Boost Safety and Styling –
from Today up to Autonomous Vehicles

Safer, Smaller and Smarter Lighting Technologies

5th DVN US workshop in Rochester, Michigan
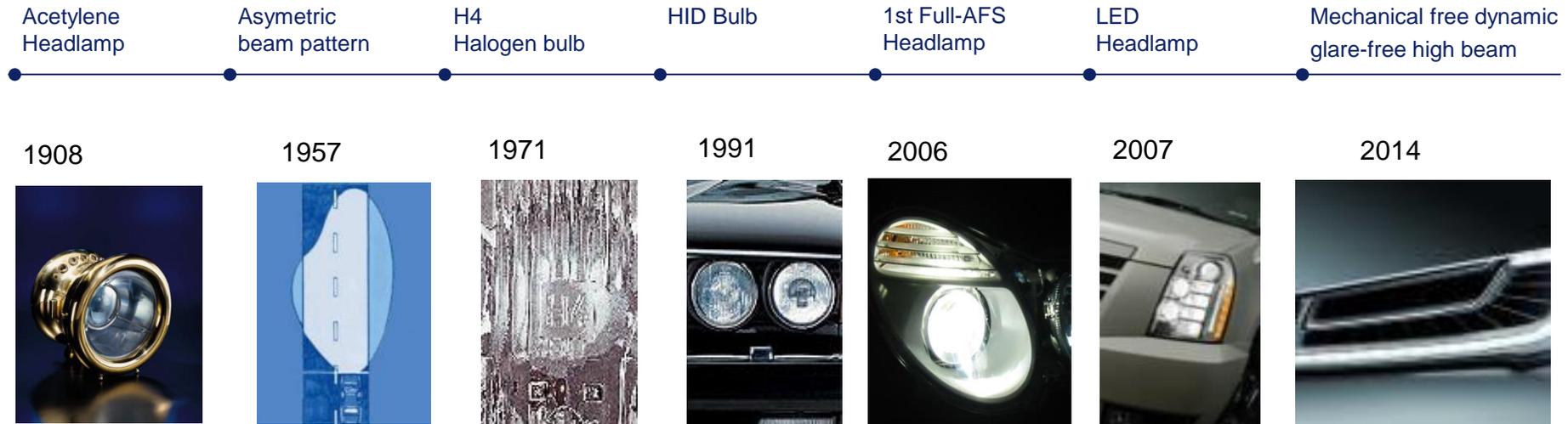15–16 January, 2019

Christian Schmidt   Innovation Lighting
Michael Kleinkes   VP Lighting Development

HELLA GmbH & Co. KGaA

Automotive lighting technology history

Acetylene Headlamp	Asymetric beam pattern	H4 Halogen bulb	HID Bulb	1st Full-AFS Headlamp	LED Headlamp	Mechanical free dynamic glare-free high beam
1908	1957	1971	1991	2006	2007	2014

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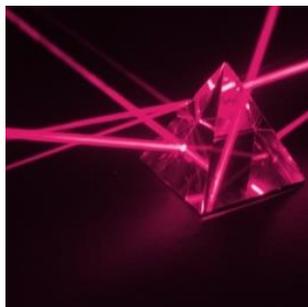# Automotive lighting technology today

Matrix headlamps for ADB

First headlamps including digital light

LASER lightsource

individuall projections

animation
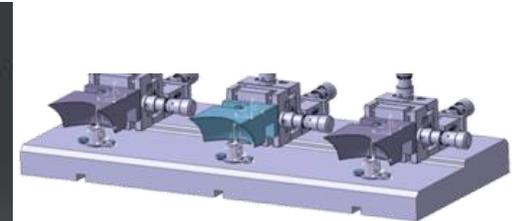
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Ongoing trend slim headlamps
Narrow visible line

HELLA VISION ONE Headlamp

10 mm forefield / 15 mm main beam

realised by high luminance light sources

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SMALLER
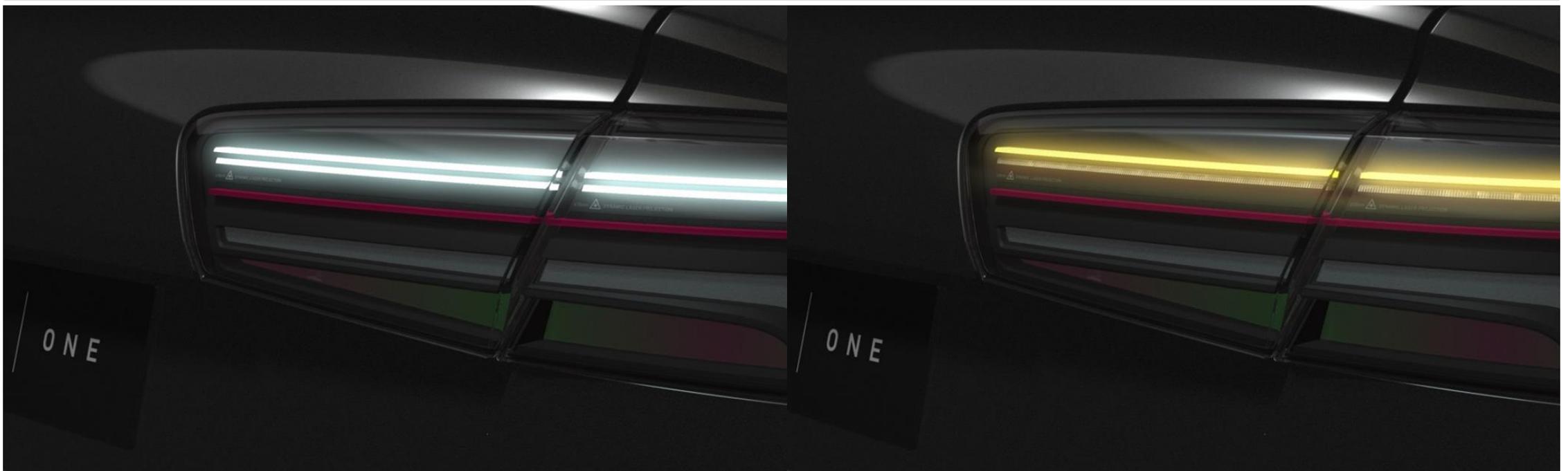## Reduced Sizes of Light Functions Serve Design Requirements

