14th International Symposium on Automotive Lighting

Darmstadt
April 04-06, 2022

TECHNISCHE UNIVERSITÄT DARMSTADT

ISAL 2021

Organization Office

Technical University of Darmstadt
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Conference Address

darmstadtium
science | congresses

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Opening hours: 8:00 - 18:00
(Apr. 04-06, 2022)

14th International Symposium on Automotive Lighting

April 04 - 06, 2022
Darmstadt, Germany

Technical University of Darmstadt
Laboratory of Adaptive Lighting Systems and Visual Processing

ISAL 2021

In 1995, the first symposium took place in the “Kekulé” lecture room at the TU Darmstadt. Since then, more than two decades have elapsed and the location of the event has been changed to the immense and representative new congress centre “darmstadtium”. After having received approximately 1000 experts at ISAL 2019, it is a great pleasure to welcome international designers, engineers, scientists and decision makers of the automotive lighting industry at ISAL 2021.

A lot of research and development focuses on communication between automated vehicles and other road users as well as on high resolution adaptive high beam to improve the visibility distance and general driving comfort for front lighting. Further research topics include adaptive rear lights to minimize discomfort and maximize road safety for following cars. In the meantime, new challenges for the automotive lighting community arise in the form of energy efficient lighting for purely electric vehicles as well as lighting design and functions for autonomous driving. The rating of headlamp systems is also the focus of ISAL 2021.

ISAL 2021 will surely encourage the exchange between lighting engineers, road safety experts and regulative bodies. They will have the opportunity to present the most recent results of research and development to continue the established traditions of this conference to be able to promote a bright future for automotive lighting.

Laboratory of Adaptive Lighting Systems and Visual Processing

The Technical University of Darmstadt was founded in 1877 and established the worldwide first professorial chair for electrical engineering in 1882. One of the first lectures included electrical lighting technology.

In this tradition, the Laboratory of Lighting Technology was founded in 1956. Prof. Jainski set an emphasis on traffic lighting. Prof. Schmidt-Clausen succeeded Prof. Jainski in 1982 as head of the laboratory and, due to successful research, strengthened its national and international reputation. It was him who realized the need for an international conference on automotive lighting, which basically was the birth of a new international symposium called “Progress in Automotive Lighting” - the predecessor of today‘s well-known ISAL.

Since the appointment of Prof. Tran Quoc Khanh in October 2006, the Laboratory of Lighting Technology has gained even more renown in the field of road lighting. Many studies in the field of automotive lighting have been conducted since and published in relevant media.

Since October 2021, the laboratory follows its research under the name Laboratory of Adaptive Lighting Systems and Visual Processing.

Steering Board

- Dr.-Ing. C. Allgeier, ams OSRAM Automotive Lighting Systems GmbH, GER
- Prof. M. J. Flannagan, University of Michigan, USA
- Dr.-Ing. M. Hamm, Audi AG, GER
- Dr.-Ing. W. Huhn, DVN Senior Advisor, FRA
- Prof. T. Q. Khanh, TU Darmstadt, GER
- Dr. rer. nat. M. Kleinkes, Hella KGaA Hueck & Co., GER
- U. Kostanzer, Mercedes-Benz AG, GER
- R. Krautscheid, Federal Ministry of Transport and Digital Infrastructure, GER
- P.-H. Matha, Volvo Car Corporation, SWE
- Dr. phil. nat. R. Neumann, Varroc Lighting Systems, GER
- Dr.-Ing. J. Ripperger Valeo, FRA
- Dr.-Ing. E.-O. Rosenhahn, Automotive Lighting GmbH, GER
- M. Sasaki, Koito Manufacturing Co. Ltd., JPN
- I. Schneider, Adam Opel GmbH, GER
- D. Vanderhaeghen, Lumileds, GER

General Information

Date	April 04 - 06, 2022
Location	darmstadtium science | congresses Schlossgraben 1 64283 Darmstadt, Germany
Language	english (no simultaneous translation)
Proceedings	Every attendee will receive the proceedings as a hard cover book. After the symposium this book will be available in stores.

