



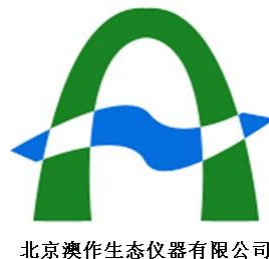
Welcome to the 2<sup>nd</sup> Chinese Symposium on Laser-Induced Breakdown Spectroscopy (LIBS), hosted by *Environmental Optics and Technology Committee of Chinese Optical Society* in Hefei, Anhui Province, China.

The symposium highlights fundamentals of LIBS and its applications in environment, industrial processes, public safety and so on. The motivation of this symposium is to bring together researchers from academia and industry as well as practitioners to share ideas, problems and solutions relating to the multifaceted aspects of LIBS technique. The goal of the symposium is to provide a platform for info-exchange face-to-face within LIBS research community mainly in China.

We would like to thank your interest in this symposium and welcome all of you to attend this symposium.

Wish all of you having a nice time in Hefei.

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Prof. F. Z. Dong  
CSLIBS'2012 Organizing Committee  
March 29, 2012



Anhui Institute  
of Optics and  
Fine Mechanics,

Chinese Academy of Sciences

- The 2<sup>nd</sup> CSLIBS was held in Hefei, March 29-31, 2012 .
- Over 100 participants attended the conference with 3 keynote , 29 invited talks and 13 poster presentations.

# 第二届中国激光诱导击穿光谱学研讨会—CSLIBS' 2012

中国·合肥 2012年3月 合影留念

Vincent Motto-Ros



Jagdish P Singh

Steve Buckley

March 29-31, 2012, Hefei, AH. China

## 会议日程

3月29日 08:00-21:00 报到		
3月30日上午 08:30-12:00		
08:30 开幕式		
主持人	董凤忠 (中科院安徽光学精密机械研究所) / 尹王保 (山西大学)	
时间	报告人姓名 (单位)	报告题目
08:45-09:20	Jagdish P.Singh Institute for Clean Energy Technology, Mississippi State University	LIBS: Application to biomedical samples
09:20-09:55	Yu Jin Lyon 1 University	Fundamental of laser-induced plasma
09:55-10:30	崔执凤 安徽师范大学	液相基质双脉冲激光诱导击穿光谱动力学研究
10:30-10:50	茶 歌	
主持人	崔执凤 (安徽师范大学) / 陆继东 (华南理工大学)	
10:50-11:25	赵南京 中科院安徽光学精密机械研究所	紫外飞秒激光作用下水的光学发射光谱特征
11:25-12:00	Steve Buckley 北美 LIBS 学会主席	LIBS 研究国际最新趋势和应用
12:15--	午餐 (丽景假日酒店 2 楼餐厅)	
3月30日下午 13:30-18:10		
主持人	俞进 (Lyon 1 University) / 杜振辉 (天津大学)	
时间	报告人姓名 (单位)	报告题目
13:30-14:00	Cheung Nai Ho/蔡镇 Hong Kong Baptist University	Laser plume spectroscopy for amol and ppb multi-element analysis
14:00-14:20	Severine Dubroecq IVEA	IVEA LIBS commercial systems
14:20-14:40	王秋平 中国科学技术大学	光谱仪器技术
14:40-15:05	尹王保/张雷 山西大学	基于 LIBS-LIF 联用技术的飞灰 UC 值高稳定高精度定量分析方法研究
15:05-15:30	王哲 清华大学	LIBS 数据处理方法
15:30-15:50	张志伟 北京爱万提斯科技有限公司	LIBS 技术、产品及应用

