

Himani Arora, Ph.D.

Postdoctoral Researcher

Specialization: *2D materials and their electronic applications*

Institute of Ion Beam Physics and Materials Research

Helmholtz-Zentrum Dresden-Rossendorf

01328 Dresden, Germany

☎ +49 176 57700611

✉ h.arora@hzdr.de

📄 [Google Scholar](#)

🌐 [himani-arora-](#)

Education

2015–2020 **Ph.D., Applied Physics**

Technische Universität Dresden, Germany

Title: Charge transport in two-dimensional materials and their electronic applications.

2012–2014 **M.Sc., Advanced Functional Materials and Engineering**

Joint Degree: *University of Augsburg, Germany & Grenoble Institute of Technology, France*

GPA: 1.32 (Rank 2 in the program)

2007–2011 **B.Tech (Hons.), Metallurgical Engineering**

Indian Institute of Technology, Banaras Hindu University (IIT-BHU), India

GPA: 8.44/10 (Rank 4 in the institute)

Research Experience

Present **Postdoctoral Researcher**, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

- Description
- Fabrication and characterization of highly stable and selective gas sensors based on black phosphorus. Funded by Federal Ministry of Education and Research (BMBF), Germany.
 - Development of reconfigurable transistors based on black phosphorus and their subsequent integration into 2D circuits.

2015–2020 **Ph.D. Project**, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

Supervisors Dr. Artur Erbe & Prof. Dr. Gianarelio Cuniberti

- Description
- Fabrication and characterization of fully-encapsulated vdW (photo)transistors based on 2D flakes of InSe and GaSe.
 - Investigation of electronic properties of 2D MOFs. Performed first-ever four-probe and Hall-effect measurements and reported highest mobility ($230 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$) achieved in a MOF system.
 - Demonstration of first-ever broadband photodetector based on a 2D MOF film.
 - Set up a nanofabrication lab dedicated fully to 2D materials at the institute.

Feb–Sep 2017 **Visiting Scholar**, Dept. of Mechanical Engineering, Columbia University, New York, USA

Supervisor Prof. Dr. James Hone

- Description
- Participated in the development of lithography-free “via-contacts”, a novel device encapsulation scheme for air-sensitive 2D materials to enhance their lifetime and performance.
 - Learnt techniques of complex vdW heterostructure stacking.

Jan–Jul 2015 **Research Assistant**, Fraunhofer Institute for Organic Electronics, Dresden, Germany

- Description
- Responsible for the deposition and investigation of AlN and AlScN thin films using magnetron sputtering.
 - Worked closely with the industrial partners; films were produced with required piezoelectric properties, stress levels, thickness, and composition.

Feb–Aug 2014 **Master’s Thesis**, Group of Large Area Electronics, IMEC, Leuven, Belgium

Supervisors Dr. Pawel Malinowski & Prof. Dr. Paul Heremans

- Description
- Investigation of the origins of dark current in organic photodetectors.
 - Integrated a metal-oxide-based electron transport layer into photodetectors for the first time, and as a result, reduced the dark current and improved their performance.

May–Jul 2010 **Undergraduate Internee**, R&D Dept., TATA Steel, India

- Description
- Metallurgical investigations of surface defects in cold rolled steel stripes (automobile panel grade of steel).
 - Rigorous statistical analysis to correlate defect severity and continuous casting parameters, such as mould level fluctuations, casting speed variation, and stopper head position.

Publications

h-index: 6, i10-index: 4 ([Google Scholar link](#))

