

# TECHNICAL DIGEST

IS-PALD 2015

International Symposium on  
Physics and Applications of Laser Dynamics

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Wednesday-Friday, November 04-06, 2015  
CentraleSupélec  
Campus de Metz, France

**Organized by**

LMOPS

Laboratoire Matériaux Optiques, Photonique et Systèmes  
Joint Research Unit between CentraleSupélec and Université de Lorraine

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## Preface

IS-PALD is the International Symposium on Physics and Applications of Laser Dynamics and is organized each year since 2011 with an organizing committee that involves in particular researchers from France and Taiwan. The 2015 edition is the second one being organized in France after the successful 2013 edition. IS-PALD 2015 takes place at CentraleSupélec, which is one of the top leading engineering school in France with more than 1000 students being graduated each year with different specializations including electrical and computer engineering. CentraleSupélec is original in the landscape of the so-called "Grandes Ecoles" in that it is organized in four Campus located at Gif-sur-Yvette, Châtenay-Malabry, Rennes, and Metz. The Metz Campus hosts the photonics research activities and coordinates a Master Program specializing the engineering students in Photonic Systems and Communication.

The 2015 edition of IS-PALD promises to be very successful with 28 oral contributions, 15 poster contributions, 8 invited talks, and 3 keynote speakers. Although the topics are varied, they all target the understanding of the physics of laser dynamics and its application to optical signal processing, sensing and communications. Authors and participants come from all the world covering more than 18 different nationalities.

We thank the invited speakers and participants for their attendance and contributions. We acknowledge the support of three companies: Yenista Optics, Tektronix, and Teledyne Lecroy that will exhibit their new products in laser and optical metrology. We also thank SFO (Société Française d'Optique), Conseil Régional de Lorraine, SEE and the French Committee for 2015 International Year of Light for their support. We thank the scientific committee members for their help in the selection of oral and poster contributions. We thank Dominique Gros, Mayor of Metz, for his agreement to host the welcome cocktail at the Grand Salon of Metz City Hall, and we thank the Abbaye des Prémontrés and Marcotullio for the organization of the gala dinner. We thank our directors at CentraleSupélec and Télécom ParisTech for their support in hosting and organizing the conference.

Finally, we would like to thank the local organizing committee without who this three-day international scientific meeting in Metz would not have been possible. In particular we thank Evelyne Steiner for her involvement and care taken in the organization of the conference. We also thank Sheng-Kwang Hwang (National Cheng Kung University, Taiwan) for his great help in updating the website, Delphine Wolfersberger, Damien Rontani, Nicolas Marsal, Noémi Wiersma, Emeric Mercier, Elodie Mirisola, Lionel Weicker, Chi-Hak Uy and Antoine Pivati (CentraleSupélec, France) for their help in preparing with us the documents, badges and bags being distributed to all participants.

We wish you all a fruitful and interesting conference and hope you will have the opportunity to create new collaborations, and therefore to promote even more the interest in studying laser dynamics and applications.

Yours sincerely

Marc Sciamanna (CentraleSupélec, France)  
Frédéric Grillot (Télécom ParisTech, France)  
Co-chairs of IS-PALD 2015

# IS-PALD 2015

04-06 November 2015, CentraleSupélec, Metz (France)



## Conference Program



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**Wednesday 04 November 2015**

**09h00 Welcome by CentraleSupélec, Metz Campus Director**  
Konrad Szafnicki, CentraleSupélec

**09h10 Welcome by conference chairs**  
Marc Sciamanna, CentraleSupélec  
Frédéric Grillot, Télécom ParisTech

**Surface-Emitting Lasers and Microcavities**  
Chair: Marc Sciamanna, CentraleSupélec (France)

**09h20 K. D. Choquette (Keynote)**  
University of Illinois at Urbana-Champaign (U.S.A.)  
*Dynamics of coherently coupled microcavity laser arrays*

