

# Dimitri UNUCHEK

## Personal Details

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## Languages

🇬🇧 English	● ● ● ●
🇷🇺 Russian	● ● ● ●
🇫🇷 French	● ● ●
🇩🇪 German	●
🇪🇸 Spanish	●

## Technical Skills

### Cryogenics

- ◆ broad experience in low-T UHV systems
- ◆ setting up and maintaining dilution fridge
- ◆ wet and dry systems with high magnetic fields

### Electrical Transport

- ◆ quantum devices design and simulation
- ◆ low-noise / low-current / low-T measurements
- ◆ lock-in and current amplifiers
- ◆ spintronics and spin measurements

### Optical Measurements

- ◆ chip integrated photonics (PIC)
- ◆ continuous wave / ultrafast laser spectroscopy
- ◆ optical setup assembly and alignment

### Clean Room Microfabrication

- ◆ photo-/ebeam lithography, ALD, PECVD
- ◆ physical deposition, wet and dry etching
- ◆ wafer dicing, wire bonding

### Metrology / Material Characterisation

- ◆ AFM, STM, SEM, FIB, PL, Raman, ellipsometry

## Computer skills

### Programming and Numerical Simulation

- ◆ Python, LabVIEW, C, Mathematica, MATLAB
- ◆ Version control in git, GitLab
- ◆ Zemax - optical design, ray tracing
- ◆ COMSOL - multiphysics device simulation
- ◆ Lumerical - FDTD photonics simulations

### Data Analysis and Image Processing

- ◆ Python (SciPy, Matplotlib, Pandas, OpenCV)
- ◆ Igor Pro, Origin, ImageJ, GnuPlot

### Design Tools

- ◆ Adobe Illustrator, DesignCAD, SolidWorks

## Hobbies

- ◆ Endurance sports, Triathlon
- ◆ IM70.3 in 4h18'
- ◆ Matterhorn summit in 2h26'



## PROFESSIONAL EXPERIENCE

### 2022–present. RnD director, Freshape, Switzerland

- ◆ Leading 30-member RnD division (4 teams, 7 direct reports including HW team)
- ◆ Driving development of 5 products in the fields of electronics and renewable energy
- ◆ Managing a portfolio of patents and steering IP strategy to protect key innovations
- ◆ Launched career-growth initiatives and cross-team chapters to foster innovation
- ◆ Implemented OKR framework aligned to product milestones, boosting delivery quality and shortening cycle times

### 2020–2022. RnD manager, Freshape (former H.Glass), Switzerland

- ◆ Built and guided cross-disciplinary team of 12 people incl. material scientists, HW (optical, mechanical, electrical) and SW (algo, FW) engineers
- ◆ Drove product development from POC to industrialization
- ◆ Managed a 2-year, \$0.5 M federal-grant collaboration with CSEM

### 2019–2020. Scientist, H.Glass, Switzerland.

- ◆ Conceived and prototyped a novel photovoltaics product, securing budget for further dev.
- ◆ Doubled efficiency of the organic PV cell with optimization of materials and fabrication

### 2015–2019. Doctoral Assistant, Nano-Electronics Lab, EPFL, Switzerland

- ◆ Research of quantum phenomena in 2-dimensional systems
- Main Achievements:
- ◆ Demonstration of the first excitonic transistors operational at room-temperature
  - ◆ 12 publications in high impact journals including Nature

#### Other Projects:

- ◆ Development of spintronic and opto-spintronic devices based on 2D materials
  - ◆ Development of the electrically pumped laser based on 2D materials
  - ◆ Integration of 2D LED/photodetector with waveguides and photonic cavities
- Key Responsibilities (quantum devices from A to Z):
- ◆ Developing novel device architectures, numerical simulations, experiment design
  - ◆ Cleanroom microfabrication of optoelectronic devices and photonic structures
  - ◆ Electrical transport and optical measurements of fabricated devices
  - ◆ Designing and assembling cryogenic setups for complex optical experiments
  - ◆ Mentoring master and PhD students and their research projects



## EDUCATION

### 2015–2019. EPFL, Lausanne, Switzerland

#### Ph.D. in Electrical engineering

- ◆ Doctoral school of Microsystems and Microelectronics (EDMI) at EE department

### 2013–2015. Ecole Polytechnique (X), Paris, France

- M.Sc. in Physics. Thesis: "Synthesis and characterization of nanomaterials"
- ◆ M1 "Physics for Optics and Nanosciences" and M2 "Nanosciences"
  - ◆ Ranked 1st in the class. M1 GPA: 3.91/4. M2 GPA: 3.81/4.