1. [H. Arora](#), Z. Fekri, A. Erbe. Anomalous Temperature Dependent Electronic Properties of Encapsulated Black Phosphorus. (In preparation).
2. T. Venanzi, [H. Arora](#), S. Winnerl, A. Pashkin, A. Patanè, Z. D. Kovalyuk, Z. R. Kudrynskyi, A. Erbe, M. Helm, H. Schneider. Infrared Induced Photoluminescence Quenching in Few-Layered InSe. (In preparation).
3. A. Echresh, [H. Arora](#), S. Pruncal, Z. Li, M. Helm, S. Zhou, A. Erbe, L. Rebohle, Y. M. Georgiev. Developing a Symmetric Hall-Bar Configuration for Top-Down Fabricated Highly p -Type Germanium Nanowires. (In preparation).
4. [H. Arora](#), R. Dong, T. Venanzi, J. Zscharschuch, H. Schneider, M. Helm, X. Feng, E. Cánovas, A. Erbe. Demonstration of a Broadband Photodetector Based on a Two-Dimensional Metal-Organic Framework. [Advanced Materials](#) **32**, 1907063 (2020). (Featured on the [issue's back cover](#), in [Optics and Photonics News](#), [laserfocusworld.com](#) and [sciencedaily.com](#)).
5. [H. Arora](#) and A. Erbe. Recent Progress in Contact, Mobility, and Encapsulation Engineering of InSe and GaSe. [InfoMat](#), 10.1002/inf2.12160 (2020).
6. [H. Arora](#), S. Park, R. Dong, A. Erbe. 2D MOFs: A New Platform for Optics?. [Optics and Photonics News](#) **31**, 36–43 (2020). (Feature article in October issue).
7. T. Venanzi, [H. Arora](#), S. Winnerl, A. Pashkin, P. Chava, A. Patanè, Z. D. Kovalyuk, Z. R. Kudrynskyi, K. Watanabe, T. Taniguchi, A. Erbe, M. Helm, H. Schneider. Photoluminescence Dynamics in Few-Layer InSe. [Physical Review Materials](#) **4**, 044001 (2020).
8. F. Kern, M. Linck, D. Wolf, N. Alem, [H. Arora](#), S. Gemming, A. Erbe, A. Zettl, B. Büchner, A. Lubk. Autocorrected Off-Axis Holography of Two-Dimensional Materials. [Physical Review Research](#) **2**, 043360 (2020).
9. [H. Arora](#), Y. Jung, T. Venanzi, K. Watanabe, T. Taniguchi, R. Hübner, H. Schneider, M. Helm, J. C. Hone, A. Erbe. Effective Hexagonal Boron Nitride Passivation of Few-Layered InSe and GaSe to Enhance Their Electronic and Optical Properties. [ACS Applied Materials & Interfaces](#) **11**, 43480–43487 (2019). (Featured in [Eurekalert.org](#), [Phys.org](#), and presented in IQ Innovation Prize Mitteldeutschland 2020).
10. T. Venanzi, [H. Arora](#), A. Erbe, A. Pashkin, S. Winnerl, M. Helm, H. Schneider. Exciton Localization in MoSe₂ Monolayers Induced by Adsorbed Gas Molecules. [Applied Physics Letters](#) **114**, 172106, (2019).
11. F. Kern, M. Linck, D. Wolf, T. Niermann, [H. Arora](#), N. Alem, A. Erbe, S. Gemming, A. Lubk. Direct Correction of Residual Symmetric Aberrations in Electron Holograms of Weak Phase Objects. [Microscopy and Microanalysis](#) **25** (Suppl 2), 98–99, (2019) .
12. R. Dong, P. Han, [H. Arora](#), M. Ballabio, M. Karakus, Z. Zhang, C. Shekhar, P. Adler, P. St. Petkov, A. Erbe, S. C. B. Mannsfeld, C. Felser, T. Heine, M. Bonn, X. Feng, E. Cánovas. High-Mobility Band-Like Charge Transport in a Semiconducting Two-Dimensional Metal-Organic Framework. [Nature Materials](#) **17**, 1027–1032, (2018).
13. [H. Arora](#), T. Schönherr, A. Erbe. Electrical Characterization of Two-Dimensional Materials and Their Heterostructures. [IOP Conference Series: Materials Science and Engineering](#) **198**, 012002, (2017).
14. [H. Arora](#), P. E. Malinowski, A. Chasin, D. Cheyng, S. Steudel, S. Schols, P. Hereman. Amorphous IGZO as Electron Transport Layer in Organic Photodetectors. [Applied Physics Letters](#) **106**, 143301, (2015).
15. [H. Arora](#), A. Kumar, M. B. N. Raju, A. Dey, S. Suresh. Study of Sliver Defects on Cold Rolled Coils: Effect of Casting Process Parameters. [TATA Search](#) **2**, 209-214 (2012), ISSN-0971-5975.

Technical Skills

Expertise in fabrication and characterization of complex and hybrid device structures (transistors, photodetectors, p - n junctions) based on 2D materials.

Sample Preparation: exfoliation and identification of 2D flakes, deterministic assembly of vdW heterostructures inside a glovebox, O₂ plasma and UV-ozone cleaning, wire-bonding.

Nanofabrication: e-beam and photo-lithography, metal deposition techniques (sputtering, thermal and e-beam evaporation), cleanroom (class 10) experience, handling of cryogenic liquids.

Characterization: Low temperature (liq. He & N₂) and high precision electrical measurements under strong magnetic fields and focused lasers, Hall-effect and four-probe electrical measurements, Raman spectroscopy, photoluminescence, scanning electron microscopy, atomic force microscopy, optical microscopy.

Software Skills: AutoCAD, OriginLab, LaTeX, Python (basics), Gwyddion, Microsoft Office.

Professional Development: Courses on "*Project planning & management*", "*Communication & presentation skills*", "*Leadership & teamwork*" certified by University of Surrey and Imperial College London.