**10h10 A. Joly<sup>1</sup>, G. Baili<sup>1</sup>, M. Alouini<sup>2</sup>, J.-M. George<sup>3</sup>, D. Dolfi<sup>1</sup>**  
<sup>1</sup>Thales Research and Technology (France), <sup>2</sup>Institut de Physique de Rennes (France), <sup>3</sup>Unité Mixte de Physique CNRS-Thales (France)  
*Compensation of the residual phase anisotropy in a VECSEL for spin injection*

**10h30 A. Quirce<sup>1</sup>, P. Pérez<sup>2</sup>, Á. Valle<sup>2</sup>, L. Pesquera<sup>2</sup>, Y. Hong<sup>3</sup>, H. Thienpont<sup>1</sup>, K. Panajotov<sup>1</sup>**  
<sup>1</sup>Vrije Universiteit Brussel (Belgium), <sup>2</sup>Instituto de Fisica de Cantabria (Spain), <sup>3</sup>Bangor University (U.K.)  
*Generation of microwave signals using a long-wavelength VCSEL under dual-beam parallel optical injection*

**10h50-11h20 Coffee Break**

**Mode-Locking and Comb Generation**  
Chair: John Mc Inerney, Tyndall (Ireland)

**11h20 D. Bimberg (Invited)**  
Technische Universität Berlin (Germany)  
*InP/InAs quantum-dot and quantum-dash lasers: mode-locking, non-linear and dynamic properties*

**11h50 L. Jaurigue<sup>1</sup>, B. Lingnau<sup>1</sup>, E. Schöll<sup>1</sup> and K. Lüdge<sup>2</sup>**  
<sup>1</sup>TU Berlin (Germany), <sup>2</sup>Freie Universität Berlin (Germany)  
*Optical control schemes for pulse train stabilization in passively mode-locked lasers*

**12h10 M. Giudici<sup>1</sup>, P. Camelin<sup>1</sup>, M. Marconi<sup>2</sup>, J. Javaloyes<sup>3</sup>, S. Balle<sup>3</sup>**  
<sup>1</sup>University of Nice Sophia Antipolis (France), <sup>2</sup>CNRS - Laboratoire Physique de Nanostructures (France), <sup>3</sup>Universitat de las Islas Baleares (Spain)  
*Control and dynamics of temporal localized structures in mode-locked semiconductor lasers*

**12h30 S. Barbieri<sup>1</sup>, H. Li<sup>1</sup>, P. Laffaille<sup>1</sup>, D. Gacemi<sup>1</sup>, M. Apfel<sup>1</sup>, C. Sirtori<sup>2</sup>,  
J. Leonardon<sup>3</sup>, G. Santarelli<sup>3</sup>, M. Roesch<sup>4</sup>, G. Scalari<sup>4</sup>, M. Beck<sup>4</sup>, J. Faist<sup>4</sup>,  
W. Haensel<sup>5</sup>, R. Holzwarth<sup>5</sup>**

<sup>1</sup>University of Paris Diderot and CNRS (France), <sup>2</sup>Universite Paris Diderot (France), <sup>3</sup>LP2N, IOGS CNRS, and Université de Bordeaux (France), <sup>4</sup>ETH Zurich (Switzerland), <sup>5</sup>Menlo Systems GmbH (Germany)

*Dynamics of ultra-broadband terahertz quantum cascade lasers for comb operation*

### 12h50-14h00 Lunch Break

**Optical Feedback and Optical Injection**  
**Chair: Deb Kane, Macqarie University (Australia)**

**14h00 F.-Y. Lin (Invited)**

National Tsing Hua University (Taiwan)

*Chaos time delay signature suppression and bandwidth enhancement by electrical heterodyning*

**14h30 E. Mercier, D. Wolfersberger, M. Sciamanna**

CentraleSupélec (France)

*Phase-conjugate feedback in a semiconductor laser enables large chaotic bandwidth*

**14h50 N. Li<sup>1</sup>, A. Locquet<sup>2</sup>, C.-Y. Chang<sup>2</sup>, W. Pan<sup>1</sup>, D. S. Citrin<sup>2</sup>**

<sup>1</sup>Southwest Jiaotong University (China), <sup>2</sup>Georgia Institute of Technology (U.S.A.)

