

## **Motiur Rahman Khan**

Assistant Professor

Department of Physics

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## **Research Interests**

- Device Physics: Organic semiconductors and perovskites
- Organic and Perovskite solar cells: fabrication and characterization
- Charge transport and recombination mechanisms via opto-electrical methods
- Investigation of interface and bulk traps via electrical methods
- Disorder and ion migration
- Electrochemically doped polymer thin film devices

## **Experimental Techniques: Device Fabrication & Characterization**

- Fabrication of solution processed solar cells using spin coating
- Thermal evaporation techniques for metal and organic thin film deposition
- Electrochemical synthesis based doped polymer devices
- Low-temperature charge transport measurements
- Charge carrier mobility measurement by TOF, SCLC and Photo-CELIV techniques
- Charge transport analysis using temperature dependent conductivity, current–voltage characteristics
- Interface and bulk phenomena by impedance spectroscopy
- Trap analysis by thermally stimulated current, thermal admittance spectroscopy

## **Employment**

**Assistant Professor**

May 2023-present

Department of Physics, Jamia Millia Islamia, New Delhi,  
India

## Research Experience

**Postdoctoral researcher** Karlsruhe Institute of Technology, Germany  
Jan 2019- April 2022 Group: Prof. Uli lemmer & Dr. Ulrich Paetzold

**Postdoctoral researcher** University of Potsdam, Germany  
Jan 2018- Dec 2018 Group: Prof. Dieter Neher

## Education

**Ph.D** Department of Physics, Indian Institute of Science, Bangalore, India  
2011-2017  
Thesis title: "Nonlinear charge transport and photo-physical studies in conjugated polymers (P3MeT, P3HT) and their hybrid composites with silver sulfide quantum dots"  
Supervisors: Prof. Reghu Menon & Prof. K.S.R.K.Rao

**M.Sc (Physics)** Banaras Hindu University, Varanasi, India  
2010

**B.Sc** D. D. U. Gorakhpur University, Gorakhpur, India  
2007

## List of Publications

1. The Duong, T. Nguyen, K. Huang, H. Pham, S.G. Adhikari, **Motiur Rahman Khan**, L. Duan, W. Liang, K.C. Fong, H. Shen, A.D. Bui, A.O. Mayon, T. Truong, G. Tabi, V. Ahmad, S. Surve, J. Tong, T. Kho, T. Tran-Phu, T. Lu, J. Zheng, U.W. Paetzold, U. Lemmer, A.H. Baillie, Y. Liu, G.Andersson, T. White, K. Weber, and K. Catchpole, Bulk Incorporation with 4- Methylphenethylammonium Chloride for Efficient and Stable Methylammonium-Free Perovskite and Perovskite-Silicon Tandem Solar Cells, *Adv. Ener. Mater.* 2203607 (2023).