3mm line for daytime running and turn indicator in the headlamp
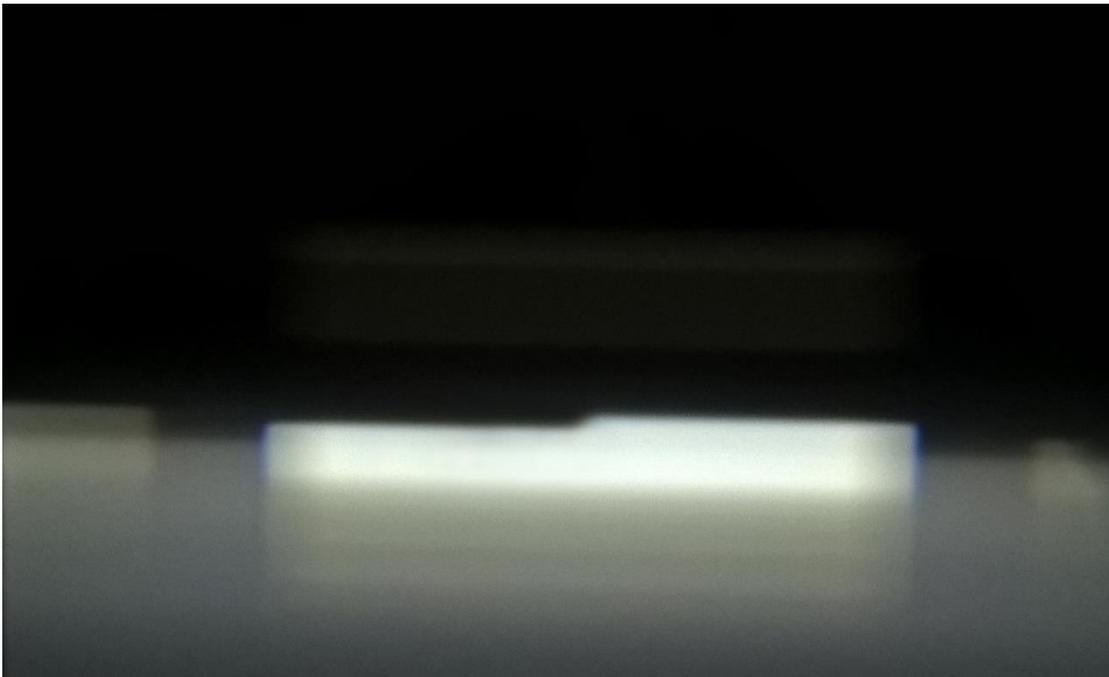
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SMALLER
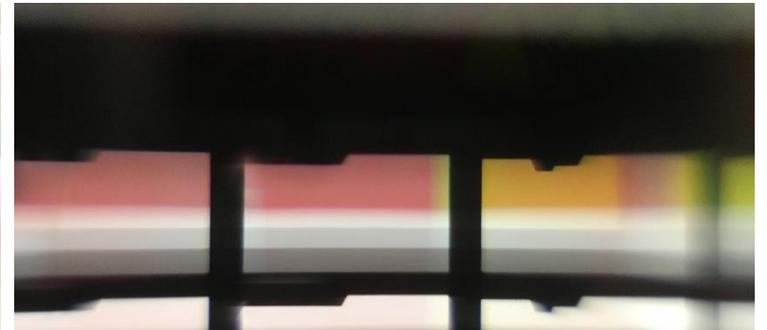## Reduced Sizes of Light Functions Serve Design Requirements
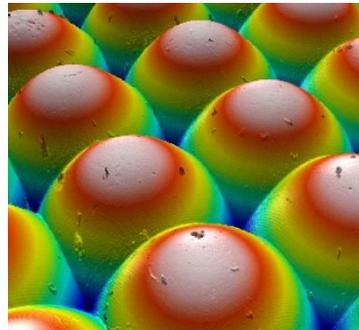

**slimline for daytime running and turn indicator
in the rearlamp**

6

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SMALLER
Micro lens arrays for headlamps

Microlens arrays allow modules with less than 15mm high for low beam applications