*Time-delay suppression and unpredictability enhancement of an external-cavity laser through optical injection*

**15h10 R. Raghunathan<sup>1</sup>, K. Schires<sup>1</sup>, H. Huang<sup>1</sup>, A. Hurtado<sup>2</sup>, L. Lester<sup>3</sup>, F. Grillot<sup>1</sup>**

<sup>1</sup>Télécom ParisTech (France), <sup>2</sup>University of Strathclyde (U.K.), <sup>3</sup>Virginia Tech (U.S.A.)

*Dual mode interaction dynamics in a 1310 nm quantum dot DFB laser under distant side mode injection*

**15h30 C. Quintero, T. Sorrentino, M. C. Torrent, C. Masoller**

<sup>1</sup>Universitat Politecnica de Catalunya (Spain), <sup>2</sup>Universidade Federal Rural do Semi-Arido (Brasil)

*Analysis of the effects of periodic forcing in the spike rate and spike correlations in semiconductor lasers with optical feedback.*

### 15h50-16h20 Coffee Break

**Fundamental Laser Properties**  
**Chair: Daan Lenstra, TU Eindhoven (The Netherlands)**

**16h20 B. Kelleher (Invited)**

Tyndall National Institute (Ireland)

*Quantum Dot Lasers: Class B but not Class B*

**16h50 P. Hamel, F. Raineri, A. Levenson, A. M. Yacomotti (Invited)**

LPN-CNRS

*Spontaneous symmetry breaking in coupled photonic crystal nanolasers*

**17h20 T. Wang<sup>1</sup>, G.P. Puccioni<sup>2</sup>, G.-L. Lippi<sup>1</sup>**

<sup>1</sup>CNRS Institut Non Linéaire de Nice (INLN) (France), <sup>2</sup>Istituto dei Sistemi Complessi, CNR (Italy),

*Dynamical buildup of lasing in mesoscale devices*

**17h40 End of Day 1**

<p><b>19h00-21h00 Welcome Cocktail and Poster Session</b> <b>Metz City Hall, Grand Salon, 1st Floor</b></p>
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- P1 C. Wang<sup>1</sup>, R. Raghunathan<sup>1</sup>, K. Schires<sup>1</sup>, S.-C. Chan<sup>2</sup>, L. Lester<sup>3</sup>, F. Grillot<sup>1</sup>**  
<sup>1</sup>Télécom ParisTech (France), <sup>2</sup>City University of Hong-Kong (China), <sup>2</sup>Virginia Tech (U.S.A.)  
*P1 dynamics in an InAs/GaAs distributed feedback quantum dot laser using optical injection and feedback*
- P2 R. M. Nguimdo, G. Verschaffelt, J. Danckaert, G. Van der Sande**  
Vrije Universiteit Brussel (Belgium)  
*Simultaneous computation of two independent tasks using reservoir computing based on a single photonic nonlinear node with optical feedback*
- P3 E. Mercier, C.-H. Uy, D. Wolfersberger, M. Sciamanna**  
CentraleSupélec (France)  
*Mapping self-pulsing frequencies in a semiconductor laser with phase-conjugate feedback*
- P4 G.P. Puccioni<sup>1</sup>, N. Dokhane<sup>2</sup>, G.-L. Lippi<sup>3</sup>**  
<sup>1</sup>Istituto dei Sistemi Complessi, CNR (Italy), <sup>2</sup>Université M'Hamed Bougara de Boumerdès (Algeria), <sup>3</sup>CNRS Institut Non Linéaire de Nice (INLN) (France),  
*Master-mode-driven evolution of the linewidth of an edge-emitting semiconductor laser at switch-on*
- P5 M. Wishon<sup>1</sup>, V. Cartillier<sup>2</sup>, D. Choi<sup>1</sup>, C.-Y. Chang<sup>1</sup>, A. Locquet<sup>1</sup>, D. Citrin<sup>1</sup>**  
<sup>1</sup>Georgia Institute of Technology (U.S.A.), <sup>2</sup>CentraleSupélec (France)  
*Confirming the reservoir computing property separability using a free space optoelectronic implementation*
- P6 C.-Y. Chang<sup>1</sup>, D. Choi<sup>1</sup>, M. Wishon<sup>1</sup>, A. Locquet<sup>1</sup>, K. Merghem<sup>2</sup>, A. Martinez<sup>2</sup>, F. Lelarge<sup>3</sup>, A. Ramdane<sup>2</sup>, D. Citrin<sup>1</sup>**  
<sup>1</sup>Georgia Institute of Technology (U.S.A.), <sup>2</sup>LPN-CNRS (France), <sup>3</sup>III-V Lab & Alcatel Lucent Bell Labs (France)  
*Simultaneous bifurcation diagrams of optical intensity and carrier number of external cavity semiconductor laser*

