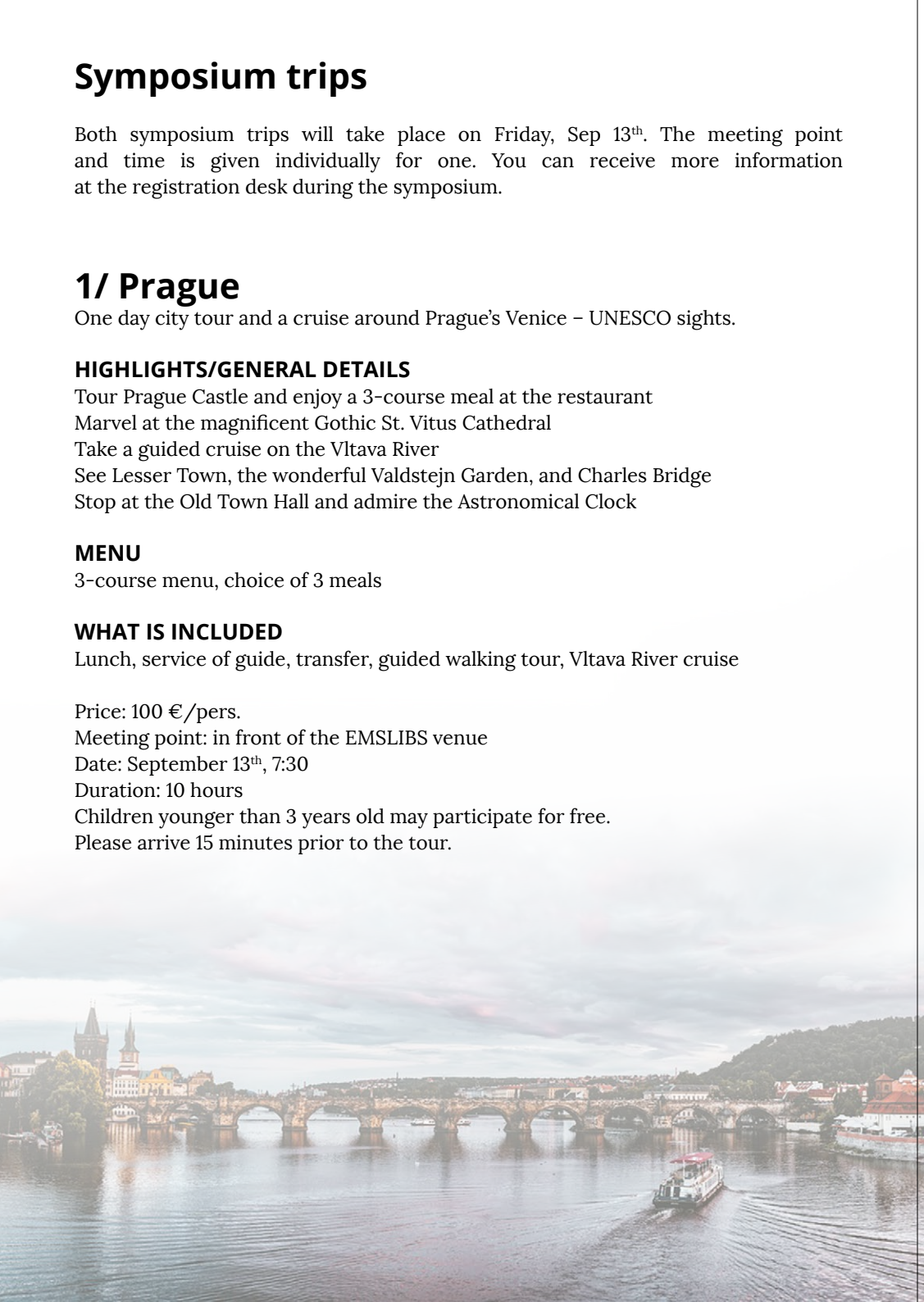
MENU

3-course menu, choice of 3 meals

WHAT IS INCLUDED

Lunch, service of guide, transfer, guided walking tour, Vltava River cruise

Price: 100 €/pers.
Meeting point: in front of the EMSLIBS venue
Date: September 13th, 7:30
Duration: 10 hours
Children younger than 3 years old may participate for free.
Please arrive 15 minutes prior to the tour.



