

## Curriculum Vitae

### **Santanu Pradhan, PhD**

Assistant Professor  
Centre for Nanotechnology  
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### **Research Interest:**

- ❖ Optoelectronic devices based on novel nanomaterials.
- ❖ Colloidal quantum dot/perovskite nanocrystals-based light-emitting diodes and photodetectors.
- ❖ Solution-processed Quantum dot (QD)/ perovskite/organic-based single junction and tandem solar cells.
- ❖ Building integrated semi-transparent solar cells
- ❖ Photon up and down-converting devices
- ❖ Light management, charge transport, and recombination dynamics in nanostructured and thin film-based devices.

### **Education:**

#### **Ph.D. in Physics**

**Dec. 2015**

Indian Institute of Technology Kharagpur

*Thesis title: Efficiency enhancement in nanostructured zinc oxide conjugated polymer-based inverted hybrid solar cells*

*Thesis supervisor: Prof. A. Dhar*

*Degree awarded: August 2016.*

#### **M.Sc. in Physics**

**July 2010**

Indian Institute of Technology Kharagpur

*Master Thesis: Efficient water-splitting with solution-processed porous titanium dioxide.*

*Thesis Supervisor: Prof. S. K. Ray*

#### **B.Sc. in Physics (Honours)**

**July 2008**

University of Calcutta

## **Professional Experience:**

June 2021-present	<i>Assistant Professor</i> (IIT Roorkee)	<i>Novel nanomaterials-based optoelectronic devices</i>
January 2016 – May 2021	<i>Post-doctoral fellow, Prof. Gerasimos Konstantatos group</i> (ICFO-The Institute of Photonic Sciences, Spain).	<i>Colloidal quantum dot-based infrared optoelectronic devices</i>
September 2015- January 2016	<i>Research Engineer, Prof. Gerasimos Konstantatos group</i> (ICFO-The Institute of Photonic Sciences, Spain).	<i>Colloidal lead sulfide quantum dot-based photovoltaics</i>
June – December 2014	<i>IUSSTF BASE fellow, Prof. Sean E. Shaheen group</i> (University of Colorado at Boulder, USA, partly with NREL, Colorado).	<i>Recombination dynamics of high-performance organic and hybrid photovoltaics with transient techniques</i>
July 2010-May 2015	<i>Ph.D. fellow, Prof. A. Dhar group</i> (Indian Institute of Technology Kharagpur, India)	<i>‘Efficiency enhancement in nanostructured zinc oxide conjugated polymer based inverted hybrid solar cells’</i>

## **Publication summary:**

Published 36 journal articles, 1 US patent (granted), 2 Indian patents (applied), and 22 international conferences. *Total citations: 1527, h-index: 19, i-10 index: 22; Source: Google Scholar* (<https://scholar.google.com/citations?user=gAlnIrIAAAAJ&hl=en>)

### ***Important publications***

#### ***After joining IITR:***

[1] A. Salunke, **S. Pradhan**, Nanoscale Bulk-Heterojunction Channel-Enabled Self-Powered Broadband Lateral Photodetectors for Efficient Weak Light Detection, *Advanced Optical Materials*, 2025, 13, 2500664.

[2] S. Kumar, **S. Pradhan**, Colloidal Quantum Dot-Based Near and Shortwave Infrared Light Emitters: Recent Developments and Application Prospects, *Advanced Optical Materials*, 2024, 12, 2400993.

[3] P. Kumar, A. Salunke, S. Kumar, **S. Pradhan**, Ultralow Dark Current in Lead Sulfide Colloidal Quantum Dots Near-Infrared Photodetectors Achieved through Trap Passivation with Efficient Surface Ligands Attachment, *ACS Appl. Electron. Mater.* 2024, 6, 9113-9121.

