Krishanu Dey, PhD

Postdoctoral Research Assistant, Department of Physics, University of Oxford
Junior Research Fellow in Sciences, Worcester College, Oxford
Stipendiary Lecturer in Engineering Science, Trinity College, Oxford

Clarendon Laboratory, University of Oxford
Parks Road, Oxford OX1 3PU
United Kingdom

krishanu.dey@physics.ox.ac.uk
+44-7587305131
https://www.physics.ox.ac.uk/our-people/deyk

EDUCATION

PhD in Physics, Cavendish Laboratory, University of Cambridge (Churchill College), United Kingdom (Oct 2018-June 2023)

Thesis: Mixed lead-tin halide perovskites for optoelectronic applications
Advisor: Prof. Samuel D Stranks

Master of Engineering (M.Eng.), Department of Electrical and Computer Engineering, National University of Singapore (NUS), Singapore (Aug 2016-Sep 2018)

GPA: 4.63 (5-point scale)
Thesis: High mobility and highly transparent cerium doped indium oxide films for photovoltaic applications
Advisors: Prof. Armin Aberle & Dr. Selvaraj Venkataraj

Bachelor of Technology (B.Tech.), Department of Electronics and Communication Engineering (ECE), National Institute of Technology (NIT) Silchar, India (July 2012-May 2016)

GPA: 9.71 (10-point scale)
Senior thesis: TCAD simulation study of high efficiency III-V multi-junction solar cells
Advisor: Prof. Trupti Ranjan Lenka

RESEARCH EXPERIENCE

June 2023-present — Postdoctoral Research Assistant (PDRA) in Condensed Matter Physics, University of Oxford, UK **(Advisor: Prof. Henry Snaith FRS)**

- Explore vacuum deposited halide perovskites for efficient and stable light emitting diodes (LEDs) and multijunction solar cells.
- Probe the light and heat stability of quantum-well heterostructures of low-bandgap 3D perovskites with wide-bandgap 2D perovskites.
- Understand the air degradation mechanism of low dimensional mixed lead-tin perovskites.
- Synthesize high quality single crystalline perovskite thin films for photovoltaic and LED applications.

Oct 2018-Mar 2023 — PhD Candidate, Cavendish Laboratory, University of Cambridge, UK **(Advisor: Prof. Samuel D Stranks)**

- Studied the various unique fundamental characteristics of mixed lead-tin halide perovskite material systems (processed by spin coating) using a combination of structural, chemical, photophysical and electrical characterization techniques.
- Integrated these as absorbers in high mobility field effect transistors and high efficiency single junction perovskite solar cells.

Aug 2016-Jul 2018 — M. Eng. candidate, National University of Singapore, Singapore **(Advisors: Prof. Armin Aberle & Dr. Selvaraj Venkataraj)**
Investigated high mobility and high near-infrared (NIR) transparent cerium doped indium oxide thin films deposited by DC magnetron sputtering as a possible alternative to indium tin oxide (ITO) for thin film solar cell applications.

Aug 2016-Aug 2018	Research Assistant (RA), Solar Energy Research Institute of Singapore (SERIS), Singapore (**Advisors: Prof. Armin Aberle & Dr. Selvaraj Venkataraj)** • Set up the CIGS solar cells R&D pilot line in Singapore. • Contributed to the development of novel transparent oxide materials at SERIS in collaboration with PVComB, Germany.
Jul 2015-May 2016	B.Tech Final Year Project, National Institute of Technology Silchar, India **(Advisor: Prof. Trupti Ranjan Lenka)** Predicted the electrical characteristics of InGaP/InP tandem solar cells as a function of different absorber parameters and incident solar intensities using TCAD simulation.
May 2015-Jul 2015	Summer Research Fellow (SRF), Bhabha Atomic Research Centre (Chemistry Division), India (**Advisor: Dr. C.A. Betty)** Examined the photoelectrochemical properties of ZnO-bare-Si and ZnO-porous-Si heterojunctions fabricated using Langmuir-Blodgett method for water splitting applications to generate green hydrogen.