15:50-16:05	茶歌、合影	
主持人	郑荣儿 (中国海洋大学) / 王哲 (清华大学)	
时间	报告人姓名 (单位)	报告题目
16:05-16:30	周卫东 浙江师范大学	激光诱导纳秒放电等离子体光谱工作参数优化及其温度和电子密度的空间分布
16:30-16:55	李润华 华南理工大学理学院物理系	LIBS 元素分析中空间分辨本领与分析灵敏度的矛盾及其解决途径
16:55-17:20	亓洪兴 中科院上海技术物理研究所	深空探测 LIBS 研究
17:20-17:45	王蕾蓓 北京理工大学	LIBS 技术在爆炸物探测中的应用
17:45-18:10	谢斌 先锋科技股份有限公司	用不同的方法做 LIBS 研究 —先锋科技 LIBS 产品线介绍
18:30--	欢迎晚宴 (丽景假日酒店 2 楼餐厅)	
3月31日上午 08:30-12:05		
主持人	周卫东 (浙江师范大学) / 李润华 (华南理工大学)	
时间	报告人姓名 (单位)	报告题目
08:30-08:55	陆继东 华南理工大学	LIBS 技术在燃煤电厂的应用研究进展
08:55-09:20	Vincent Motto-Ros Lyon 1 University	Diagnostics and spectroscopy of laser-induced plasma
09:20-09:45	杜振辉 天津大学	激光诱导击穿光谱的分析线自动选择方法研究
09:45-10:10	董晨钟/孙对兄 西北师范大学	铝合金双脉冲激光诱导击穿光谱研究
10:10-10:25	茶 歌	
主持人	刘木华 (江西农业大学) / 孙兰香 (中科院沈阳自动化研究所)	
时间	报告人姓名 (单位)	报告题目
10:25-10:50	Wing-Lam Yip LP3, CNRS – Université d'Aix Marseille, Marseille, France	Calibration-free analysis of materials by laser-induced breakdown spectroscopy
10:50-11:15	姚明印 江西农业大学	LIBS 在农产品检测中的应用
11:15-11:40	高勋 长春理工大学	长春理工大学 LIBS 研究进展
12:15--	午餐 (丽景假日酒店 2 楼餐厅)	

# The 2<sup>nd</sup> Chinese Symposium on Laser-Induced Breakdown Spectroscopy (LIBS)

CSL/IBS2012

会议日程

3月31日下午 13:30-18:00		
主持人	王茜菡 (北京理工大学) / 郑贤锋 (安徽师范大学)	
时间	报告人姓名(单位)	报告题目
13:30-13:50	李红娟 北京澳作生态仪器有限公司	国外 LIBS 技术研究进展
13:50-14:10	钟石磊 青岛大学	UN-LIBS 在液体样品重金属元素检测中的应用
14:10-14:30	王琦 中科院安徽光学精密机械研究所	垂直双脉冲激光诱导等离子体发射光谱的实验研究
14:30-14:50	张博 中科院沈阳自动化所	LIBS 信号提纯与处理
14:50-15:10	张勇 钢铁研究总院	影响激光诱导击穿光谱分析性能的机理探讨
15:10-15:30	蔡铖 Hong Kong Baptist University	Multi-element analysis by ArF laser induced emissions of ablated plumes
15:30-15:55	郑荣儿 中国海洋大学	LIBS 应用于海洋原位探测的关键问题及可行性分析
15:55-16:20	董凤忠 中科院安徽光学精密机械研究所	中科院安徽光机所 LIBS 研究进展
16:20-16:50	张永东 北京镭宝光电技术有限公司	LIBS 系统中的激光源技术新进展
16:50-18:00	闭幕式、茶歇、实验室参观	
18:15--	晚餐 (丽景假日酒店 2 楼餐厅)	
备注: 所有报告时间中均包含 5 分钟提问交流讨论时间		

CSL/IBS2012

张贴报告

## 会议张贴报告

编号	报告人姓名(单位)	报告题目
P1	黄志文(北京理工大学)	人工神经网络在 LIBS 光谱数据处理中的应用
P2	姚顺春(华南理工大学)	不同球化程度 12Cr <sub>1</sub> MoV 的激光烧蚀特性分析
P3	张博(华南理工大学)	分子光谱 C <sub>2</sub> 的转动温度特性研究
P4	张大成 (中科院近代物理研究所)	Al 样品的双脉冲 LIBS 研究
P5	陈振玉(河北大学)	序列激光脉冲对激光诱导土壤等离子体辐射的影响
P6	潘从元 (中国科学技术大学国家同步辐射实验室)	激光诱导等离子体光谱技术检测钢水中碳含量的实验研究
P7	宋矫健(中国海洋大学)	海水光学特性对 LIBS 原位探测的影响分析
P8	杨德旺(中国海洋大学)	LIBS-Raman 在地质录井现场应用的可行性评估试验
P9	谷艳红(中国海洋大学)	复杂铜铁合金化学成分的 LIBS 定量分析方法研究
P10	钱慧国(浙江师范大学)	液体中铜和铁的 LIBS 检测
P11	王莉(安徽师范大学)	Quantitative determination of Cr <sup>3+</sup> in liquid jets using laser-induced breakdown spectroscopy
P12	傅院霞(蚌埠学院)	液相基质中微量金属元素 Pb 的激光诱导击穿光谱研究
P13	梁云仙 (中科院安徽光学精密机械研究所)	激光诱导击穿光谱谱图寻峰实现

注: 张贴报告编号以回执先后排序



- The director of the Institute, Prof. Wenqing Liu was invited to deliver a speech.
- A special issue of LIBS was published in **Frontiers of Physics** at Dec. 2012.