- P7 F. Baladi<sup>1</sup>, M. W. Lee<sup>1</sup>, J.-R. Burie<sup>2</sup>, M. A. Bettiati<sup>2</sup>, A. P. A. Fischer<sup>1</sup>,  
A. Boudrioua<sup>1</sup>**  
<sup>1</sup>Université Paris 13 (France), <sup>2</sup>3SP Technologies (France)  
*Low frequency fluctuation mapping of a high power laser diode emitting at 980 nm  
subject to filtered optical feedback*
- P8 M. Almulla**  
University of California Los Angeles (France)  
*Fluctuation-frequency dependence of the low-sensitivity periodic oscillations in  
optically injected semiconductor lasers*
- P9 D. Rontani<sup>1</sup>, D. Choi<sup>2</sup>, C.-Y. Chang<sup>2</sup>, A. Locquet<sup>2</sup>, D. Citrin<sup>2</sup>**  
<sup>1</sup>CentraleSupélec (France), <sup>2</sup>Georgia Institute of Technology (U.S.A.),  
*Sparse signal reconstruction using optical chaos generated by a laser diode with  
optical feedback*
- P10 L. Wang, M. Romanelli, M. Vallet**  
Institut de Physique de Rennes (France),  
*Synchronization of DFB lasers in bounded regime with optical feedback loop*
- P11 W.-J. Lee, Y.-S. Chiu and Y.-S. Juan**  
Yuan Ze University (Taiwan),  
*Analysis of amplitude variation of regular pulses under dual feedback loops*
- P12 C.-W. Fu and Y.-S. Juan**  
Yuan Ze University (Taiwan),  
*Chaos generation utilizing switching optical injection system*
- P13 M. Mattheakis<sup>1</sup>, Th. Oikonomou<sup>2</sup>, M. I. Molina<sup>3</sup>, G. P. Tsironis<sup>4</sup>**  
<sup>1</sup>Harvard University (U.S.A.), <sup>2</sup>Nazarbayev University (Kazakhstan), <sup>3</sup>Universidad  
de Chile (Chile), <sup>4</sup>University of Crete (Greece)  
*Parity-time plasmonic instabilities*
- P14 E. Mirisola, E. Mercier, D. Wolfersberger, M. Sciamanna**  
CentraleSupélec (France)  
*Observation and simulation of extreme events in a laser diode with time-delayed  
feedback*
- P15 N. Wiersma, N. Marsal, M. Sciamanna, D. Wolfersberger**  
CentraleSupélec (France)  
*Nonlinear interactions of accelerating beams*



**Thursday 05 November 2015**

**Quantum-Cascade Lasers**  
**Chair: Wolfgang Elsaesser, TU Darmstadt (Germany)**

**09h00 J. Faist (Keynote)**

ETH Zurich (Switzerland)

*Quantum cascade frequency combs: noise, stability and spectroscopy applications*

**09h50 L. Jumpertz<sup>1</sup>, K. Schires<sup>1</sup>, M. Carras<sup>2</sup>, M. Sciamanna<sup>3</sup>, F. Grillot<sup>1</sup>**

<sup>1</sup>Telecom ParisTech (France), <sup>2</sup>MirSense (France), <sup>3</sup>CentraleSupélec (France)