Schedule - Overview

Monday, Apr. 04

18:00 Get-Together Soirée & Check-In

Tuesday, Apr. 05

08:00 Opening
08:25 Key Note Speech
09:00 Main Session
HD Headlamps

10:15 Coffee & Exhibition
10:45 Parallel Session
a. Simulation & VR
b. Light Sources I

12:15 Lunch
13:30 Parallel Session
a. Signalling
b. Headlamps & Cameras I

14:35 Coffee & Exhibition
15:00 Parallel Session
a. Rating
b. Visual Performance

16:25 Coffee & Exhibition
16:45 Podium Discussions
a. Rating
b. ADB in the USA

18:15 Exhibition and Beer
20:00 Presenters‘ Party

Wednesday, Apr. 06

08:00 Coffee & Exhibition
08:20 Key Note Speech
09:00 Parallel Session
a. Light Sources II
b. Car Interior Lighting

10:15 Coffee & Exhibition
10:45 Parallel Session
a. Road Projections
b. Headlamps & Cameras II

12:15 Lunch
13:30 Main Session
Sustainability & Future Lighting

14:45 Coffee & Exhibition

15:15 Award Ceremony
15:45 Closing Speech
16:00 End of ISAL 2021

The check-in counter will be open from 7:30 at the main entrance.

Program - Tuesday

07:30 - 08:00	Entry & Coffee
08:00	**TU Darmstadt** Welcome speech of the Chairman & President of TU Darmstadt
8:20	**Keynote** The Future Importance of Car Lighting *Dr.-Ing. W. Huhn, DVN Senior Advisor*
	High Resolution Headlamps (Spectrum)
09:00	**Introductory Talk** High Resolution Headlamps *I. Schneider, Adam Opel GmbH*
09:10	SSL|HD - High Tech Light for new safety & comfort functions *Dr. M. Kleinkes, Hella KGaA Hueck & Co.*
09:20	Digital light for digital life *S. Berlitz, Audi AG*
09:30	DIGITAL LIGHT takes the Mercedes-Benz Adaptive High Beam Assist to the next level *Dr. C. Gut, Mercedes-Benz AG*
09:40	Safety Benefit by ultra-flexible Beam Patterns in High Resolution Headlamp Technology *A. Austerschulte, Marelli Automotive Lighting Reutlingen GmbH*
09:50	Using the MTF to Benchmark Image Quality for High-Resolution Headlamps *Dr. S. Köhler, Hella KGaA Hueck & Co.*
10:00	Discussion

Program - Tuesday

10:15 - 10:45		Coffee & Exhibition
		Simulation & VR (Spectrum)
10:45		**Introductory Talk** Simulation & VR *Dr. M.Hamm, Audi AG*
10:55		Analysis of the effect of road projection lamp on enhancing a pedestrian's cognitive ability using a VR simulator *Prof. Dr. K. Suzuki, Kagawa University*
11:05		Photometric Characterization and Evaluation of Head-Mounted-Displays for Virtual Night Driving *T. Singer, TU Darmstadt*
11:15		Quantitative evaluation of individual glare-induced visual impairment using a nighttime driving simulator *Dr. J. Ungewiß, UAS Aalen*
11:25		A Unique High-Definition Night Driving Simulator for Development and Testing of New Generation Lighting Systems at Mercedes-Benz *M. Borowski, Mercedes-Benz AG*
11:35		Simulative development of object-based adaptive front lighting *N. Rüddenklau, Universität Paderborn*
11:45		Virtual Reality Analysis of the effect on traffic partners being confronted with intelligent beam pattern driver information *Prof. Dr. D. Meyer, Technische Hochschule Mittelhessen*
11:55		Discussion
12:15- 13:30		Lunch

Program - Tuesday

Light Sources I (Ferrum)	
10:45	How to increase headlamp efficiency with High Luminance LEDs *Dr. B. Spinger, Lumileds*
10:55	Next Generation Micro-LED Technology enabling full Field of View Digital Headlighting *O. Shchekin, Lumileds*
11:05	High Resolution LED-Headlamp Concept *S. Groetsch, Osram Opto Semiconductors GmbH*
11:15	New light source architecture design for Car Body Lighting, bringing form and function together *Dr. T. Anger, Lumileds*
11:25	Light propagation through injected plastic: density gradient impact *Dr. S. Paroni, Marelli Automotive Lighting Italy SpA*
11:35	Discussion
12:15-13:30 	Lunch

Program - Tuesday

Signalling & Communication (Spectrum)	
13:30	**Introductory Talk** Signalling & Communication *Dr. J. Ripperger, Valeo*
13:40	Car2X Communication by Embeded Displays - Digital OLED Evolution Part 2 *Dr. M. Kruppa, Audi AG*
13:50	FlatLight-Technologies enabling new stylings for automotive signal lighting *M. Vollmer, Hella KGaA Hueck & Co.*
14:00	Style and signalling: display sizing for an optimized perception *J. Petit, Valeo*
14:10	The Reality of Distraction by illuminated Brand signatures and animated Functions *Dr. J. Kobbert, Audi AG*
14:20	Discussion
14:35-15:00	Coffee & Exhibition