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Boost Safety and Styling –
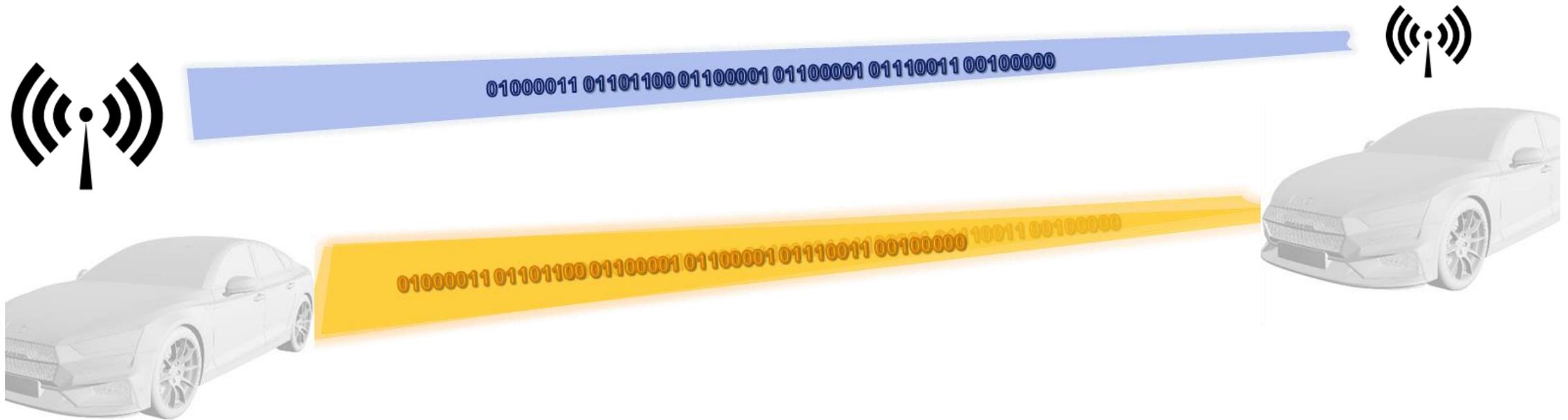# from Today up to Autonomous Vehicles

Topics to work on:

- **Communication**
  Car to Car
  Car to pedestrian
  Car to x

- **Animation/ Individualisation**

- **Sensor integration**

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Communication Car to Car
Visual Light Communication (VLC) Data transfer by light

- Radio alone is not able to guarantee a continuous and fast communication

- Visible Light is suitable as redundant communication link

- Connectivity relay on a fast and smart combination

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Communication Car to Car
rear lamp as information panel

Information about autonomous mode by display

Communication Car to Car / Car to pedestrian
usage of color

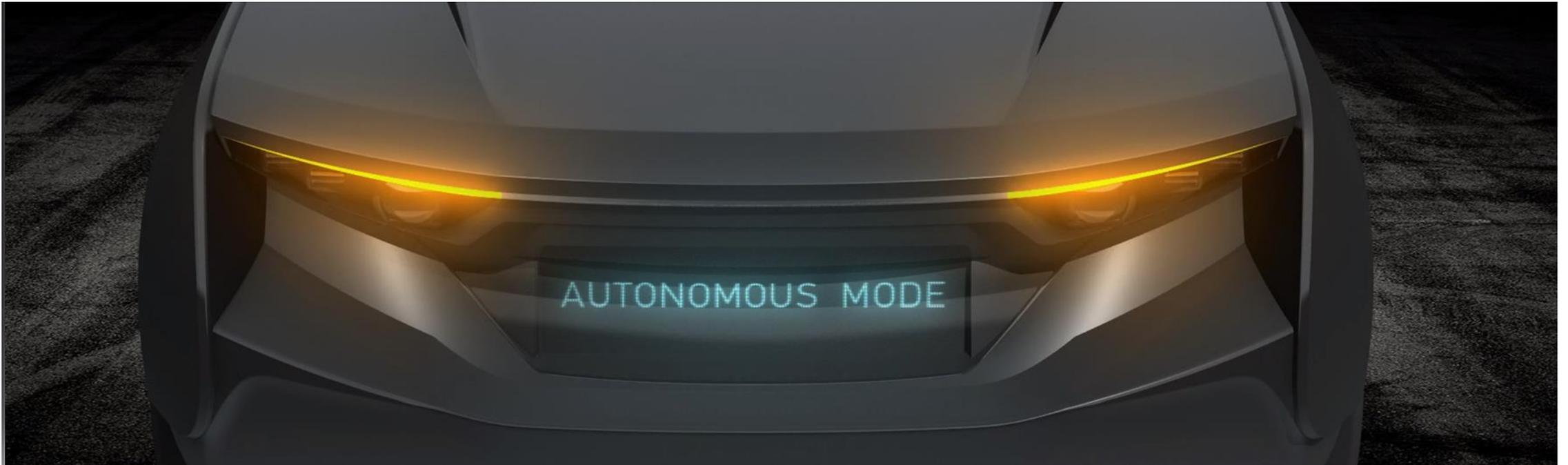**Information about autonomous mode by color**