### 2009–2013. MIPT, Moscow, Russia

#### B.Sc. in Physics and Technology of Nanostructures

- ◆ Faculty of General and Applied Physics. Diploma with high honors. GPA: 4.94/5



## TEACHING EXPERIENCE

### 2015–2019. Teaching Assistant of "Measuring Systems" at EPFL

- ◆ Supervising and guiding electrical engineering students
- ◆ Conducting theoretical and experimental classes
- ◆ Prototyping on NI ELVIS board and LabVIEW programming

### 2009–10. Teacher, Distance School of Physics and Technology at MIPT

- ◆ Students counseling and correction of their works



## EXTRACURRICULAR EXPERIENCE

### 2018. Organizer, Summer School "Optoelectronics on 2D materials"

- ◆ Fundraising (40k CHF), sponsorship search, and venue arrangement
- ◆ Speakers selection, invitation, and their travel arrangement; participants selection
- ◆ School promotion, website and school's design development

### 2012. Jury, Final Round of National Physics Olympiad

- ◆ Organization of theoretical and experimental rounds
- ◆ Correcting and grading participants' works including tête-à-tête appeals



## SELECTED PUBLICATIONS

### First Authorship / Equal Contribution\*

- ◆ D. Unuchek et al., "Room-temperature electrical control of exciton flux in a van der Waals heterostructure", **Nature**, 2018
- ◆ D. Unuchek et al., "Valley-polarized exciton currents in a van der Waals heterostructure", **Nature Nano**, 2019
- ◆ A. Ciarrocchi\*, D. Unuchek\* et al., "Polarization switching and electrical control of interlayer excitons in two-dimensional van der Waals heterostructures", **Nature Photonics**, 2019
- ◆ J. Gonzalez\*, D. Unuchek\* et al., "MoS<sub>2</sub> photodetectors integrated with photonic circuits", **Nature npj 2D materials**, 2019
- ◆ A. Avsar\*, D. Unuchek\* et al., "Optospintrronics in Graphene via Proximity Coupling", **ACS Nano**, 2017

### Other Authorship

- ◆ J. Gonzalez, D. Unuchek et al., "Room-temperature electrical control of polarization and emission angle in a cavity-integrated 2D pulsed LED", **Nature Communications**, 2022
- ◆ A. Avsar, A. Ciarrocchi, M. Pizzochero, D. Unuchek, O. Yazyev, A. Kis, "Layer-modulated magnetism in two-dimensional metallic PtSe<sub>2</sub>", **Nature Nanotechnology**, 2019



## CONFERENCE PRESENTATIONS

- ◆ **2019** American Physical Society March Meeting. Boston, USA  
D. Unuchek et al., "Electrostatic control of exciton flux in van der Waals heterostructures"
- ◆ **2018** Flatlands Beyond Graphene. Leipzig, Germany  
D. Unuchek et al., "Control of interlayer excitons in two-dimensional van der Waals heterostructures"
- ◆ **2018** American Physical Society March Meeting. Los Angeles, USA  
D. Unuchek et al., "Reconfigurable Diodes Based on Vertical WSe<sub>2</sub> Transistors with van der Waals Bonded Contacts"
- ◆ **2018** GRC Two Dimensional Electronics Beyond Graphene. Easton, USA  
D. Unuchek et al., "Optospintrronics in Graphene via Proximity Coupling"
- ◆ **2017** Flatlands Beyond Graphene. Lausanne, Switzerland  
D Unuchek et al., "Atomically thin electrically tunable light-emitting diodes"



## PATENTS

- ◆ US 17/926,750 - "Multilayer Electronic Device and Method for Producing the Same" - **Granted**
- ◆ EP4152184.A1 - "Process of signing documents" - **Granted**
- ◆ WO2022208130A1 - "Dispersive optical device, dispersive optical system comprising the same"
- ◆ WO2023031655A1 - "Sunlight steering apparatus and solar energy harvesting system comprising the same"
- ◆ WO2023175034A1 - "Light collecting assembly"
- ◆ WO2023175034A1 - "Optical system for a position determination device"
- ◆ WO2024184765A1 - "Method of detecting and processing spatially-distributed two-dimensional markers"
- ◆ WO2019229653A1 - "Excitonic device and operating methods thereof"
- ◆ Not yet published: EP24162349.5, EP24161016.1, EP24161026.0



## AWARDS

### Scientific recognition

- ◆ **2020** Gilbert Hausmann Award "For ground-breaking work on the realization of the first room-temperature exciton transistor and exceptional contributions to the understanding of exciton transport in two-dimensional semiconductors."
- ◆ **2019** Featured on the cover of the Nature Photonics (volume 13, issue 2)

### Scholarships

- ◆ **2013–15** Two years of "Paris-Saclay" master scholarship
- ◆ **2012–13** "Presidential Scholarship" for outstanding academic performance
- ◆ **2012–13** Scholarship "Lift to the Future" for outstanding research and academic performance
- ◆ **2010, 12** Scholarship of "Foundation for the Development of Natural Science Innovation Education"

### Awards

- ◆ **2009** Presidential Award for Talented Youth
- ◆ **2007, 08, 09** Moscow Governor's Youth Award

### Science Olympiads Medals

- ◆ **2008** Silver medal at International Physics Olympiad "Tuymaada"
- ◆ **2008** Bronze medal at Russian National Physics Olympiad