Program - Tuesday

	Headlamps & Cameras I (Ferrum)
13:30	Investigation of different influencing parameters on the quality of object detection by camera systems in highly automated vehicles *D. Hoffmann, TU Darmstadt*
13:40	Trajectory Prediction for Less Camera-Dependent Adaptive Drive Beam *Dr. W. Gonçalves, Stellantis*
13:50	Future of headlamps: Optical sensor for rain and fog detection *F. Krieft, L-Lab*
14:00	Discussion
14:35-15:00	Coffee & Exhibition

Program - Tuesday

	Rating (Spectrum)
15:00	**Introductory Talk** Rating *Dr. R. Neumann, Varroc Lighting Systems*
15:10	Headlamp Safety Performance Rating (HSPR): Improved Method triggered by GTB *Dr. E.-O. Rosenhahn, Marelli Automotive Lighting Reutlingen GmbH*
15:20	Field Test Validation of the Headlamp Safety Performance Rating (HSPR) *A. Erkan, TU Darmstadt*
15:30	Headlamp Performance Rating System and Benefit for OEM Model Portfolio *Dr. M. Hamm, Audi AG*
15:40	Digital lighting for headlamps to fulfill international regulations and ratings *Dr. D. Brunne, Hella KGaA Hueck & Co.*
15:50	Vehicle Lighting Assessment on Laboratory Level within C-NCAP *Dr. T. Reiners, LMT Lichtmesstechnik Berlin*
16:00	The Aiming of Headlamps in Real Life and Resulting Influences on Benchmarks and Road Users *C. Hinterwälder, Audi AG*
16:10	Discussion
16:25-16:45	Coffee & Exhibition

Program - Tuesday

Visual Performance (Ferrum)	
15:00	Evaluation of a Model for the Prediction of the Visibility of Intensity Gaps in Headlamp Light Patterns *K. Schier, L-Lab*
15:10	Quantitative Evaluation of the Visibility of CCT Tunable LED Headlamp under Adverse Weather Conditions *Dr. P. Hyensou, Yeungnam University*
15:20	Effects of adaptive headlight systems (ADB) on visual attention while driving on curvy roads *Dr. M. Stolte, University of Vienna*
15:30	Shaping new light distributions for different road lighting scenarios *S. Vogel, L-Lab*
15:40	Investigating symbol recognition time as a function of system resolution *J. Pulliam, Texas Instruments Inc.*
15:50	Photometric Characterization and Vehicle Operator Observations of Road Projections and Adaptive Driving Beam Headlights *Dr. J. Bullough, Mount Sinai Icahn School of Medicine*
16:00	Discussion
16:25-16:45	Coffee & Exhibition

Program - Tuesday

	Podium Discussions
16:45	Headlamp Rating *Chair: Dr. R. Neumann*
17:30	ADB in the USA *Chair: Dr. M. Hamm*
18:15	Exhibition and Beer
20:00 	Presenters‘ Party

Program - Wednesday

08:00-08:20	Coffee & Exhibition
08:20	**Keynote** Interaction of Road– and Automotive Lighting in Smart cities *Prof. Dr. S. Onaygil, Istanbul Technical University*
	Light Sources II (Spectrum)
09:00	**Introductory Talk** Light Sources II *D. Vanderhaeghen, Lumileds*
09:10	ECU-Free Exterior Lighting; Disruptive trend for vehicle E/E architecture with focus on exterior lighting *Dr. R. Leute, Marelli Automotive Lighting Reutlingen GmbH*
09:20	From MLA to CLA - keeping benefits while reducing complexity *B. Fischer, Hella KGaA Hueck & Co.*
09:30	Amazing Backup Lamp - How to get white light out of a rear lamp with a red covered lens *H. P. Schiffert, Mercedes-Benz AG*
09:40	Plug & Play Glare-free High Beam *Dr. K. Kosmas, ZKW Group GmbH*
09:50	Automatic Controlled Lighting Systems - Safety for All Road Users *Dr. R. Neumann, Varroc Lighting Systems*
10:00	Discussion
10:15-10:45	Coffee & Exhibition