Cyan as indicator for autonomous mode

Communication Car to pedestrian
usage of color

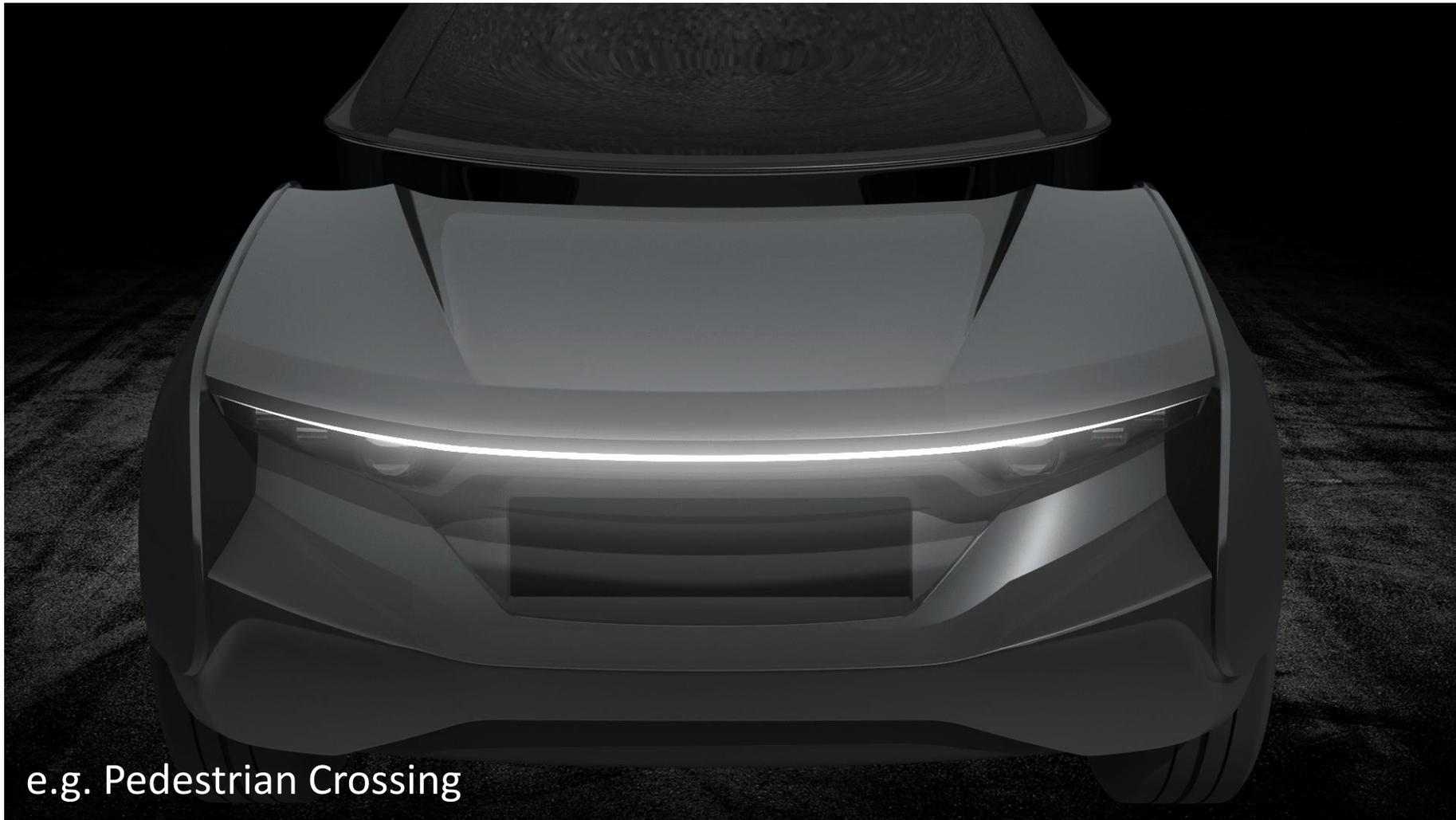**Information about autonomous mode by color**

Communication Car to pedestrian
by display

Information about autonomous mode by display

Communication Car to pedestrian
by display

e.g. Pedestrian Crossing

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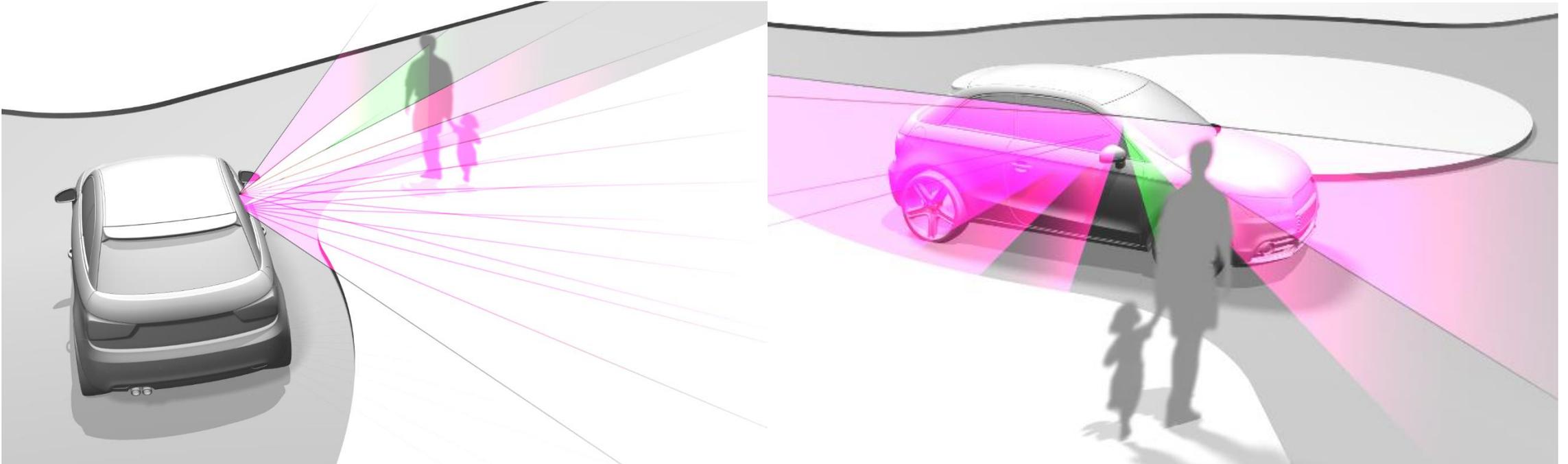
Communication Car to pedestrian
by light