2/ Brno

A/ GUIDED TOUR THROUGH BRNO

There will be a half-day guided tour through the historical city center of Brno.

HIGHLIGHTS/GENERAL DETAILS

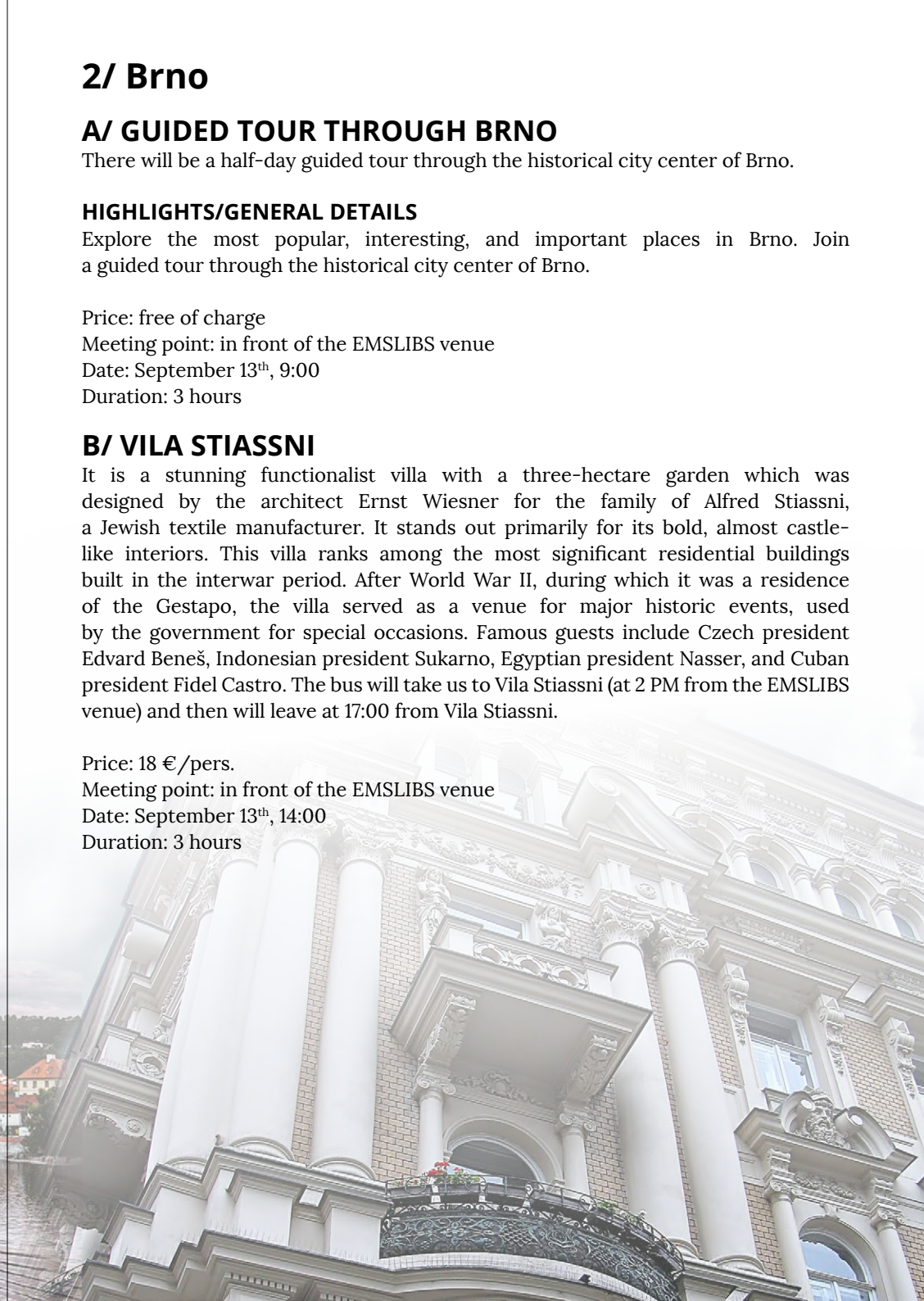
Explore the most popular, interesting, and important places in Brno. Join a guided tour through the historical city center of Brno.