RESEARCH GRANTS PORTFOLIO (TOTAL ~ £150K)

- **Industrial Collaboration Grant (£125,000)** from **Henry Royce Institute** for developing all-inorganic halide perovskites for all-perovskite triple junction solar cells, Nov 2024-Mar 2025. **(Researcher Co-Investigator)**
- **EPSRC Vacation Internship Grant (~£7000)** from Oxford University's **EPSRC DTP funding** for supervising a undergraduate summer intern in the group, July-Sep 2024. **(Principal Investigator)**
- **Royce Undergraduate Research Internship Grant (£3300)** from **Henry Royce Institute** for supervising a undergraduate summer intern in the group, July-Sep 2024. **(Principal Investigator)**
- **John Fell Fund Small Grant (£10,000)** from **Oxford University Press** for developing single crystalline perovskites for photovoltaic and LED applications, Mar 2024-Sep 2025. **(Principal Investigator)**
- **VIPERLAB Equipment Access Grant (~£2500)** for XPS/UPS measurements in Helmholtz Zentrum-Berlin (HZB), 2024-2025. **(Principal Investigator)**
- **VIPERLAB Equipment Access Grant (~£1200)** for TEM measurements in Helmholtz Zentrum-Berlin (HZB), 2024-2025. **(Principal Investigator)**
- **Cambridge Royce facilities grant EP/P024947/1 and Sir Henry Royce Institute** - recurrent grant EP/R00661X/1 **(£2,000)** for developing all-perovskite tandem solar cells, 2020-2021. **(Co-Investigator).**

INDIVIDUAL FUNDING

- Full-cost **Cambridge India Ramanujan Scholarship** for pursuing PhD from University of Cambridge, 2018-2022 **(~£180,000** towards tuition fees + living costs).
- **Cambridge Philosophical Society Research Studentship** for pursuing PhD from University of Cambridge, 2022 **(£1800)**.
- **Lockey Fund Travel Grant** from MPLS Oxford for presenting at the PSCO conference in Perugia, Italy, 2024 **(£500)**.
- **RSC Energy Sector Knowledge-Exchange Travel & Subsistence Bursary** for presenting at 2024 Nanoseries conference in Lisbon, Portugal, 2024 **(£500)**.

- **IET International Travel Award** for presenting at MRS Fall Meeting at Boston, Massachusetts, 2023 **(£1500)**.
- **IET National Travel Award** and **Armourers and Brasiers' Travel Grant** for presenting at HOPV23 Conference in London, UK, 2023 (total **£1025**).
- **Armourers and Brasiers' Travel Grant** for presenting at WCPEC-8 Conference in Milan, Italy, 2022 **(£900)**.
- **Latsis Young Scientists Travel Grant** for presenting at SeeFuturePV Symposium in Lausanne, Switzerland, 2022 **(£600)**.
- **SuperSolar International Conference Grant** for presenting at MRS Spring Meeting in Honolulu, Hawai'I, 2022 **(£500)**.
- **Cambridge Trusts Conference Grant** for presenting at (Virtual) E-MRS Fall Meeting, 2021 **(£100)**.
- **Summer Research Fellowship** from Indian Academy of Sciences, 2016 **(£200)**.

AWARDS AND HONORS

- **Best PhD Thesis Award 2023** from Royal Society of Chemistry (Energy Sector).
- **Junior Research Fellowship in Sciences** at Worcester College, University of Oxford (2023-2025).
- **Student Award Finalist** for World Conference on Photovoltaic Energy Conversion (WCPEC-8), held during 26-30 September 2022 (Milan).
- **Hudswell International Research Award** from Institution of Engineering and Technology (IET), 2022.
- **Best Question Prize** in Virtual Perovskite Conference (ViPerCon), held on 4 April 2022.
- **Graduate Student Award** in (Virtual) E-MRS Fall Conference, held during 20-23 September 2021.
- **2nd prize in 3-Minute Thesis (3MT) competition**, held as a part of (Virtual) E-MRS Fall conference, held during 20-23 September 2021.
- **Gold Medal for Best Engineering Graduate** of NIT Silchar (India) for the batch of 2012-16 (out of 600 students).
- **Silver Medal for Top Ranked Student** in the Department of ECE, NIT Silchar for the batch of 2012-16 (out of 92 students).
- **8th rank** in the state of Assam (India) in the Higher Secondary School Leaving Examination 2012 (Out of 18,442 students).
- **20th rank** in the state of Assam (India) in the High-School Leaving Examination 2010 (Out of 270,930 students).