*Chaotic pulsing in quantum cascade lasers subject to optical feedback*

**10h10 M.I. Amanti<sup>1</sup>, M. Renaudat Saint-Jean<sup>1</sup>, A. Bismuto<sup>1</sup>, M. Beck<sup>2</sup>, J. Faist<sup>2</sup>,  
C. Sirtori<sup>1</sup>**

<sup>1</sup>Université Paris Diderot/Paris 7 (France), <sup>2</sup>ETH Zurich (Switzerland)

*Mode stabilization in quantum cascade lasers via an intra-cavity cascading nonlinearity*

**10h30 G. Friart<sup>1</sup>, Th. Erneux<sup>1</sup>, G. Van der Sande<sup>1</sup>, G. Verschaffelt<sup>1</sup>, J. Danckaert<sup>1</sup>**

<sup>1</sup>Université Libre de Bruxelles (Belgium), <sup>2</sup>Vrije Universiteit Brussel (Belgium)

*Stability of quantum cascade lasers subject to optical feedback*

**10h50-11h20 Coffee Break**

**Quantum-Dot and Quantum-Dash Lasers**  
**Chair: Frédéric Grillot, Télécom ParisTech (France)**

**11h20 S. Breuer (Invited)**

TU Darmstadt (Germany)

*Stabilization of passively mode-locked quantum dot lasers*

**11h50 M. Gioannini, P. Bardella, I. Montrosset**

Politecnico di Torino (Italy)

*Role of the homogeneous and inhomogeneous broadening on the mode dynamics of Quantum dot Fabry-Perot lasers*

**12h10 H. Huang<sup>1</sup>, K. Schires<sup>1</sup>, D. Arsenijević<sup>1</sup>, D. Bimberg<sup>2</sup>, F. Grillot<sup>1</sup>**

<sup>1</sup>Telecom ParisTech (France), <sup>2</sup>Technische Universität Berlin (Germany)

*Excited state and ground state optical feedback sensitivity of an InAs/GaAs quantum dot lasers*

**12h30 D. Marah, P. Kumar, H. Asghar, S. Keshri, R. Kumar, J. McInerney**

University College Cork (Ireland)

*Pulse characteristics of passively mode-locked dual-section quantum-dash laser subjected to optical feedback*

**12h50-14h00 Lunch Break**

**Extreme Events**  
**Chair: K. Alan Shore, Bangor University (U.K.)**

**14h00 Ph. Grelu (Invited)**

ICB, Université de Bourgogne (France)  
*Extreme wave dynamics in ultrashort fiber lasers*

**14h30 M. Romanelli<sup>1</sup>, M. Brunel<sup>1</sup>, Th. Erneux<sup>2</sup>, M. Vallet<sup>1</sup>**

<sup>1</sup>Université Rennes-1 and IPR (France), <sup>2</sup>Université Libre de Bruxelles (Belgium),  
*Extreme events and excitability in an opto-RF oscillator*

**14h50 M. W. Lee<sup>1</sup>, F. Baladi<sup>1</sup>, J.-R. Burie<sup>2</sup>, M. A. Bettati<sup>2</sup>, A. Boudrioua<sup>1</sup>,  
A. P. A. Fischer<sup>1</sup>**

<sup>1</sup>Université Paris 13 (France), <sup>2</sup>3SP Technologies (France)  
*Observation of rogue waves in a high-power laser diode subject to optical feedback via a fibre Bragg grating*

**15h10 D. Choi, A. Locquet, J. Barnoud, C-Y. Chang, M. Wishon, D. Citrin**

Georgia Institute of Technology (France)  
*Extreme events in external-cavity lasers: from low frequency fluctuations to coherence collapse*

**15h30-16h00 Coffee Break**

**High-Performance Optoelectronic Oscillators**  
**Chair: Fan-Yi Lin, National Tsing Hua University (Taiwan)**

**16h00 S.C. Chan (Invited)**

City University of Hong-Kong (China)  
*Microwave phase noise characteristics of P1 dynamics in semiconductor lasers*