[4] A. Salunke, P. Kumar, S. Kohli, **S. Pradhan**, Designing energetic landscape in the multi-bandgap lead sulphide colloidal quantum dots ensemble for efficient solar spectrum utilization, *Solar Energy*, 2024, 269, 112321.

[5] S. Kumar, A. Salunke, **S. Pradhan**, Achieving ultra-stable, near-unity photoluminescence quantum yield under extreme humidity and high electric field for CsPbBr<sub>3</sub> nanocrystals through the surface attachment of ZnO nanoparticles, *ACS Appl. Opt. Mater.* 2024, 2, 128-138.

[6] **S. Pradhan**, M. Dalmases, N. Taghipour, B. Kundu, G. Konstantatos, Colloidal Quantum Dot Light Emitting Diodes at Telecom Wavelength with 18% Quantum Efficiency and Over 1 MHz Bandwidth, *Advanced Science* 2022, 9, 2200637.

Before joining IITR:

[1] **S. Pradhan**, F. Di Stasio, Y. Bi, S. Gupta, S. Christodoulou, A. Stavrinadis and G. Konstantatos, High efficiency colloidal quantum dot infrared light emitting diodes via engineering at the supra-nanocrystalline level, *Nature Nanotechnology*. 2019, 14, 72-79. (Covered by 7 news outlets).

[2] **S. Pradhan**, M. Dalmases, G. Konstantatos, Solid-state Thin-Film Broadband Short-wave Infrared Light Emitters, *Advanced Materials* 2020, 32, 2003830. (Covered by 8 news outlets).

[3] Y. Bi\*, **S. Pradhan**\*, S. Gupta, M. Z. Akgul, A. Stavrinadis, G. Konstantatos, Infrared Solution-Processed Quantum Dot Solar Cells Reaching External Quantum Efficiency of 80% at 1.35  $\mu\text{m}$  and Jsc in Excess of 34  $\text{mA cm}^{-2}$ , *Advanced Materials*, 2018, 30, 1704928. (\*equal contribution).

[4] **S. Pradhan**, M. Dalmases, A.-B. Baspinar, G. Konstantatos, Highly Efficient, Bright and Stable Colloidal Quantum Dot Short-Wave Infrared Light Emitting Diodes, *Advanced Functional Materials* 2020, 30, 2004445.

[5] **S. Pradhan**, A. Stavrinadis, S. Gupta, S. Christodoulou, G. Konstantatos, Breaking the Open-Circuit Voltage Deficit Floor in PbS Quantum Dot Solar Cells through Synergistic Ligand and Architecture Engineering, *ACS Energy Lett.*, 2017, 2, 1444–1449.

[6] **S. Pradhan**, A. Stavrinadis, S. Gupta, Y. Bi, F. Di Stasio, G. Konstantatos, Trap-State Suppression and Improved Charge Transport in PbS Quantum Dot Solar Cells with Synergistic Mixed-Ligand Treatments, *Small*, 2017, 13, 1700598.

[7] A. Stavrinadis, **S. Pradhan**, P. Papagiorgis, G. Itskos, G. Konstantatos, Suppressing Deep Traps in PbS Colloidal Quantum Dots via Facile Iodide Substitutional Doping for Solar Cells with Efficiency >10%, *ACS Energy Lett.*, 2017, 2, 739–744.

### **Ongoing/completed research projects:**

#### **Sponsored:**

(1) Developing efficient colloidal quantum dot-based solid-state light emitters in the short-

wave infrared region of 1500 -1700 nm. (SERB, Govt. of India, PI, INR. 32.86 lakh)

(2) Developing efficient colloidal quantum dot-based infrared sensitizer through engineering at supra-nanocrystalline level. (IIT Roorkee for faculty initiation grant, PI, INR 20 lakh)

(3) Developing highly efficient short-wave infrared light emitting diodes through solution-processed perovskite nanocrystals-colloidal quantum dots heterostructures. (Royal Society of Chemistry, PI, GBP 4960.00)

