



## **OLED diagnostic: calibration of a smartphone camera, production of scientific quality images**

The LAPLACE laboratory's researches range within a "activity continuum" encompassing the production, the transportation, the management, the conversion and the use of the electricity while covering all the aspects right from the study of fundamental processes in solid and gas to the development of processes and systems. Within this widespread field, the major themes concern the plasma discharges as well as plasma applications, the study of the dielectric materials (polymers, in particular) and their integration into the systems, the study and the design of the electrical systems, the optimization of the control and the power converters.

Because of its human resources, **LAPLACE is the first French concentration of research** in the field of Electrical Engineering and Plasma nationally with 160 fulltime researchers and a similar number of PhD students and postdocs.

The **Light & Matter (L&M)** research group is working on the production and use of light. Our research themes are centered around the science and technology of light sources and lighting systems as well as the study of the uses of light and its interactions with the environment and society. The themes of the group are inseparable from the applications. Although our activities are strongly linked to applications, they do not neglect fundamental aspects in the field of energy conversion materials and systems, and to a lesser extent in the field of electric discharge physics for lighting.

**CODIASE** (Control and DIAGnostic of Electrical Systems) research group works on the improved control, the performance and reliability of electrical systems, including converters, electrical machines, batteries, embedded actuators, alterno-starters, fuel cells in railways, aviation, automobile and other industries.

### **Research proposal: OLED diagnostic: calibration of a smartphone camera, production of scientific quality images**

Organic Light Emitting Diodes (OLEDs) are becoming ubiquitous with lifetimes greater than a few thousands of hours. The L&M group studied OLEDs performances degradation over time and developed models where the useful remaining lifetime can be predicted from luminance evaluation. Luminance is measured with quite expensive devices. The proposed topic is about evaluating OLEDs luminance using smartphone camera. This implies to study if such approach permits to evaluate the luminance level, as well as transforming the image coordinates, which are in pixels, into dimensional units, knowing the OLEDs size. This way, a OLEDs producer could distribute a simple application to diagnose their devices by taking a simple picture. The experimental part will consist in using L&M sources with known luminance, and compare OLEDs luminance evaluated by the smartphone to results produced by a reference device.

Pictures taken with a smartphone are optimized in the framework of a memory-constrained device (high compression rate) and within the use of applications like selfies. The obtained images are not suitable for scientific analysis, as a number of parameters like color fidelity or light gain are unknown. The proposed topic is to fully characterize, i.e. calibrate, smartphone camera in order to be able to reconstruct images in terms of photometric units (luminance) and colorimetric units. This also implies to develop a specific application that interacts with the basic settings of the camera. The experimental part will consist in using known light sources at L&M group in order to establish the link between physical values and images.

Depending on the progress of the work, image processing could be achieved as well for diagnostic purposes.

## Bonus for the student

- The internship will be paid, 600€/month above 2-month duration
- The Toul'Box full pack, the resource specially designed for students and doctoral students, as well as lecturers and researchers, to help get settled in Toulouse and the surrounding region, will be provided for free, see <https://toulbox.univ-toulouse.fr/en/packages/student>
- The French language summer school will be provided for free, see <https://www.inp-toulouse.fr/en/international/summer-schools/fle.html>

**Supervisors:** Pascal Dupuis (LAPLACE-LM), Pascal Maussion (LAPLACE-CODIASE) and Georges Zissis (LAPLACE-L&M), past President of the IEEE Industry Application Society

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**Pascal Dupuis** received the M.Sc. degree in electrical engineering and the Ph.D. degree in applied sciences from the Louvain School of Engineering, Louvain-la-Neuve, Belgium, in 1989 and 2001 respectively. From 2002 to 2006, he was a Postdoctoral Researcher with the Katholieke University Leuven, Belgium. From 2006 to 2012, he was a Senior Researcher with the Louvain School of Engineering. In 2012, he joined Paul Sabatier University, France, as a Development Engineer. His background includes measurements in a wide sense, for which he applied statistical approaches to validate data extracted from raw measurements in various contexts where a priori information about the system behavior or evolution was not available. He is currently working on lighting systems in a wide sense, including power supplies, conversion efficiency, photometric and colorimetric properties, aging concerns, environmental and health impacts.



**Pascal MAUSSION, PhD, MIEEE'06, SIEEE'17**, got his PhD in Electrical Engineering in 1990 from Université de Toulouse, Institut National Polytechnique (INP), France. He is currently full Professor at Université de Toulouse and researcher with CNRS research Laboratory: LAPLACE, Laboratory for PLASMA and Conversion of Energy in CODIASE (Control and Diagnostic of Electrical Systems) group. His research activities deal with the design of experiments as an optimization and modelling tool in control and diagnosis, the diagnosis of electrical systems such as drives and lighting, the control of power converters for induction heating or energy efficiency improvement in renewable energy systems, life cycle assessment in renewable energy systems. He is currently Toulouse INP Vice President for the International Affairs.



**Georges ZISSIS, PhD, MIEEE'92, SMIEEE'06.** Born in Athens in 1964, has graduated in 1986 from Physics department of University of Crete in general physics. He got his MSc and PhD in Plasma Science in 1987 and 1990 from Toulouse 3 University (France). He is today full Professor in Toulouse 3 University (France) and vice-rector for international projects. His primary area of work is in the field of Light Sources Science and Technology. He is especially interested in the physics of electrical discharges used as light sources; system and metrology issues for solid-state lighting systems; normalization and quality issues for light sources; impact of lighting to energy, environment, quality of life, health and security; interaction between light source and associated power supply; illumination and lighting. He is director of "Light & Matter" research group of LAPLACE that enrolls 20 researchers. He won in December 2006 the 1st Award of the International Electrotechnical Committee (IEC) Centenary Challenge for his work on normalization for urban lighting systems (in conjunction with IEEE, IET and the Observer). In 2009, he won the Energy Globe Award for France and he got the Fresnel Medal from the French Illuminating Engineering Society. In 2011 has been named Professor Honoris Causa at Saint Petersburg State University (Russian Federation) and he was President IEEE Industrial Application Society for the period 2019-20.