e.g. Pedestrian Crossing

J3134 SAE   Automated-Driving Lamps
J578   Color Specification (discussed green or ~~blue~~)

LIGHTING INNOVATION PREDEVELOPMENT | **HELLA VISION | ONE** | L-LIP Christian Schmidt

Communication Car to pedestrian
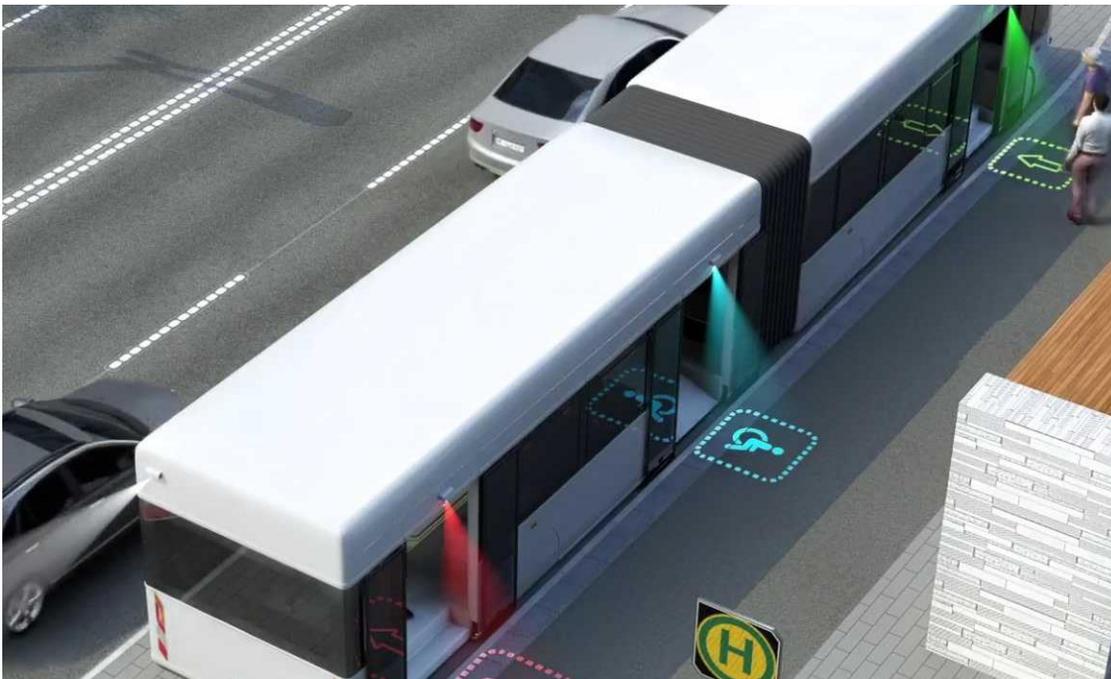## signal modul for indviduall information

Pedestrians are informed "I have detected you"

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Communication Car to X
## warnings by additional elements

Attention warning by rearwindow projection

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Communication Car to x
additional projection moduls