(4) Asymmetric Non-fullerene Acceptor with low energy loss for high performance organic solar cells. (DST, Govt. of India, Co-PI, INR 91.09 lakh) (PI: Prof. S. Karak, IIT Delhi)

(5) Commercial scale-up of a portable Potentiostat platform for non-invasive multiplexed salivary diagnosis and prognosis of oral and lung cancer. (Co-PI, Funding Agency: ICMR, INR 399.95 lakh). (PI: Prof. P. Gopinath, IIT Roorkee)

#### **Consultancy:**

(1) Commissioning and Testing of Energy Storage Technology. (Esyntra Ltd, India; PI, INR 5.9 lakh)

#### **Scholastic Honours/awards:**

- Recipient of Royal Society of Chemistry (**RSC**) research grant award 2024.
- Received Director's appreciation letter for high faculty score at IIT Roorkee for academic year 2023-24.
- Selected for Bhaskara Advanced Solar Energy (**BASE**) fellowship – 2013-14 sponsored by Indo-US Science & Technology Forum (**IUSSTF**) and DST, Govt. of India.
- **MCM Scholarship**-IIT Kharagpur, During M.Sc. course 2008 to 2010.
- Qualified national fellowship entrance test like **NET, GATE, JEST, etc.**
- Ranked in the national top 1% in the National Graduate Physics Examination (**NGPE**)-2008, organised by the Indian Association of Physics Teachers (IAPT)

#### **Teaching Experience:**

- Taught PG courses NTN-601 (Structural analysis of Nanomaterials), NTN-605 (Electronic properties and measurement techniques of nanomaterials), NTN-504 (Nanoscale modeling and simulations), NTN-604 (Physics of Nanomaterials), NTC-503 (Advanced characterizations of nanomaterials) at the Centre for Nanotechnology, **IIT Roorkee**.
- Taught UG course PHI-101 (preliminary physics course for UG students) at the Department of Physics, **IIT Roorkee**.
- Taught UG Open elective course NTO-101 (Nanodevices) at **IIT Roorkee**.

- Laboratory instructor for NTN 505 for M.Tech students at the Centre for Nanotechnology, **IIT Roorkee**.
- Laboratory instructor for 3<sup>rd</sup> year master students of Engineering Physics at **UPC**, Barcelona for the course “Photovoltaic device characterizations”. (3 semesters)
- Laboratory instructor for master’s students (EM & Optics laboratory), Department of Physics & Meteorology, **IIT Kharagpur**. (2 semesters)

### **Positions of responsibility:**

- ✓ Currently supervising: five Ph.D. Students (two PMRFs, one thesis submitted), one M.Tech student at IIT Roorkee.
- ✓ Hosted four SPARK summer fellows for a short-term internship at IIT Roorkee.
- ✓ Mentored three M. Tech students towards the completion of their respective projects at IIT Roorkee.
- ✓ Guided three summer fellows for the completion of their projects at ICFO. Partially mentored a Ph.D. student at ICFO.

### *Conference/workshop/symposium:*

- ✓ Acted as the convener of the Nanotechnology Day-2023.
- ✓ Acted as the co-convener of the joint Indo-Japan workshop on nanomedicine (InJaNa-2024).
- ✓ Organised a SERB-sponsored one-day symposium and hands-on training session on ‘Functional nanomaterials and nanodevices’ for academic professionals at the Centre for Nanotechnology, IIT Roorkee. (2<sup>nd</sup> March 2024)

### **Journal reviewer:**

Reviewed articles from the journal *Nature Communications*, *Advanced Materials*, *Advanced Functional Materials*, *Advanced Science*, *Scientific Reports*, *Sensors*, *RSC*, *ACS*, *Springer journals*, etc. (More than 50)

### **Membership:**

- (1) Member of the Royal Society of Chemistry (MRSC) (From 2022)
- (2) Community associate of the American Chemical Society (ACS) (From 2022)