Price: free of charge
Meeting point: in front of the EMSLIBS venue
Date: September 13th, 9:00
Duration: 3 hours

B/ VILA STIASSNI

It is a stunning functionalist villa with a three-hectare garden which was designed by the architect Ernst Wiesner for the family of Alfred Stiassni, a Jewish textile manufacturer. It stands out primarily for its bold, almost castle-like interiors. This villa ranks among the most significant residential buildings built in the interwar period. After World War II, during which it was a residence of the Gestapo, the villa served as a venue for major historic events, used by the government for special occasions. Famous guests include Czech president Edvard Beneš, Indonesian president Sukarno, Egyptian president Nasser, and Cuban president Fidel Castro. The bus will take us to Vila Stiassni (at 2 PM from the EMSLIBS venue) and then will leave at 17:00 from Vila Stiassni.

Price: 18 €/pers.
Meeting point: in front of the EMSLIBS venue
Date: September 13th, 14:00
Duration: 3 hours



The city of Brno

Brno, with its population up to 400,000 inhabitants, is the largest Moravian city and the second largest city in the Czech Republic. It is an important center of higher education with 6 universities which in total comprises 33 faculties.

You won't be surprised then that Brno is a lively city with 89,000 students. Brno is an important center of science, research and innovations. Besides that, many companies, especially technical and technological, reside here, which makes it a multicultural city with people from different countries from all over the world. Thanks to trade fairs, Brno is a thriving place with the high quality of life, offering many services and consequently a high standard of living.

PUBLIC TRANSPORT AND TAXI SERVICES

Public transport in Brno is accurate and regular. You can buy a ticket in the yellow vending machines at some stops, DPMB shops, kiosks and railway stations. You have to validate your ticket by a validating machine right after boarding. The 60-minute one costs 25 CZK (1 euro). After 11 PM there are night buses going every hour.
www.jizdnirady.idnes.cz/brno/spojeni

There are only taxi services, unfortunately no Uber. We reccommend using only verified taxies, such as:
City taxi – phone number: 14004; *www.citytaxibrno.cz/en*
Liftago – download the app; *www.liftago.com*

WHAT TO SEE IN BRNO

You can explore the most interesting places of Brno during the free city tour with us at the end of the symposium or check the map at the back page of this booklet and visit them on your own.

Useful information

BADGES

You will receive badges with your name at the registration desk. Those will be used as your meal vouchers for lunches. You will receive additional tickets for gala dinner, wine tasting and ice breaker in case you purchased those.

For security reasons, participants are requested to wear their badges visibly during the whole symposium, including social events.

CERTIFICATE OF ATTENDANCE

Every participant will be provided with a certificate of attendance.

CAR PARKING

There is a system of residential parking in Brno.

In places where on the vertical traffic sign there is an orange stripe you can now park for 30 minutes for free. Parking for longer is paid (payment in parking meter or through an online mobile app).

There are also some parking houses you could use (Domini park, Pinki Park, Parking at Janacek Theatre ...).
More parking spots might be available at your hotels.

Overall information about parking and parking houses:
www.bkom.cz/parking
www.parkovanivbrne.cz/en/

ELECTRICITY

The voltage and plug size are 230 V/50 Hz, type E, F.

INTERNET FACILITIES

Wireless internet connection will be available during the symposium.
SSID: EMSLIBS2019
Password: EMSLIBS2019

SMOKING POLICY

Smoking is generally allowed, but always outside at designated areas.