Information and warning by projection

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Communication Car to x
additional projection moduls
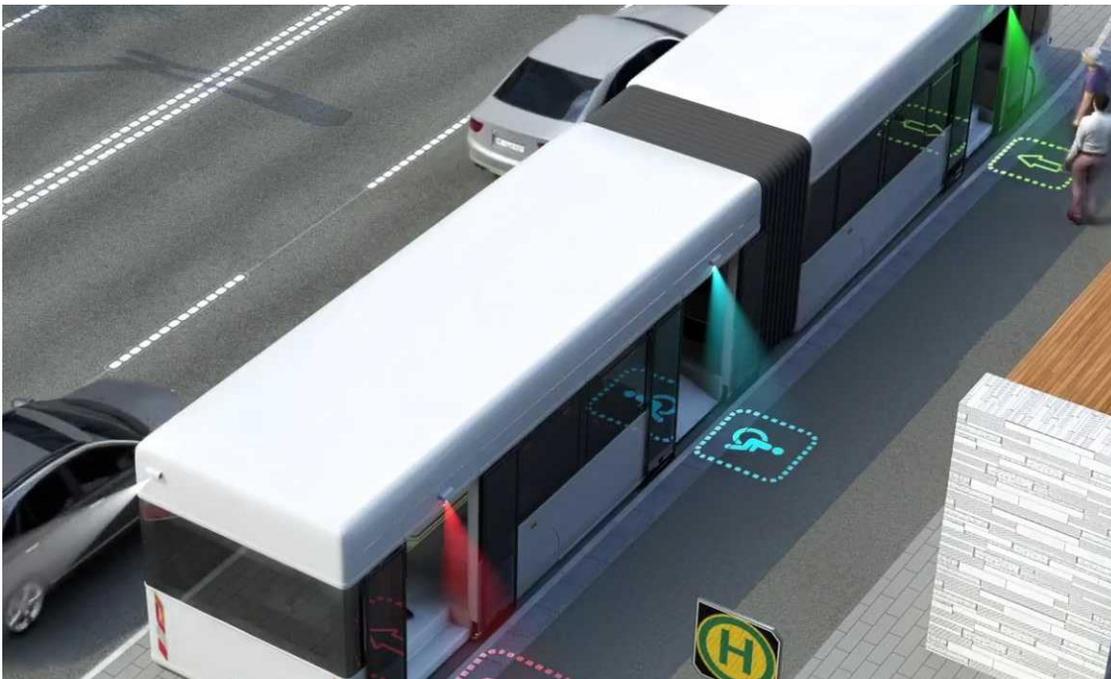
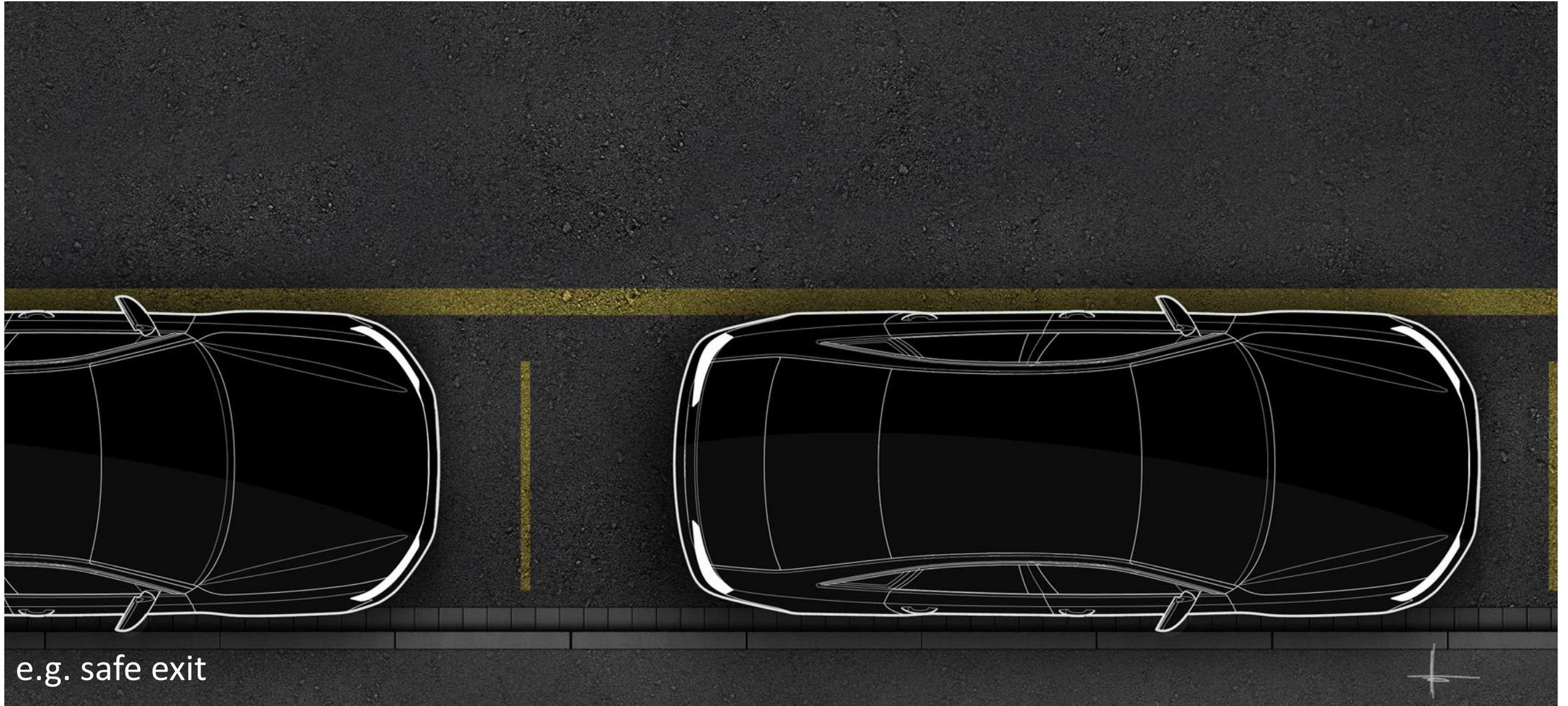**Information and warning by projection**

"from dusk till dawn"