Program - Wednesday

Car Interior Lighting (Ferrum)	
09:00	A study to create a pleasant environment in the vehicle interior by applying Violeds (UV) technology *W. Shin, Seoul Semiconductor Co., Ltd.*
09:10	Non-Visual Effects of Light for Vehicles Interior - Realistic Chance or Disturbing Feature? *Dr. M. Niedling, Hella KGaA Hueck & Co.*
09:20	Illumination models in the context of modern human centric in-vehicle lighting *C. Weirich, Fudan University*
09:30	ADAPTIVE INTERIOR LIGHT - An innovative technological approach for multifunctional interior lighting *Dr. D. Betz, Mercedes-Benz AG*
09:40	PMMA light guides with laser etched microstructure enables ultra-thin surface lighting *T. Seidl, feno GmbH*
09:50	Demanding requirements for interior projection met by micro-optical solutions *C. Bremer, Suss MicroOptics SA*
10:00	Discussion
10:15-10:45	Coffee & Exhibition

Program - Wednesday

Road-Projections (Spectrum)	
10:45	**Introductory Talk** Road-Projections *U. Kostanzer, Mercedes-Benz AG*
10:55	A study of optical system for high-performance road projection lamp *D. Kang, Hyundai Mobis Co., Ltd.*
11:05	Intuitive recognition of motorcycle presence using road projections *Dr. T. Kimura-Minoda, Stanley Electric Co., Ltd.*
11:15	Future Ground Projections around the Vehicle *Dr. U. Schlöder, Marelli Automotive Lighting Reutlingen GmbH*
11:25	Analysis and definition of resolution requirements for projections in the near field of a vehicle *A. Stuckert, BMW Group*
11:35	Symbol Projection for Pedestrians *M. Baumann, Karlsruhe Institute of Technology*
11:45	360° Near Field projection – Enhanced safety or just a nice gadget? *S. Namyslo, Valeo*
11:55	Discussion
12:15-13:30 	Lunch

Program - Wednesday

Headlamps & Cameras II (Ferrum)	
10:45	The Study of Night Safety Improvement by Headlamps with Built-in Cameras *Y. Shibata, Koito Manufacturing Co., Ltd.*
10:55	Provident vehicle detection at night: A subject study *Dr. S. Saralajew, Bosch Center for Artificial Intelligence*
11:05	The Smart Corner Approach - why we will need sensor integration into head and rear lamps *J. Brill, Marelli Automotive Lighting Reutlingen GmbH*
11:15	Feedforward Control of HD-Headlights for Automated Driving *M. Waldner, TU Dortmund University*
11:25	Discussion
12:15-13:30 	Lunch

Program - Wednesday

Sustainability and Future Lighting (Spectrum)	
13:30	**Introductory Talk** Sustainability and Future Lighting *P.-H. Matha, Volvo Car Corporation*
13:40	Headlamp technologies - outlook into the future *G. Böhm, ZKW Group GmbH*
13:50	Eco-Innovation with exterior lighting: Opel/Vauxhalls contribution to CO2 savings in the EU *T. Feid, Opel Automobile GmbH*
14:00	Sustainable vehicle lights *C. Schmidt, Hella KGaA Hueck & Co.*
14:10	Front Fascia Evolution For Electrical Vehicles and Autonomous Driving *B. Reiss, Valeo*
14:20	Innovative Application of Phase Light Modulation for Energy Efficient Projection in Automotive Use-cases *J. Pulliam, Texas Instruments Inc.*
14:30	Discussion
14:45-15:15	Coffee & Exhibition
15:15	**Award Ceremony** *Best Paper, Best Presentation*
15:45	**Closing Speech**
16:00	**End of ISAL 2021**