EMERGENCY NUMBERS (FREE OF CHARGE)

155 Ambulance/ Medical service
158 Police department/156: Municipal police
150 Fire department
112 European emergency number

SOCIAL MEDIA

Follow us on social media:
Linkedin *www.linkedin.com/company/emslibs*
Twitter *www.twitter.com/emslibs*

DISCLAIMER

Participants shall be bound by Terms and Conditions of EMSLIBS 2019 upon registering for the Symposium and are advised to read and understand these terms carefully before registering. The Organizers will not accept any conditions contradictory to or deviating from these general terms and conditions and shall be responsible for supervising this and for taking immediate action if needed.

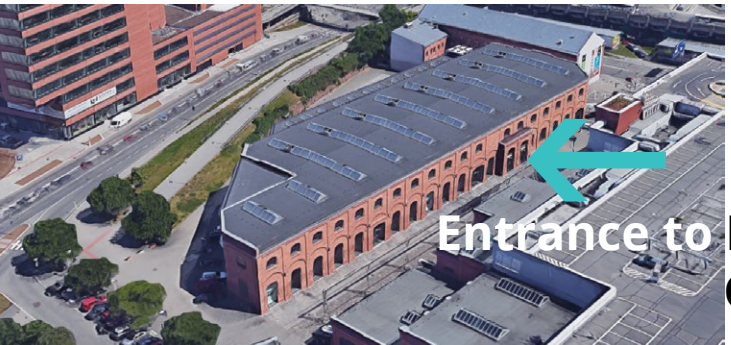
Venues of social events

EMSLIBS Venue, Faculty of Social Studies

Wine tasting in Mendel Museum of Masaryk University

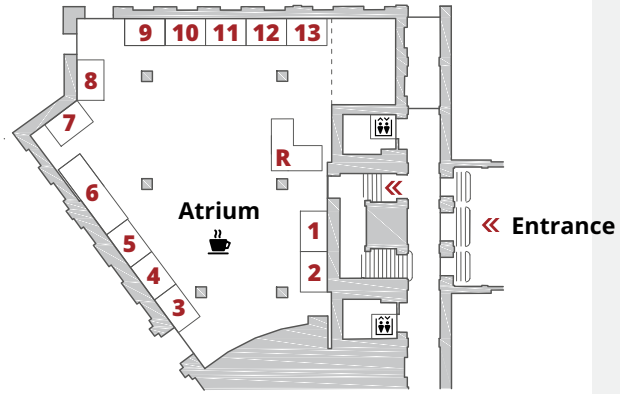
Gala dinner in Fait Gallery

Entrance to Mendel Museum



Entrance to Fait Gallery

1st floor



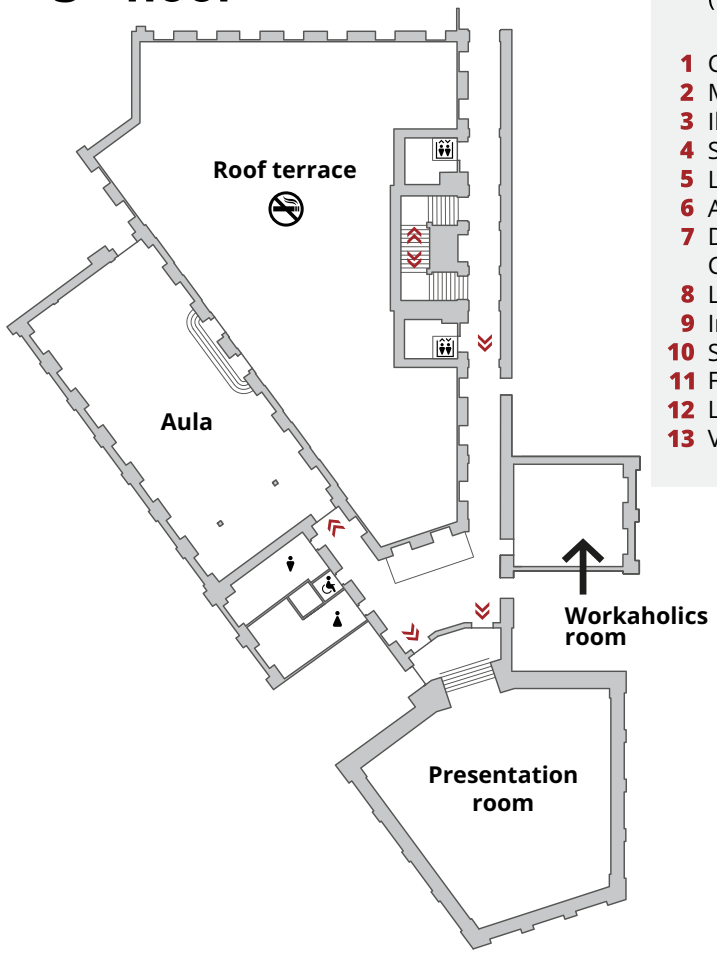
Atrium
R – Registration booth
Vendor
Coffee breaks

