

# Curriculum vitae

PD. Dr. sci. Eduard Lavrov

## 1 Curriculum vitae

### 1.1 Personal data

*Name:* Eduard V. Lavrov  
*Date of birth:* September 30, 1966  
*Place of birth:* Volzhskiy, Volgograd region, Soviet Union  
*Family status:* Married, one daughter  
*Affiliation:* Institute for Applied Physics  
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### 1.2 University education

*University:* Moscow Institute of Physics and Technology  
*City, Country:* Moscow, Soviet Union  
*Years:* 1984–1990  
*Diploma:* Decay kinetics of excitons bound to isoelectronic traps in neutron-irradiated silicon

### 1.3 Academic degrees

<i>Degree</i>	<i>Year</i>	<i>University</i>	<i>City, Country</i>	<i>Subject</i>
Master of Science	1990	Moscow Institute of Physics and Technology	Moscow, Soviet Union	Physics
Candidate of Sciences (Ph.D.)	1994	Institute of Radioengineering and Electronics of Russian Academy of Sciences (IRE RAS)	Moscow, Russia	Thin structure of the photoluminescence spectra of excitons bound to isoelectronic centers in silicon
Doctor of Sciences (Dr. habil.)	2004	IRE RAS	Moscow, Russia	Optical spectroscopy of hydrogen- and carbon-related centers in semiconductors
Privat-Dozent	2014	Technische Universität Dresden	Dresden, Germany	

## 1.4 Professional background

<i>Position</i>	<i>Affiliation</i>	<i>City, Country</i>	<i>Year(s)</i>
Ph.D student	Moscow Institute of Physics and Technology	Moscow, Russia	1990–1992
Junior research fellow	IRE RAS	Moscow, Russia	1992–1995
Research fellow	IRE RAS	Moscow, Russia	1995–1997
Senior research fellow	IRE RAS	Moscow, Russia	1997–2006
Research assistant	Aarhus University	Aarhus, Denmark	1997–1999
Humboldt fellow	TU Dresden	Dresden, Germany	2000–2001
Research fellow	TU Dresden	Dresden, Germany	2001–till present
Senior research fellow	IRE RAS	Moscow, Russia	2012–2013

## 2 Teaching

**Lab classes:** Different basic and advanced lab classes for physics and non-physics students 2001–2006. Advanced photovoltaic-lab course, 2013–2021. All at the Technische Universität Dresden.

**Lecture courses at the Technische Universität Dresden:** “Physics of Semiconductor Devices”, 2007–2013; “Solid state spectroscopy”, 2013; “Solid state physics” for student teachers, 2020; “General physics” for Faculty of Electrical and Computer Engineering, 2013 till present.

**Invited lecture course:** “Solid state spectroscopy” at the Nelson Mandela University, Gqeberha (former Port Elizabeth), South Africa, summer 2016.

### Supervised diploma and master works

<i>Name</i>	<i>Title</i>	<i>Year</i>	<i>Status</i>
M. Hiller	Raman scattering on hydrogen-induced platelets in Ge	2004	Complete
F. Börrnert	Orientation kinetics of the Cu-H complex in ZnO	2007	—”—
F. Herklotz	Diffusion of copper und hydrogen in ZnO single crystals	2008	—”—
S. Koch	Rotational states of interstitial H <sub>2</sub> in GaAs und Si	2010	—”—
D. Bastin	Acceptor passivation by hydrogen in ZnO	2010	—”—
S. Socher	Hydrogen-induced defects in ion-implanted Si	2011	—”—
P. Pandey	IR absorption on Co in ZnO	2014	—”—

### Supervised Ph.D. thesis

<i>Name</i>	<i>Title</i>	<i>Year</i>	<i>Status</i>
M. Hiller	Properties of interstitial H <sub>2</sub> in Silicon and Germanium: A Raman scattering study	2007	Complete
F. Herklotz	Hydrogen-related defects in ZnO and TiO <sub>2</sub>	2011	—”—
D. Bastin	Reassignment of oxygen-related defects in CdTe and CdSe	2015	—”—
S. Koch	Electrical and optical properties of hydrogen-related defects and their interplay in ZnO	2015	—”—

### Ph.D. examiner:

- Robert Heinhold, “Hydrogen-related effects in the optical and surface electronic properties of ZnO”, University of Canterbury, New Zealand, 2014.
- Naveen Goud Ganagana, “Electrical characterization of impurity-defect complexes in silicon” University of Oslo, Norway, 2015
- Nyasha Joseph Suliali, “Development of TiO<sub>2</sub> nanostructure arrays for photonic extraction of hydrogen gas”, Nelson Mandela University, Gqeberha (former Port Elizabeth), South Africa, 2020.