TEACHING AND SUPERVISION EXPERIENCE

Oct 2024-Sep 2025	**Stipendiary Lecturer in Engineering Science** (Trinity College, University of Oxford) • Tutoring 1st- and 2nd-year Eng. Sci. undergraduates (Mathematics & Electronics and Information Engineering courses) • Setting and marking college collections (internal examinations) • General administration of Engineering Science teaching in the college
Oct 2023-Jun 2025	**Lead Tutor** (Department of Engineering Science, University of Oxford) 3rd year course: Electronic Devices (B12)
Oct 2024-Dec 2024	**Tutor** (Department of Materials, University of Oxford) 1st year course: Mathematics for Materials Science
Jul 2024-Sep 2024	**Supervisor for Undergraduate Summer Internships** (University of Oxford)

	Student 1 (Oxford Chemistry): Passivation of halide perovskite films and devices using diammonium halides *Student 2 (Oxford Physics):* Electrical doping of 2D and mixed 2D-3D perovskites
May 2024-Jun 2024	**MPhys Project Assessor** (Department of Physics, University of Oxford) Examined the MPhys theses and took the Viva of 12 MPhys students
Oct 2023-June 2024	**Final Year Project Supervisor** (University of Oxford) *MPhys Project (2023-24):* Fabrication and Characterization of Perovskite Single Crystalline films for PV Applications *MChem Part II Project (2024-25):* Evaporated Mixed-Halide Perovskites for Efficient Blue Perovskite Light Emitting Diodes
Oct 2023-Jun 2024	**Laboratory Demonstrator** (Department of Physics, University of Oxford) 1st year Electronics labs
Oct 2021-May 2022	**Undergraduate Tutor/Supervisor** (Department of Engineering, University of Cambridge) 3rd year (Part IIA) courses: Semiconductor Engineering (3B5) & Photonic Technologies (3B6)
Jan 2019-May 2021	**Laboratory Demonstrator** (Department of Physics, University of Cambridge) 1st year (Part I) labs
Jan 2019-May 2021	**Examination Invigilator** (Department of Physics, University of Cambridge) MPhil in Scientific Computing Examinations, 3rd year (Part II) Minor Topic Examinations

LEADERSHIP AND MANAGERIAL EXPERIENCE

- **Lead Organizer:** *#LeadFreePero Symposium, MATSUS Spring 25 Meeting, Sevilla (to be held from 3-7 Mar 2025)*
- **Lead Organizer:** *#PeroLIGHT Symposium, MATSUS Fall 24 Meeting, Lausanne (to be held from 12-15 Nov 2024)*
- **Organizer:** *Worcester Energy Day, Worcester College, University of Oxford (2024)*
- **Panel member:** *IET Engineers in Society Awards (2024-2026)*
- **Reviewer:** *DoE grant*, *Science Advances* (Science), *Nature Protocols (Nature), Analytical Chemistry (ACS), ACS Applied Energy Materials (ACS), Applied Physics A (Springer)*
- **Chair:** *Sustainability Research Working Group, Worcester College Oxford (2023-24)*
- **JRF Representative:** *Governing Body of Worcester College Oxford (2024-2025)*
- **Organizing Member:** *PSCO-23 Conference, Oxford (2023); PVSEC-26 Conference, Singapore (2016)*
- **Chair:** *Cambridge University Commonwealth Society (2018-19)*
- **Co-Founder & General Secretary**: *Cambridge University Bharatiya Society (2018-19)*
- **Chair**: *NUS ECE Graduate Students' Council (2017-18)*
- **Class Representative:** *Department of ECE, NIT Silchar (2012-16)*
- **Technical Head:** *Electronics and Communication Society, NIT Silchar (2014-15)*

SELECTED INVITED TALKS

- ***3rd Annual NanoSeries Conference on Global Nanotechnology***, Lisbon, Portugal, 17-19 June 2024 (Title- Suppressed Ion Migration and Composition Instabilities in Mixed Lead-Tin Halide Perovskite Materials and Devices).

- ***Indian Institute of Technology Delhi***, India, 8 January 2024 (Title- Transparent Conductive Oxides and Mixed-Metal Halide Perovskites: Implications for Photovoltaics and Beyond).

- ***Solar Energy Research Institute of Singapore***, National University of Singapore, Singapore, 12 December 2023 (Title- Mixed-Metal Halide Perovskites: From Fundamentals to Devices).
- ***ATHENA & MSCA Intensive Course in Metal Halide Perovskites*: From Materials to Applications**, Online, 9 November 2022 (Title- Probing Charge Transport in Halide Perovskites using Field Effect Transistors).
- ***International Conference on Solar Energy Materials and Technology (ICSEMT-2022)***, Online, 24 November 2022 (Title- Mixed Lead-Tin Halide Perovskites for Optoelectronic Applications).
- ***EPSRC-funded APSISSFE (Affordable Perovskite Solar Irrigation Systems for Small-holder Farmers in Ethiopia) Workshop***, University of Cambridge, 30 March 2022 (Title- Spectral Considerations in the Measurements of Solar Cells).
- ***One Week International Online Faculty Development Program (FDP) On Computational Intelligence and Modelling in Modern Power System***, VRS Engineering College (Andhra Pradesh, India), 26 June 2020 (Title- Perovskite Photovoltaics: Reimagining the Energy Landscape).