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Communication Car to x
additional projection moduls

e.g. safe exit

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Communication Car to x
additional projection moduls

e.g. Topographic grid

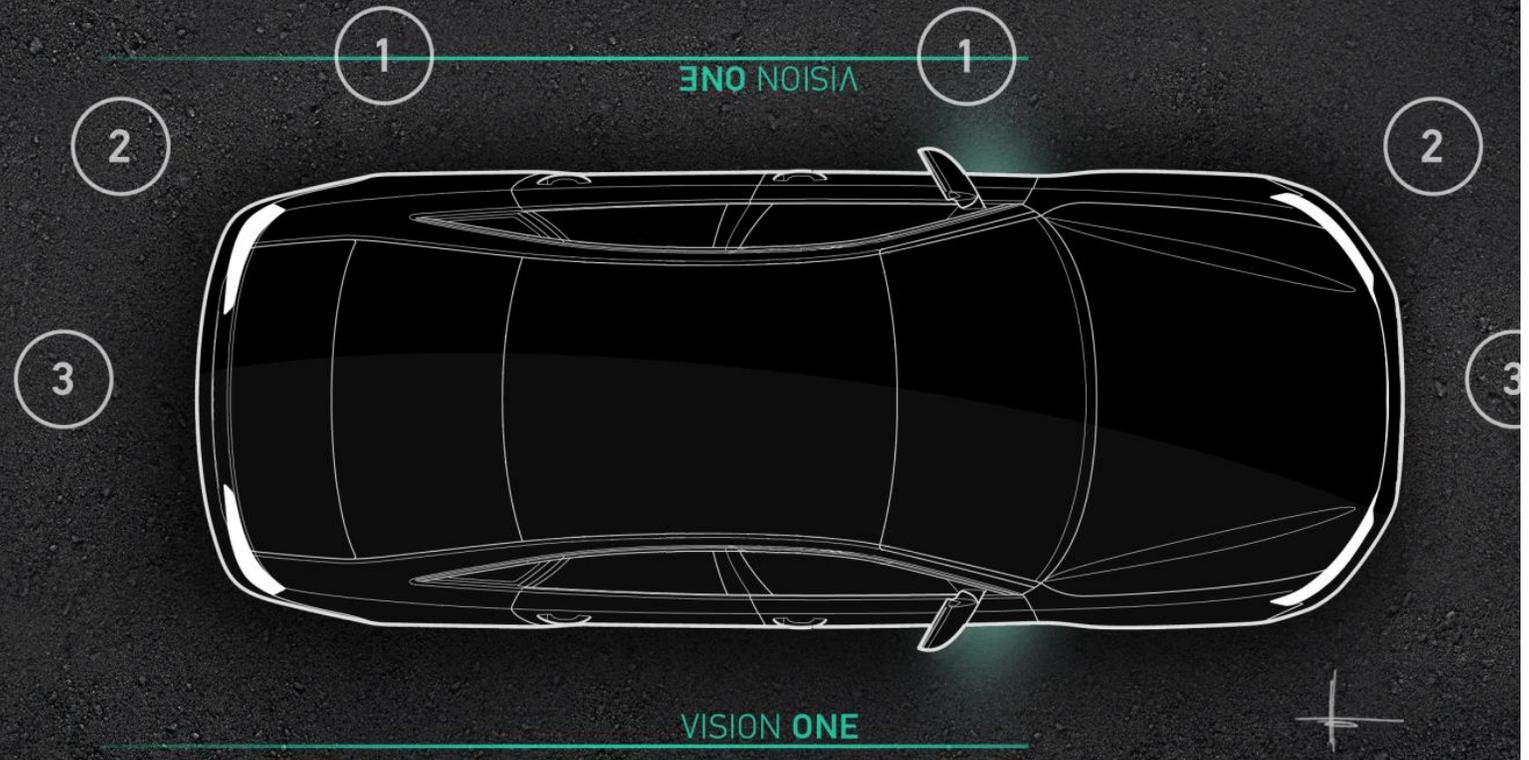Boost Safety and Styling | Christian Schmidt | L-D-ILI | Rochester, MI., JAN-15-2019
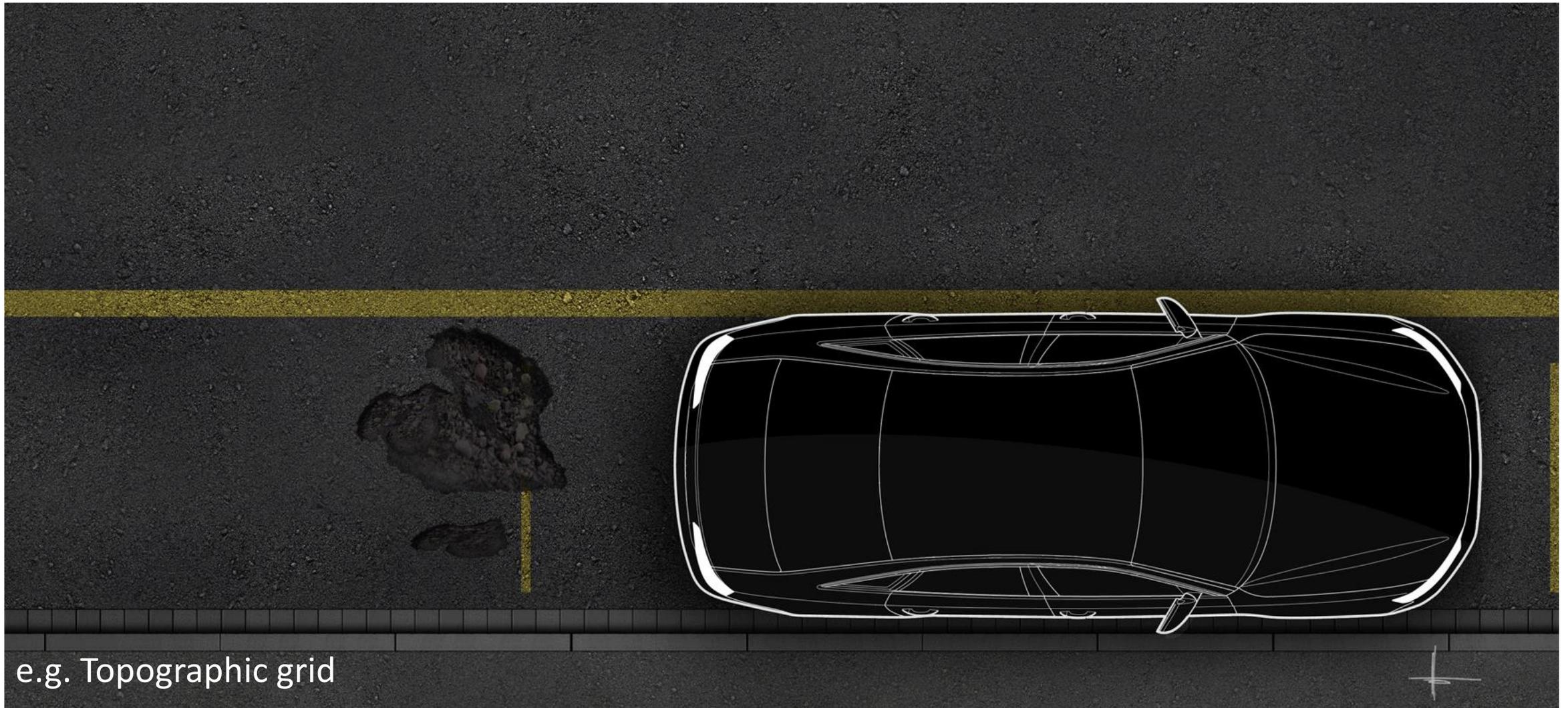
Animation/ Individualisation
additional projection moduls