Presentation room
Presentations
Workshops

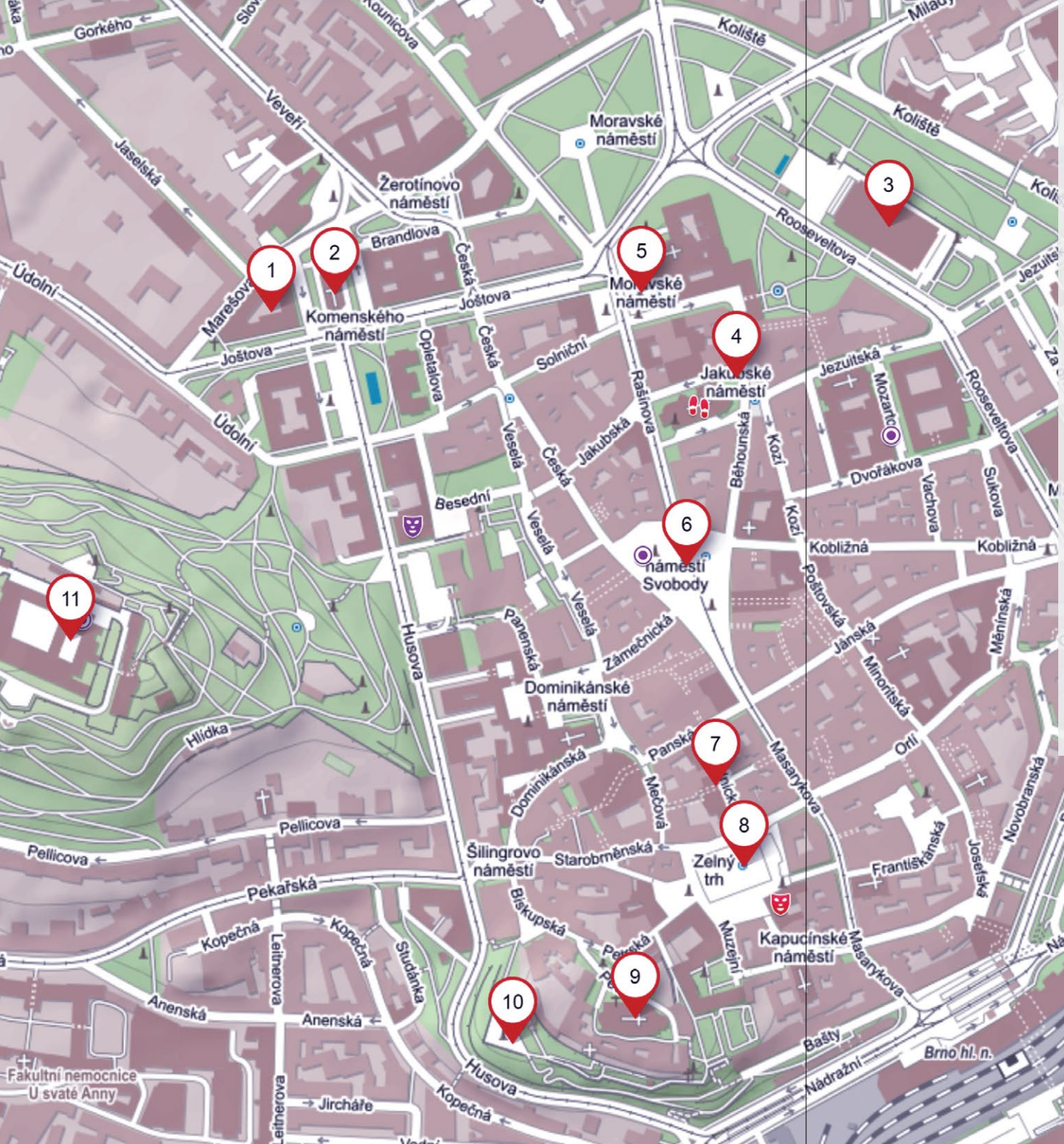
Aula
Icebreaker
Poster session

Workaholics room
(Your office at EMSLIBS)

3rd floor



1 CEITEC
2 Montfortlaser
3 Ibsen Photonics a. s.
4 SOL Instruments
5 LTB Lasertechnik Berlin GmbH
6 AtomTrace a. s.
7 DT-Equipment & Innovation Center Iceland
8 Lumibird
9 Imagine Optic
10 SciAps
11 Femtonika s.r.o.
12 Litron
13 VM-TIM GmbH



Brno

This map of the city centre will take you to the most popular, interesting, and important sights, squares, streets, and parks.

1 EMSLIBS Venue, Faculty of Social Studies

2 Red Church (Červený kostel)

3 The Janáček Theatre (Janáčkovo divadlo)

4 St James's Square (Jakubské náměstí)

5 The Moravian Square – Statue of Margrave Jobst (Moravské náměstí – Socha markraběte Jošta)

6 Freedom Square – The clock, the Facades of local houses, and the Round fountains (náměstí Svobody – Brněnský orloj, fasády zdejších domů, kašny)

7 The Old Town Hall – Brno Dragon and Fabled wheel (Stará radnice – Brněnský drak, loukoťové kolo)

8 The Vegetable Market – The local Baroque fountain (Zelný trh – barokní kašna)

9 Cathedral of St Peter and Paul (katedrála svatého Petra a Pavla)

10 The Denis Gardens (Denisovy sady)

11 Špilberk Castle (hrad Špilberk)

Monday – 9th September

8:30	**Opening**		
	Heritage (chair: Kaiser)		
8:45	Niemax	H1	The arduous way of LIBS becoming an established technique
	Fundamentals I (chair: Kaiser)		
9:30	Gornushkin	FU1	Equilibrium chemistry in laser induced plasmas and plasma chemical reactors