SELECTED CONFERENCE PRESENTATIONS

- *PSCO International Conference*, Perugia, 16-19 September 2024 **(ORAL)**
- *UK Semiconductors Conference*, Sheffield, 8-9 July 2024 **(ORAL)**
- *MRS Fall Conference*, Boston, 26 November-1 December 2023 **(3x ORAL)**
- *MATSUS Fall Conference*, Torremolinos, 16-20 October 2023 **(ORAL)**
- *PSCO International Conference*, Oxford, 18-21 September 2023 **(POSTER)**
- *HOPV International Conference*, London, 12-14 June 2023 **(POSTER)**
- *World Conference on Photovoltaic Energy Conversion (WCPEC-8)*, Milan, 26-30 September 2022 **(ORAL)**
- *Binks Trust Renewable Energy Conference*, Oxford, 23-24 June 2022 **(ORAL)**
- *SeeFuturePV Symposium*, Lausanne, 22-24 June 2022 **(ORAL)**
- *MRS Spring Meeting*, Honolulu, 8-13 May 2022 **(ORAL)**
- *E-MRS Fall Meeting*, Virtual, 20-23 September 2021 **(ORAL)**
- *HOPV International Conference*, Virtual, 24-28 May 2021 **(POSTER)**
- *Cavendish Graduate Student Conference*, Cambridge, 25 November 2021 **(ORAL)**
- *Churchill College Conference on Everything*, Cambridge, 6 November 2021 **(ORAL)**
- *ICMAT Conference*, Singapore, 18-23 June 2017 **(ORAL)**

PUBLICATIONS (Scholar: https://shorturl.at/2CQov)

1. Substitution of Lead with Tin Suppresses Ionic Transport in Halide Perovskite Optoelectronics, **Energy and Environmental Science 2024**, 17, 760-769, DOI: 10.1039/D3EE03772J. ***(First author)***
2. Charge Transport in Mixed Metal Halide Perovskite Semiconductors, **Nature Materials 2023**, 22, 216-224, DOI: 10.1038/s41563-022-01448-2. ***(First author)***
3. Optoelectronic Properties of Low-Bandgap Halide Perovskites for Solar Cell Applications, **Advanced Materials 2021**, 33, 2102300, DOI: 10.1002/adma.202102300. ***(First author)***
4. Superior optoelectrical properties of magnetron sputter-deposited cerium-doped indium oxide thin films for solar cell applications, **Ceramics International** 2021, 47, 1798-1806, DOI: 10.1016/j.ceramint.2020.09.006. ***(First author)***
5. Simulation of High Efficiency InGaP/InP Tandem Solar Cells Under Flat Plate and Concentrator Conditions, **IEEE International Conference on Microelectronics Devices, Circuits and Systems** 2017, India, DOI: 10.1109/ICMDCS.2017.8211717. ***(First author)***
6. Electrochemical Impedance Spectroscopy of All-Perovskite Tandem Solar Cells, **ACS Energy Letters 2024**, 9, 442-453, DOI: 10.1021/acsenergylett.3c02018. ***(Second author)***

7. Impact of the Addition of Tin on the Charge Carrier Dynamics of Metal Halide Perovskites, 47th **International Conference on Infrared and Millimeter Waves 2022**, Netherlands, DOI: 10.1109/IRMMW-THz50927.2022.9895582. ***(Second author)***
8. A Critical Assessment of the Use of Excess Lead Iodide in Lead Halide Perovskite Solar Cells, **Journal of Physical Chemistry Letters 2020**, 11, 6505–6512, DOI: 10.1021/acs.jpclett.0c01820. ***(Second author)***
9. Unravelling low-temperature structural and dielectric characteristics in lead-free bismuth halide perovskites, **Journal of Materials Chemistry C 2024**, *just accepted*. ***(Co-author)***
10. Strain Heterogeneity and Extended Defects in Halide Perovskite Devices, **ACS Energy Letters 2024**, 9, 3001-3011, DOI: 10.1021/acsenergylett.4c00921. ***(Co-author)***
11. Tailoring Interlayer Charge Transfer Dynamics in 2D Perovskites with Electroactive Spacer Molecules, **Journal of American Chemical Society 2023**, 145, 39, 21330-21343, DOI: 10.1021/jacs.3c05974 ***(Co-author)***
12. Tuneable Multiband Halide Perovskite Tandem Photodetectors with Switchable Response, **ACS Photonics 2022**, 9, 3958- 3966, DOI: 10.1021/acsphotonics.2c01328. ***(Co-author)***
13. Enhanced Visible Light Absorption in Layered Cs3Bi2Br9 through Mixed-Valence Sn(II)/Sn(IV) doping, **Chemical Science 2021**, 12, 14686-14699, DOI: 10.1039/D1SC03775G. ***(Co-author)***
14. An Open-Access Database and Analysis Tool for Perovskite Solar cells based on the FAIR Data Principles, **Nature Energy 2021**, 7, 107-115, DOI: 10.1038/s41560-021-00941-3. ***(Co-author)***
15. Numerical Analysis of high-efficiency lead-free perovskite solar cell with NiO as hole transport material and PCBM as electron transport material, **CSI Transactions on ICT 2020**, 8, 111-116, DOI: 10.1007/s40012-020-00291-7. ***(Co-author)***