➤ Apply for **Hosting** "LIBS 2014" in China was on the way...

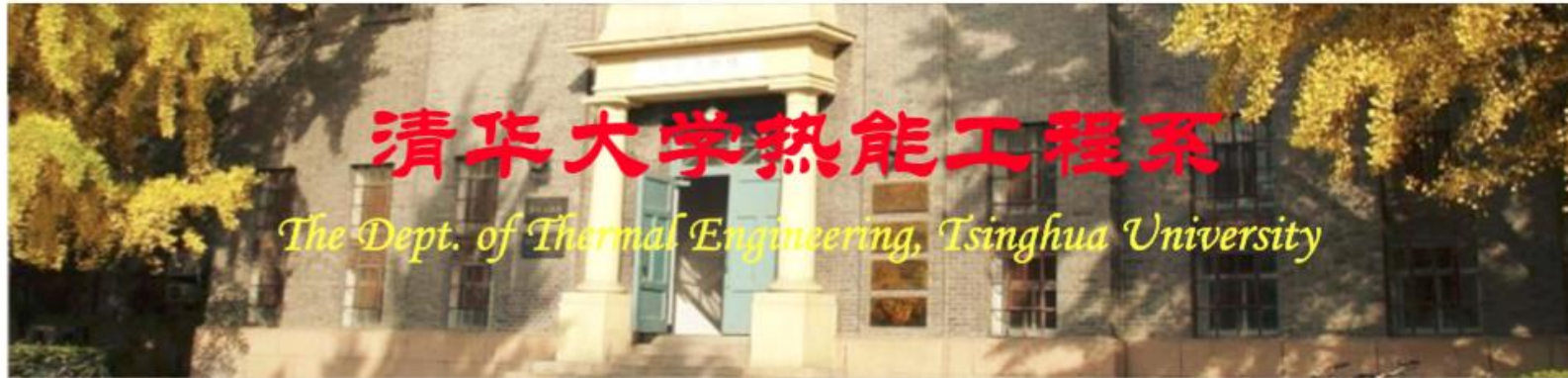


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**Laser-Induced Plasma and LIBS**

Higher Education Press  
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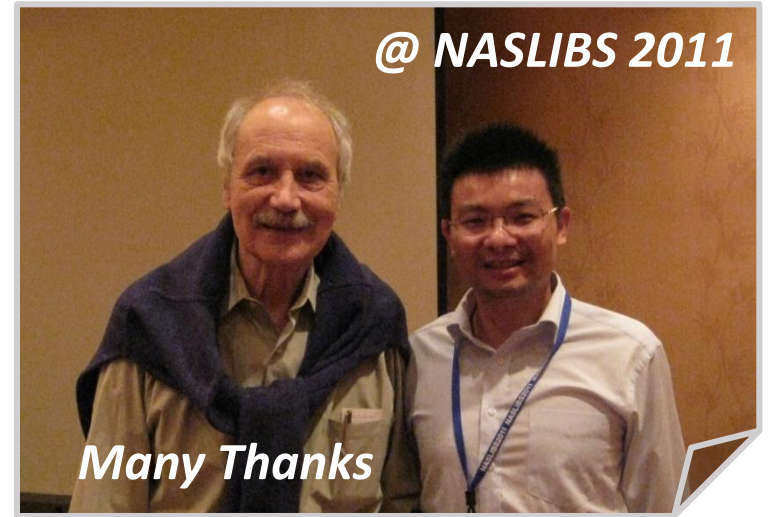
# @LIBS 2012, Oct. 2012, LUXOR, EGYPT



*The application presentation for hosting  
8th International Conference on Laser-Induced Breakdown  
Spectroscopy (LIBS2014)  
in Beijing, China  
On behalf of Chinese LIBS Community*

**Prof. Zheng Li**  
**Head of Dept. of Thermal Engineering**  
**Tsinghua University**

*Oct. 1<sup>st</sup>, 2012*



@ NASLIBS 2011, July 2011, Clearwater, USA, we were encouraged by ISC to host international LIBS 2014 in China.