HOLISTIC LIGHTING SCENARIO
„Welcome"

- Start by pushing the remote key
1 MLA projection lamp: CYAN
  Additional mirror indicator lamp: CYAN
2 Headlamp (DRL/indicator): CYAN
  Rear lamp (backup light/indicator): CYAN
3 Grill lamp: CYAN
  License plate lamp: CYAN
4 All lamps: turned off or color change

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Sensor integration
## headlamp system knowledge as a basis for sensor integration

HELLA | LIDAR 120° CONCEPT

WATER	SNOW / ICE LOW TEMP	DEFOGGING	ANIMAL IMPACT	SAND	SCRATCHES

Integration of sensors e.g. Lidar in headlamps

Enabler for autonomous driving?

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Resumé

- Overall: Shift from technology driven towards application / use cases

- Communication to environment by light is key element for autonomous driving

- Projection elements are important for information and animation

- Sensor integration is necessary to support the new driver "The computing unit of the car"
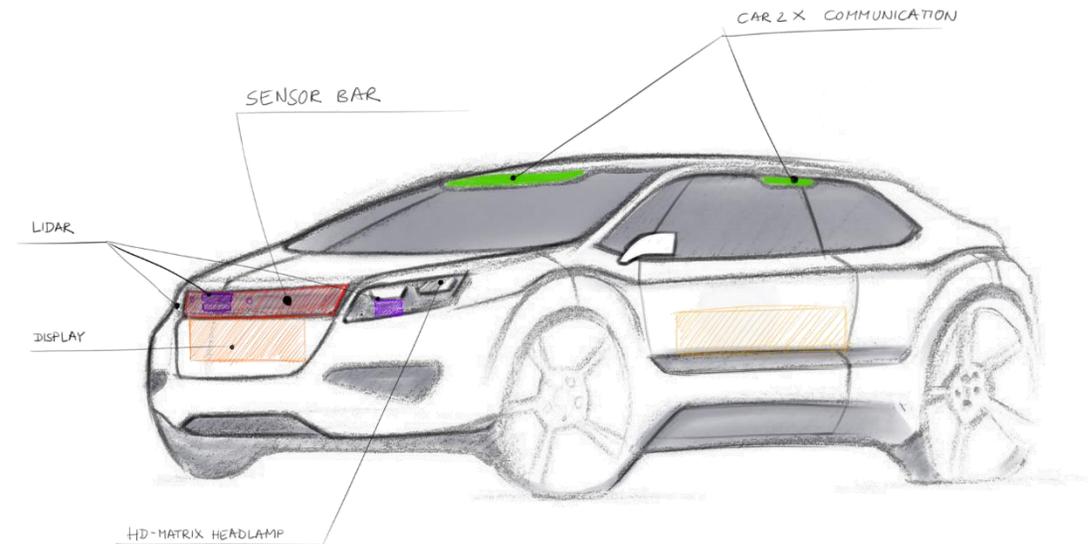
Christian Schmidt

Michael Kleinkes