### 3 Scientific interests

**Topic:** Point, line, and two dimensional defects and defect complexes in semiconductor materials with the emphasis on electrical and optical activity, thermochemistry, diffusion rate, and interaction with other impurities and defects.

**Methods of investigation:** Preferentially optical spectroscopy including: IR absorption, Raman scattering, photoluminescence, and photoconductivity.

#### 3.1 Publications

Referred papers	108	
Conference proceedings	34	
Review articles	3	
Participation in scientific meetings	~50	
Hirsch index	23	Web of Science
	25	Scopus

#### 3.2 Professional service

- Referee for Physical Review Letters, Physical Review, Applied Physics Letters, Journal of Applied Physics, etc.
- Reviewer for Deutsche Forschungsgemeinschaft (German Research Foundation), Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research), Russian Science Foundation, etc.

#### 3.3 Invited talks

<i>Conference</i>	<i>Country</i>	<i>Year</i>
9th International Conference on Shallow Level Centers in Semiconductors	Awaji Island, Japan	2000
23d International Conference on Defects in Semiconductors	Aarhus, Denmark	2003
NATO Advanced Research Workshop on ZnO	St-Petersburg, Russia	2004
Workshop on Advanced Spectroscopy	Kazimierz Dolny, Poland	2005
Gordon Research Conference on Point and Line Defects in Semiconductors	New London, USA	2006
3d South African Conference on Photonic Materials	Mabula Game Lodge, South Africa	2009
25th International Conference on Defects in Semiconductors	St-Petersburg, Russia	2009
SPIE Conference on Oxide-based Materials and Devices	San Fransisco, USA	2010
Materials Research Society Spring Meeting	San Fransisco, USA	2013
Materials Research Society Fall Meeting	Boston, USA	2013
International Conference on Single Dopants	St-Petersburg, Russia	2014
International Conference on Nanostructured Zinc Oxide and related materials	Bremen, Germany	2014
Transparent Conductive Oxides—Fundamentals and Applications	Leipzig, Germany	2014
Gordon Research Conference on Point and Line Defects in Semiconductors	New London, USA	2016
SPIE Conference on Sensors, MEMS and Electro-Optic Systems (SMEOS16)	Skukuza, South Africa	2016

Gettering and Defect Engineering in Semiconductor Technology	Lopota Resort, Georgia	2017
31st International Conference on Defects in Semiconductors	Oslo, Norway	2021