9:50	Vadillo	FU2	Femtosecond laser ablation: as fun as it gets
10:10	Roldan	FU3	Quantitative analysis of indium in sphalerites by CF-LIBS using pre-classification by PCA
10:30	**Coffee break**		
	Fundamentals II (chair: Gornushkin)		
11:15	Labutin	FU4	Application of spectra modeling for Laser-Induced Breakdown Spectroscopy
11:35	Skočić	FU5	Model function for Optical Time of Flight signal in Laser Induced Plasma
11:55	Yu	FU6	Physical and Statistical Studies of the Influence of Minor Elements on Plasma Temperature and Emission Intensity in LIBS Measurements
12:15	Veis	FU7	Fundamentals of simultaneous Vacuum UV - UV LIBS for quantification
12:35	**Lunch**		
	Mapping (chair: De Giacomo)		
14:10	Motto-Ros	MA1	LIBS-based Imaging: critical focus on current status and future directions
14:30	Dietz	MA2	LIBS Microscopy for Elemental Imaging of Heterogeneous Samples
14:50	Müller	MA3	Detection of REE-rich areas in Storkwitz drill cores using LIBS and a combination of normalization, clustering and spatial raster analysis
15:10	Leprince	MA4	In situ, quantitative, elemental imaging of lung tissues
15:30	**Coffee break**		
	Biology (chair: Motto-Ros)		
16:15	Rehse	BI1	Bacterial Limit of Detection Reduction Utilizing A Novel Sample Preparation Protocol
16:35	Martin	BI2	Switchgrass and Woody Biomass Elemental characterization using Laser-induced Breakdown Spectroscopy
16:55	Melikechi	BI3	Classifying diseased and healthy biomedical samples one laser pulse at a time
17:15	Boyaci	BI4	LIBS Applications for Food Safety and Quality
18:00	**Poster session / beer tasting**		