WORKS IN PROGRESS

1. Assessing the Impact of Tin Substitution on the Photostability of Mixed-Halide Perovskites, *to be submitted*. ***(First author)***
2. Thermally Evaporated All-Inorganic Perovskites for Pure-Red Light Emitting Diodes, *manuscript under preparation.* ***(First author)***
3. Understanding the air degradation mechanism of 2D tin and mixed lead-tin perovskites, manuscript under preparation. ***(First author)***

BOOK CHAPTERS

1. Lead-Free Perovskite Solar Cells, **Perovskite Optoelectronic Devices (Springer Nature Book)**, DOI: 10.1007/978-3-031-57663-8_8. ***(First & corresponding author)***
2. Instabilities and Degradation in Perovskite Materials and Devices, **Perovskite Optoelectronic Devices (Springer Nature Book)**, DOI: 10.1007/978-3-031-57663-8_17. ***(Last & corresponding author)***

KEY (ONGOING) COLLABORATIONS

Prof. Saiful Islam (Department of Materials, University of Oxford)
Prof. Petra Cameron (Department of Chemistry, University of Bath)
Prof. Sir Richard Friend FRS (Department of Physics, University of Cambridge)
Prof. Henning Sirringhaus (Department of Physics, University of Cambridge)
Prof. Robert Palgrave (Department of Chemistry, University College London)
Dr. Jesper Jacobsson (Department of Chemistry, Uppsala University)
Prof. Dibyajyoti Ghosh (Department of Materials Science and Engineering, IIT Delhi)
Prof. Marcus Bar (HZB, Berlin)
Prof. Hannah Joyce (Department of Engineering, University of Cambridge)
Prof. Laura Herz FRS (Department of Physics, University of Oxford)

Prof. Satyaprasad Senanayak (NISER Bhubaneswar)
Prof. Bruno Ehrler (AMOLF, Amsterdam)
Prof. Keehoon Kang (Seoul National University)
Prof. Bo Ram Lee (Sungkyunkwan University)

FEATURED NEWS

- Cambridge researchers unravel exciting prospects for mixed metal halide perovskite systems for a variety of optoelectronic applications, Cavendish Laboratory, University of Cambridge, 2023.
- Cambridge University PhD student awarded 2022 IET Hudswell International Research Scholarship, University of Cambridge, 2022.

OUTREACH AND IMPACT

Physics Lab to Life, 2024	Public exhibition in Oxford Physics aimed at adults and young people (age 14+ years) who are curious about the applications of physics. Conducted 3 lab tours for members of the general public and organized hands-on demonstrations of next-generation solar technology.
Davidsons Inventors Challenge, 2022	Collaborative initiative of the Department of Chemical Engineering & Biotechnology (CEB) at Cambridge and the Association of Science Technology and Innovation (ASTI), Malaysia for year 11 and 12 students to work on a STEM project under the remit of the UN Sustainable Development Goals (SDGs). As part of the CEB team, mentored students and judged project proposals to decide the winner.
Cambridge Festival, 2019 and 2022	Annual public exhibition of various research activities in different departments at Cambridge. As part of the research group, took part in poster display and hands-on demonstrations (building dye-sensitized solar cells from different kinds of berries).
Physics at Work, 2019	Annual outreach event of the Cavendish Lab for students of age group 12-16 years from various UK schools to motivate them towards a career in Physics and consider Cambridge as a prospective undergrad destination. Prepared and delivered a research overview of the Optoelectronics group as part of a 7-member team and organized a QnA round; conducted a science game to disseminate the idea of ‘bandgap’ in semiconductors.