**16h30 V. Kovanis**

Nazarbayev University, Astana (Kazakhstan)  
*Fast, tunable & low linewidth photonic oscillators*

**16h50 R. M. Nguimdo<sup>1</sup>, K. Saleh<sup>2</sup>, A. Coillet<sup>2</sup>, G. Lin<sup>2</sup>, R. Martinenghi<sup>2</sup>, Y. K. Chembo<sup>2</sup>**

<sup>1</sup>Vrije Universiteit Brussel (Belgium), <sup>2</sup>CNRS FEMTO-ST, University Franche-Comté (France)  
*Phase noise performance of optoelectronic oscillators based on whispering-gallery mode resonators*

**17h10 End of Day 2**

**18h45 Bus Transfer to Gala Dinner from CentraleSupélec**  
**19h00 Bus Transfer to Gala Dinner from Place d'Armes, Metz**  
**to: Abbaye des Prémontrés, Pont-à-Mousson**

**Friday 06 November 2015**

**Nonlinear Laser Dynamics and Chaos**  
**Chair: Vassilios Kovanis, Nazarbayev University (Kazakhstan)**

**09h00 D. Lenstra (Keynote)**

TU Eindhoven (The Netherlands)  
*Laser dynamics in integrated photonics*

**09h50 D. Kane<sup>1</sup>, J. Toomey<sup>1</sup>, C. McMahon<sup>1</sup>, A. Argyris<sup>2</sup>, D. Syvridis<sup>2</sup>**

<sup>1</sup>Macquarie University (Australia), <sup>2</sup>University of Athens (Greece)  
*Open database from experimental nonlinear laser systems - bigger data for science today and as a research resource for the future*

**10h10 L. Weicker<sup>1</sup>, Th. Erneux<sup>2</sup>, D. Wolfersberger<sup>1</sup>, M. Sciamanna<sup>1</sup>**

<sup>1</sup>CentraleSupélec (France), <sup>2</sup>Université Libre de Bruxelles (Belgium)  
*Dynamical properties of a semiconductor laser with filtered phase-conjugate optical feedback*

**10h30 A. Vladimirov<sup>1</sup>, A. Pimenov<sup>1</sup>, M. Tlidi<sup>2</sup>, D. Turaev<sup>3</sup>, D. Puzyrev<sup>1</sup>, S. Yanchuk<sup>1</sup>, S. Gurevich<sup>4</sup>**

<sup>1</sup>WIAS (Germany), <sup>2</sup>Université Libre de Bruxelles (Belgium), <sup>3</sup>Imperial College (U.K.), <sup>4</sup>University of Muenster (Germany)  
*Feedback induced instabilities of cavity solitons*

**10h50-11h20 Coffee Break**

**Dynamics of new laser structures**  
**Chair: Thomas Erneux, Université Libre de Bruxelles (Belgique)**

**11h20 R. Colombelli (Invited)**

Institut d'Electronique Fondamentale (France)  
*Perspectives for intersubband polariton lasers*

**11h50 Z.A. Sattar, K.A. Shore**

Bangor University (U.K.)  
*Effect of optical Injection in semiconductor nanolasers*

**12h10 S. Barbay<sup>1</sup>, F. Selmi<sup>1</sup>, R. Braive<sup>1</sup>, F. Lelièvre<sup>1</sup>, A. Golestani<sup>1</sup>, R. Kuszelewicz<sup>2</sup>.**

<sup>1</sup>LPN-CNRS (France), <sup>2</sup> Université Paris Descartes (France)  
*Nonlinear dynamics in a neuromimetic micropillar laser*

**12h30 K. Schires<sup>1</sup>, N. Girard<sup>2</sup>, G. Baili<sup>2</sup>, G.-H. Duan<sup>3</sup>, F. Grillot<sup>1</sup>**

<sup>1</sup>Télécom ParisTech (France), <sup>2</sup> Thales Research and Technology (France), <sup>3</sup> III-V lab (France)  
*Feedback sensitivity of hybrid III-V silicon lasers*

**12h50 End of IS-PALD 2015**