Tuesday - 10th September

	Key note (chair: Niemax)		
8:45	Omenetto	K1	Critical considerations on the use of several experimental methodologies to evaluate self-absorption effects in atomic emission spectroscopy
	Quantification I (chair: Niemax)		
9:30	Palleschi	QA1	Self-absorption is your friend: exploiting self-absorption for improving the accuracy of Laser-Induced Breakdown Spectroscopy analysis
9:50	Deguchi	QA2	Improvement of LIBS Quantitative Capability for Remote Elemental Detection Using Collinear Long and Short DP Laser
10:10	Touchet	QA3	Direct isotopic analysis of solids by laser-induced breakdown self-reversal isotopic spectrometry (LIBRIS)
10:30	**Coffee break**		
	Quantification II. (chair: Palleschi)		
11:15	Bousquet	QA4	Advanced data processing to improve the analytical performance of LIBS
11:35	Wang	QA5	Origin of Measurement Uncertainty and its Reduction methods
11:55	Pelascini	QA6	Calibration-free laser-induced breakdown spectroscopy for industry
12:15	Rollin	QA7	A standard methodology for characterization of matrix effects in laser-induced breakdown spectroscopy
12:35	**Lunch**		
	Chemometrics (chair: Bousquet)		
14:10	El Haddad	CH1	Mineral Quantification by Laser-Induced Breakdown Spectroscopy for In-Field Rock Characterization
14:30	Jorge	CH2	Self-Learning Artificial Intelligence Methodology for the Accurate Quantification and Classification of Laser Induced Plasma Breakdown Spectroscopy applied to Geological Lithium Surveys in Portugal
14:50	Sun	CH3	Machine Learning for Classification and Regression of LIBS Spectra from ChemCam Calibration Targets
15:10	Duponchel	CH4	Embedded k-Means Clustering for a deep exploration of megapixel LIBS imaging data sets
15:30	**Coffee break**		
16:15	**Mining** (chair: Kaski)		
16:15	Sabsabi	MI1	A look at LIBS instrumentations as an emerging tool for mining applications
16:35	Cousin	MI2	New quantification of Barium for MSL/ChemCam Mars data, and implications for geological interpretations
16:55	Forni	MI3	Fluorine detection on Mars: experiments and geological interpretation
17:15	Schmitt	MI4	Quantification of Lithium in pegmatites using handheld Laser Induced Breakdown Spectroscopy : a new approach for mining exploration
19:00	**Mendel museum / wine tasting**		