Awards / Fellowships / Honors

- Oct 2020 **Best Student Award** in the entire Ph.D. Program at the Annual Workshop of IHRS NanoNet (International Helmholtz Research School for Nanoelectronic Networks).
- Aug 2018 **1st prize in Scientific Image Competition** organized by cfaed (Center for Advancing Electronics Dresden). Won travel grant worth 500 EUR. ([Link to the announcement](#)).
- Jun 2018 **3rd prize in Science Slam on "2D or not 2D"** organized by Technische Sammlungen Dresden in collaboration with Silicon Saxony e.V.
- Nov 2016 **INSPIRE cfaed Research Grant** for research stay at Columbia University, USA. Amount awarded 3,060 EUR.
- Oct 2016 **Best Student Paper Award** at IEEE Radio 2016 Conference out of many student entries. Presented Ph.D. work titled, "*Building electronics from two-dimensional materials*".
- Oct 2016 **Travel Grant from GFF Association at TU Dresden** to support my participation in IEEE Radio 2016 Conference.
- 2015–2018 **IHRS NanoNet Fellowship** for pursuing Ph.D. degree at Helmholtz-Zentrum Dresden-Rossendorf. Stipend worth 50,000 EUR.
- 2012–2014 **Erasmus Mundus Scholarship** by the European Union for pursuing M.Sc. degree. Only 10 candidates were awarded the scholarship from non-EU countries. Stipend worth 48,000 EUR with Rank 1 in the selection procedure.
- Apr 2011 **BHU Alumni Association Scholarship** for overall academic and curricula excellence during undergraduate studies at IIT-BHU.
- Aug 2007 Honored by **District Administration** and **District Red Cross Society of Bhiwani** (home-town located in Haryana, India) for extraordinary academic excellence.

International Conferences

- Talks:**
- Invited:
 - 2DMAT Conference, Paris (France), 2021.
 - At Nanoelectronics Research Lab, UC Santa Barbara (USA), 2020.
 - Annual Workshop of IHRS NanoNet, Dresden (Germany), 2019.
 - Contributed:
 - Falling Walls Labs, Berlin (Germany), 2018.
 - Flatlands beyond Graphene, Leipzig (Germany), 2018.
 - Annual Meeting of the DPG and Spring Meeting, Berlin (Germany), 2018.
 - IEEE Radio Conference, Réunion Island, 2016.

- Posters:**
- MRS Spring Meeting, Phoenix (USA), 2017.
 - CECAM conference on “Tailor-made 2D-materials and functional devices”, Bremen (Germany), 2016.
 - EFDS Workshop on Graphene, Dresden (Germany), 2015.
- Summer**
- “Frontier research in 2D materials” by Graphene & Co., Cargèse (Corsica), 2018.
- Schools:**
- “2D Layered Materials: synthesis, properties and applications” by EPFL Lausanne, Zermatt (Switzerland), 2016.

Teaching and Mentoring

- Apr–Aug 2016 **Laboratory supervisor, Faculty of Physics, TU Dresden**
Physikalische Grundpraktikum III, undergraduate level course
- Responsibilities included preparing and supervising the experiments, and grading students’ tests and laboratory journals.
- 2016–2018 **Mentored six graduate students**
- Training them on laboratory procedures and equipment.
 - Helping conceptualizing project ideas and experiments.
 - Training them on data analysis, evaluation of the results, and scientific writing.

Outreach and Professional Services

- Active Peer reviewer for *ACS Applied Materials & Interfaces* and *Advanced Science*.
- Serving on the Reviewer Board of *MDPI Crystals*.

Personal Skills and Competences

- Languages: **Hindi** (Mother tongue), **English** (Proficient), **German** (Fluent).
- Member of **International Peace Slam Dresden**. <https://peaceslam.com/himani/>
 - Pitched the Peace slam initiative project at **TEDx Dresden 2018**.
 - Presented the peace slam at **Palais Sommer 2018**. The news coverage is available at: <https://www.sachsen-fernsehen.de/peace-slam-beim-palais-sommer-in-dresden/>
- Member of Centre for Advancing Electronics Dresden (cfaed), TU Dresden.
- Student representative, NanoNet fellowship program (2016–2017).
- Active Badminton player, associated with *TSV Dresden-Bühlau* Badminton Club.
- Former team player of Belgium National Women’s Cricket (Feb–Aug 2014).
- Participated in mountaineering expedition led by Bachendri Pal (first Indian woman to climb Mt. Everest). Trekked to Surya Top in Himalayas (4,200 meters above sea level).
- **Pastime:** Sports (swimming, badminton), cooking, solving puzzles.