**@LIBS 2012, Oct. 2012, LUXOR, EGYPT**



*Prof. Zheng Li*

*is delivering the acceptance speech @ Oct. 1<sup>st</sup>, 2012*



*Many Thanks*



*Many Thanks*



*Share the happiness*

EDITORIAL

# Laser-induced plasma and laser-induced breakdown spectroscopy (LIBS) in China: The challenge and the opportunity

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Laser-induced plasma as a spectroscopic emission source was introduced only two years after the invention of the laser. By focusing a pulse delivered by a ruby laser on the surface of a solid target, Brech and Cross in 1962 first observed optical emission following the laser impact [1], which later had been further identified as the emission from the plasma produced during the laser ablation process of the impacted target. Spectroscopic analysis of the plasma emission immediately demonstrated its huge potential for direct chemical analysis by showing a rich spectrum consisting of specific lines from ions, atoms as well as molecules in the ablation plume [2]. The simplicity of the original concept leads to the intrinsic advantages of the analytical technique developed later according to the above mentioned pioneer works and generally called nowadays, laser-induced breakdown spectroscopy (LIBS). The versatility of laser ablation process enables LIBS to directly analyze all kinds of materials, whether solid, liquid or gas. Sampling and excitation by laser pulse together with detection of optical emission are fully compatible with stand-off operation. On the other hand, the ability of a laser beam to be tightly focused provides microanalysis feature of the technique. Last but not least, LIBS shares multiple elemental analysis capability with other analytical techniques based on emission spectroscopy.

Staying a laboratory curiosity up to the 1980's, LIBS has found its first applications with the developments in Los Alamos conducted by Radziemski and Cremers on the detection of hazardous airborne trace metallic or nonmetallic elements [3, 4]. The development in the 1990's was more spectacular thanks to the technological progresses realized in laser, in spectrometer and in detector [5]. The further development turned to resolve very practical problems, such as monitoring environmental contaminations [6], controlling industrial processes [7, 8], or sorting waste materials [9]. With the first international LIBS conference held in 2000 in Pisa, Italy, the international LIBS community was established with the specific missions to make LIBS a mature technology and to develop its applications. A much larger range of demands in various domains has stimulated the development of the technique. In a non-exhaustive list, we can cite analysis of art works and cultural heritages for their conservation [10]; detection and analysis of bacteria [11, 12] and explosives [13, 14] for the needs from national security and homeland defence; direct analysis of trace metallic elements in fresh vegetables [15]; geological studies [16]; application in the nuclear industry [17]; and finally the space exploration with the integration by the NASA of the LIBS module, ChemCam, in Curiosity rover for the analysis of the soil on the Mars [18, 19].

The widespread and rapid development of LIBS applications contrasts however with its actual status of "between science and mature technology" [5]. Such contrast can be considered in parallel with that existing between the conceptual simplicity of the LIBS technique and the complexity of the physical processes involved in laser ablation and in expansion of the produced plasma into ambient gas. The requirement of a quantitative analysis with high performance is actually the major challenge faced by the international LIBS community to mature the technique. Back to the fundamental in order to reach a deeper understanding of the laser-induced plasma is considered today



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as the priority to trigger a significant breakthrough in LIBS technology [20, 21].

In such a context we welcomed the birth of the Chinese LIBS community. The first Chinese Symposium on LIBS (CSLIBS) held on March 26, 2011 in Ocean University of China in Qingdao was, at the same time, the first meeting of this community and a milestone in the development of LIBS in China. The participants of this conference wished to publish selected papers in order to make an inventory of LIBS research and development in China. *Frontiers of Physics* has kindly accepted the proposition of a special topic on LIBS gathering papers from several Chinese research teams (including a French team). This is the origin of the collection of the 8 papers which are now ready to be published in *Frontiers of Physics*. What the readers will discover through these papers is a picture of LIBS in China at that time. Draw a picture of an evolving community is obviously a difficult task. Such a special topic has at least the merit to present the state of the art of LIBS in China at a time when the Chinese LIBS community has started to write its own history. Among these 8 papers, 5 are review articles and the other 3 are research papers. The fundamental [22] as well as the application aspects are treated. Application papers occupy logically the major part of the special topic. Important domains of LIBS application developed in China have been reported concerning coal thermal power plant [23, 24], metallurgy [25], and national security [26]. The new configurations and variants of LIBS are also under investigation [27–29].

Beyond the inventory, clarifying the challenges as well as the opportunities is surely even more important for the Chinese LIBS community. Improving the quantitative analysis capability of LIBS and making it a mature technology accepted by a larger range of applications are the common vocation shared with the international LIBS community. The Chinese LIBS indeed faces its own opportunities with specific applications to develop in a country undergoing modernization. Huge and urgent demands are certainly the best asset of this community. Let us therefore wish a rapid and balanced development of LIBS in China, and hope that such development in turn actively contributes to the international LIBS community.

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• A special issue of LIBS published in *Frontiers of Physics*