Wednesday - 11th September

	Key note (chair: Noll)		
8:45	Hahn	K2	LA-LIBS: High repetition rate ablation in combination with aerosol LIBS for quantitative analysis of solid samples
	Hyphenated systems (chair: Noll)		
9:30	Kaski	HY1	LIBS, Raman and LIF in analysis of rocks containing rare earth elements
9:50	Marmatakis	HY2	Coupling LIBS to SSI-MS. Interference of plasma formation with mass analysis
10:10	Zheng	HY3	Development of in-situ spectroscopy and its ocean applications
10:30	Fantoni	HY4	Complementary characterization of ancient Roman frescoes by PIXE and LIBS techniques
10:50	**Coffee break**		
	Molecular (chair: Martin)		
11:35	Gaft	MO1	Molecular LIBS and Plasma Induced Luminescence of BaF2:Tm3+
11:55	Yang	MO2	Double-pulse laser synchronization aimed at simultaneous detection of intensified atomic and molecular signals for space exploration
12:15	Bordel	MO3	Evaluation of the spatial and temporal distribution of atomic and molecular species at different LIBS plasma conditions
12:35	Samek	MO4	Analysis of biological samples combining data from LIBS, Raman spectroscopy and LA-ICP-MS
12:55	**Lunch**		
	Vendor (chair: Novotný)		
14:30	V1		LTB - Pfeifer
14:45	V2		AtomTrace - Mandel
15:00	V3		SciAps - Machaqueiro
15:15	V4		Lumibird - Colin
15:30	V5		Sol Instruments - Dubouski
15:45	V6		Femtonika - Hubert
16:00	V7		DT-Equipment & Innovation Center Iceland
16:15	V8		Imagine Optic - Gorju
16:30	**Symposium photo**		
18:00	**Poster session**		
	7:00 PM EMSLIBS committee meeting		

Thursday - 12th September

	Key note (chair: Pedarnig)		
8:45	Laserna	K3	Chemistry in the laser-induced plasma. An astrobiology perspective for Mars exploration
	Nanoparticles (chair: Pedarnig)		
9:30	De Giacomo	NP1	NELIBS vs LIBS: dealing with outstanding advantages and real limits
9:50	Novotný	NP2	LIBS assessment of spatial photon-upconversion nanoparticle distribution in model plants (R. sativus and L. minor)
9:10	Salajková	NP3	Nanoparticle Enhanced Laser Induced Breakdown Spectroscopy (NELIBS) as a technique for elemental analysis of microdrops at sub ppm level
10:30	**Coffee break**		
	Industry (chair: Galbács)		
11:15	Noll	IN1	Challenges and perspectives of inverse production for sustainable material recycling – what LIBS can contribute
11:35	Pedarnig	IN2	Quantification of the vulcanizing system of rubber in industrial tire rubber production by laser-induced breakdown spectroscopy
11:55	Smetaczek	IN3	Investigating the Li+/H+ exchange in garnet-type solid electrolytes using LIBS
12:15	Wilsch	IN4	Mobile LIBS-System for evaluation of concrete structures on-site
12:35	Lednev	IN5	Laser induced breakdown spectroscopy for in-situ multielemental analysis during metal additive manufacturing
12:55	**Lunch**		
	Future LIBS (chair: Veis)		
14:30	Galbacs	FT1	Exploring the potential of LIBS for the in-field analysis of nuclear samples
14:50	Grisola	FT2	LIBS developments for fusion applications
15:10	Purohit	FT3	Polydispersity and fractionation in laser ablation studied by LIBS in an optical trap
15:30	Alwahabi	FT4	Enhancement Limitations of Microwave-assisted LIBS: Application to Sulphur Detection
15:50	Fricke-Begem	FT5	LIBS for robotic alloy sorting
16:10	**Last coffee**		
16:30	**Free time**		
17:00	**Registration closing**		
19:00	**Gala dinner**		

EMSLIBS 2019 symposium booklet

Publisher: Spektroskopická společnost Jana Marka Marci
Ioannes Marcus Marci Spectroscopic Society
Ke Karlovu 2027/3, 120 00 Praha 2 - Nové Město, Czech Republic

Editor: Zuzana Chládová, Pavel Pořízka, Andrea Chyťová, Kateřina Kočendová, Jozef Kaiser, Jakub Vrábel, Viktor Kanický, Zita Salajková, Petra Bláhová, Karel Novotný, Pavlína Modlitbová

Brno 2019

ISBN 978-80-88195-12-2