### 3.4 Grant history

<i>Title</i>	<i>Funding agency</i>	<i>Year(s)</i>	<i>Participation</i>
Hydrogen in silicon	INTAS, <sup>1</sup> 93-622	1993–1996	Coworker
Excitons bound to radiation defects in silicon	RFBR, <sup>2</sup> 99-02-16652	1999–2002	—”—
Vacancy complexes in silicon	RFBR, 02-02-16030	2002–2005	—”—
Surface enhanced Raman scattering (SERS) on the metal/semiconductor interface	DFG, <sup>3</sup> 436 RUS 17/86/02	2002–2003	Principal investigator
Detection of close Frenkel pairs in silicon	DFG, 463 RUS 17/22/06	2006	—”—
Properties of hydrogen molecules in semiconductors	DFG, WE 1319/14	2004–2007	Coworker
Properties of hydrogen in ZnO	DFG, WE 1319/16	2005–2008	—”—
Low dimensional H <sub>2</sub> gas in semiconductors	DFG, LA 1397/3	2009–2012	Principal investigator
Transparentes leitfähiges <i>p</i> -dotiertes Zinkoxid für die Photovoltaik	SAB, <sup>4</sup> 14253/2423	2009–2012	Coworker
PVD-Abscheidung von Absorberschichten für die Dünnschicht-Photovoltaik	SAB, 14255/2423	2009–2012	—”—
Hydrogen multicenter bond in oxides	DFG, LA 1397/4	2011–2014	Principal investigator
Identification of complexes of substitutional copper with fastdiffusing impurities in silicon	DFG, LA 1397/7	2011–2012	—”—
IR spectroscopy of electronic and vibrational transitions in semiconductors and semiconductor nano-structures	MES <sup>5</sup> of Russia, 2012-1.5-12-000-1009-014	2012–2013	—”—
Photoconductive detection of vibronic states at semiconductor interfaces and thin films	DFG, LA 1397/10	2015–2018	—”—
Two dimensional hydrogen “gas” captured in {111} platelets in silicon	DFG, LA 1397/15	2017–2018	—”—
Hydrogen in anatase TiO <sub>2</sub>	DFG, LA 1397/13	2017–2020	—”—
Compensating and recombination centers in CdTe and CdSe	DFG, LA 1397/14	2018–2021	—”—
Local vibrational modes of hydrogen-related defects in anatase TiO <sub>2</sub>	DFG, LA 1397/17	2020–2021	—”—
Hydrogen in tin (di)oxide	DFG, LA 1397/20	2021–2024	—”—
Shallow dopants and compensating centers in antimony chalcogenides	DFG, LA 1397/21	2023–2026	—”—

### 3.5 Most important publications

- [1] E. V. Lavrov, L. Hoffmann, and B. Bech Nielsen, “Local vibrational modes of the metastable dicarbon center C<sub>s</sub>–C<sub>i</sub> in silicon,” *Phys. Rev. B* **60**, p. 8081, 1999.

<sup>1</sup>International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union.

<sup>2</sup>Russian Foundation for Basic Research.

<sup>3</sup>Deutsche Forschungsgemeinschaft (German Research Foundation).

<sup>4</sup>Sächsische Aufbaubank (Development Bank of Saxony).

<sup>5</sup>Ministry of Education and Science of the Russian Federation.

- [2] E. V. Lavrov and J. Weber, "Evolution of hydrogen platelets in silicon determined by polarized Raman spectroscopy," *Phys. Rev. Lett.* **87**, p. 185502, 2001.
- [3] E. V. Lavrov, J. Weber, F. Börrnert, C. G. Van de Walle, and R. Helbig, "Hydrogen-related defects in ZnO studied by infrared absorption spectroscopy," *Phys. Rev. B* **66**, p. 165205, 2002.
- [4] M. Hiller, E. V. Lavrov, and J. Weber, "Raman scattering study of H<sub>2</sub> in Si," *Phys. Rev. B* **74**, p. 235214, 2006.
- [5] E. V. Lavrov, F. Herklotz, and J. Weber, "Identification of two hydrogen donors in ZnO," *Phys. Rev. B* **79**, p. 165210, 2009.
- [6] E. V. Lavrov, F. Herklotz, and J. Weber, "Identification of hydrogen molecules in ZnO," *Phys. Rev. Lett.* **102**, p. 185502, 2009.
- [7] S. G. Koch, E. V. Lavrov, and J. Weber, "Photoconductive detection of tetrahedrally coordinated hydrogen in ZnO," *Phys. Rev. Lett.* **108**, p. 165501, 2012.
- [8] F. Herklotz, I. Chaplygin, and E. V. Lavrov, "On the method of photoconductive detection of defects in semiconductors by vibrational mode-related Fano resonances," *J. Appl. Phys.* **124**, p. 025704, 2018.
- [9] V. V. Melnikov, M. Hiller, and E. V. Lavrov, "Two-dimensional H<sub>2</sub> in Si: Raman scattering and modeling study," *Phys. Rev. B* **97**, p. 125307, 2018.
- [10] E. V. Lavrov, I. Chaplygin, F. Herklotz, V. V. Melnikov, and Y. Kutin, "Hydrogen in single-crystalline anatase TiO<sub>2</sub>," *J. Appl. Phys.* **131**, p. 030902, 2022.
- [11] E. V. Lavrov, "Subthreshold photodissociation of H<sub>2</sub> in silicon," *Phys. Rev. A* **106**, p. 013116, 2022.