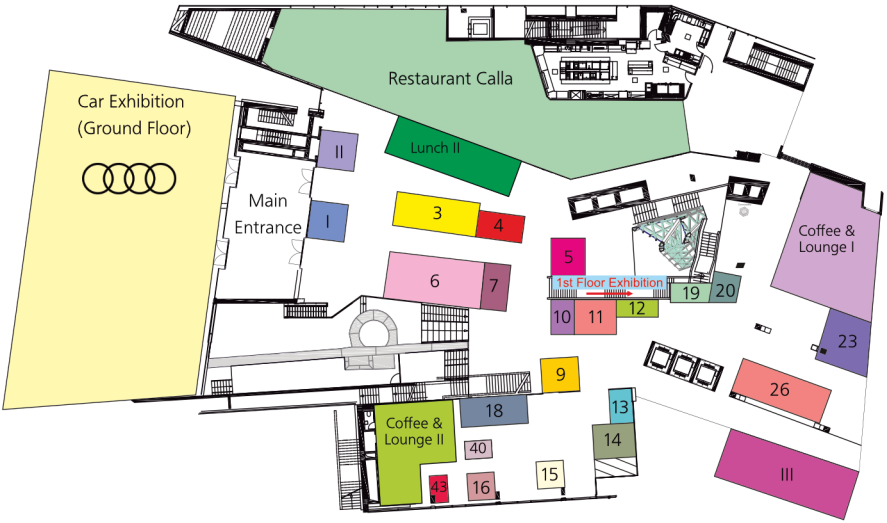
Video on Demand

VOD01	Explicit and Implicit Communication for Automated Vehicles *J. Reschke, Audi AG*
VOD02	Driver Monitoring System with intelligent Light Function - Increase of Driver's vigilance *B. Balkan, IAV GmbH*
VOD03	Car2X communication on autonomous driving vehicles set up via flat-angle projection on free form bumper surfaces *Dr. H. Bechert, Minda Delvis GmbH*
VOD04	Edge Detection Algorithm for Inhomogeneous Luminance Images - an Approach for Standard Object Luminance Determination *J. Willmann, Fraunhofer Institute for Solar Energy Systems*
VOD05	Headlamps as a sustainable system product *Dr. P. Hartmann, ZKW Group GmbH*
VOD06	Evolution of bandwidth requirements in pixelated light distributions *S. Schwarz, ZKW Group GmbH*
VOD07	Automotive car-body-lighting digital projector based on LCoS technology *Dr. M. Virsek, Hella Saturnus Slovenija*
VOD08	Investigation of the effect of transversely tilted headlamps *Dr. A. Walkling, Federal Highway Research Institute*
VOD09	Development of surface emitting T-Stop optical system HLED *Dr. S. Jeong, Hyundai Mobis Co., Ltd.*

Video on Demand

VOD10	Technology of the Predictive ADB with ADAS (AADB) *J. Sung, Hyundai Mobis Co., Ltd.*
VOD11	Light Guides technology for Front lighting application *P. Ferbas, Varroc Lighting Systems*
VOD12	Design and experimental investigation of a technology demonstrator for hologram-based vehicle headlights *L. T. Hiller, Hella KGaA Hueck & Co.*
VOD13	Re-Inventing Product Headlamp *D. Duhme, Hella KGaA Hueck & Co.*

Exhibition Floor Plan



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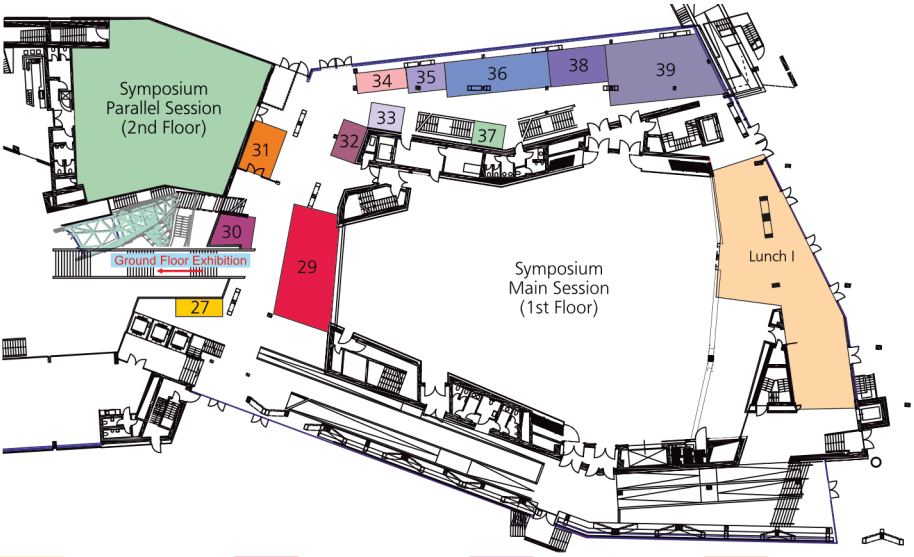
7	PLEXIGLAS® THE ORIGINAL BY RÖHM	9	eoi EXCELLENCE OPTO. INC.	10	HOFMANN	11	LUXOR Lighting
12	feno	13	IAV	14	Texas Instruments	15	TQ TECHNOLOGY
16	Silcos	18	OLEDWorks	19	SAX POLYMERS	20	ventec INTERNATIONAL GROUP 展晖電子
23	NICHIA	26		40	microrelleus	43	NEUMAN ALUMINIUM IMPACT EXTRUSION
I	Registration	II	Help Desk	III	Cloak Room		

Virtual Exhibitors

46 AL AUTOMOTIVE LIGHTING | MARELLI 47 SAMSUNG



27 SUSS MicroOptics
29 LMT
30 via optic
31 CREAT
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34 SYNOPSYS
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36 SEOUL SEMICONDUCTOR
37 tSL
38 ams OSRAM
39 LUMILEDS