2. **Motiur Rahman Khan**, J.A. Schwenzler, J. Lehr, U.W. Paetzold and U. Lemmer, Emergence of deep traps in long-term thermally stressed CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite revealed by thermally stimulated currents, *J. Phy. Che. Lett.* **13**, 552-558 (2022).
3. A.A. Eliwi, M.M. Byranvand, P. Fassel, **Motiur Rahman Khan**, I.M. Hossain, M. Frericks, S. Ternes, T. Abzieher, J.A. Schwenzler, T. Mayer, J.P. Hofmann, B.S. Richards, U. Lemmer, M. Saliba, and U.W. Paetzold, Optimization of SnO<sub>2</sub> Electron Transport Layer for Efficient Planar Perovskite Solar Cells with Very Low Hysteresis, *Mater. Adv.* **3**, 456–466 (2022).
4. S. Gharibzadeh, P. Fassel, I.M. Hossain, P. Rohrbeck, M. Frericks, M. Schmidt, The Duong, **Motiur Rahman Khan**, T. Abzieher, B.A. Nejjand, F. Schackmar, O. Almora, T. Feeney, R. Singh, D. Fuchs, U. Lemmer, J.P. Hofmann, S.A.L. Weber and U.W. Paetzold, Two birds with one stone: dual grain-boundary and interface passivation enables >22% efficient inverted methylammonium-free perovskite solar cells, *Ene. Env. Sci.* **14**, 5875-5893 (2021).
5. A. Farooq, **Motiur Rahman Khan**, T. Abzieher, A. Voigt, D.C. Lupascu, U. Lemmer, B.S. Richards, U.W. Paetzold, Photodegradation of Triple-Cation Perovskite Solar Cells: The Role of Spectrum and Bias Conditions, *ACS Appl. Energy Mater.* **4**, 3083-3092 (2021).
6. M.M. Byranvand, F. Behboodi-Sadabad, A.A. Eliwi, V. Trouillet, A. Welle, S. Ternes, I.M. Hossain, **Motiur Rahman Khan**, J.A. Schwenzler, A. Farooq, B.S. Richards, J. Lahann and U.W. Paetzold, Chemical vapor deposited polymer layer for efficient passivation of planar perovskite solar cells, *J. Mater. Chem. A*, **8**, 20122–20132 (2020).
7. R. Haldar, M. Jakoby, M. Kozłowska, **Motiur Rahman Khan**, H. Chen, Y. Pramudya, B.S. Richards, L. Heinke, W. Wenzel, F. Odobel, S. Diring, I.A. Howard, U. Lemmer, and C. W ö ll, Tuning Optical Properties by Controlled Aggregation: Electroluminescence Assisted by Thermally-Activated Delayed Fluorescence from Thin Films of Crystalline Chromophores, *Chem. Eur. J.* **26**, 17016 – 17020 (2020).
8. The Duong, H. Pham, T.C. Kho, P. Phang, K.C. Fong, Di Yan, Y. Yin, J. Peng, M.A. Mahmud, S. Gharibzadeh, B.A. Nejjand, I.M. Hossain, **Motiur Rahman Khan**, N. Mozaffari, Yi L. Wu, H. Shen, J. Zheng, H. Mai, W. Liang, C. Samundsett, M. Stocks, K. McIntosh, G.G. Andersson, U. Lemmer, B.S. Richards, U.W. Paetzold, A.

- Ho-Ballie, Y. Liu, D. Macdonald, A. Blakers, J. Wong-Leung, T. White, K. Weber, K. Catchpole, High Efficiency Perovskite-Silicon Tandem Solar Cells: Effect of Surface Coating versus Bulk Incorporation of 2D Perovskite, *Adv. Ener. Mater.* **10**, 1903553 (2020).
9. S. Moghadamzadeh, I.M. Hossain, M. Jakoby, B.A. Nejang, D. Rueda-Delgado, J.A. Schwenzler, S. Gharibzadeh, T. Abzieher, **Motiur Rahman Khan**, A.A. Haghighirad, I.A. Howard, B.S. Richards, U. Lemmer, U.W. Paetzold, Spontaneous enhancement of the stable power conversion efficiency in perovskite solar cells, *J. Mater. Chem. A* **8**, 670-682 (2020).
  10. A.J.L. Hofmann, S. Züfle, K. Shimizu, M. Schmid, V. Wessels, L. Jäger, S. Altazin, K. Ikegami, **Motiur Rahman Khan**, D. Neher, H. Ishii, B. Ruhstaller, W. Brütting, Dipolar Doping of Organic Semiconductors to Enhance Carrier Injection, *Phys. Rev. Appl.* **12**, 064052 (2019).
  11. **Motiur Rahman Khan**, A.M. Jagtap, K.S.R. Koteswara Rao and R. Menon, Tuning the charge transport and photo-physical behavior in hybrid poly(3-hexylthiophene) and silver sulfide quantum dot based nanocomposite devices, *Organic Electronics* **69**, 361-366 (2019).
  12. **Motiur Rahman Khan**, K.S.R. Koteswara Rao and R. Menon, Electric field activated nonlinear and disorder-induced charge transport in doped polymer devices, *Organic Electronics* **52**, 288-294 (2018).
  13. **Motiur Rahman Khan**, P. Anjaneyulu, K.S.R. Koteswara Rao and R. Menon, Investigation of disorder and its effect on electrical transport in electrochemically doped polymer devices by current-voltage and impedance spectroscopy, *J. Phys. D: Appl. Phys.* **50**, 095103 (2017).
  14. **Motiur Rahman Khan**, V. Varade, K.S.R. Koteswara Rao and R. Menon, Injection barrier induced deviations in space charge limited conduction in doped poly(3-methylthiophene) based devices, *J. App. Phys.* **108**, 164503 (2015).

## Conference Proceedings

1. S. Moghadamzadeh, S. Gharibzadeh, M. Jakoby, **Motiur Rahman Khan**, A.A. Haghighirad, I.A. Howard, B.S Richards, U. Lemmer, U.W. Paetzold, Spontaneous

Enhancement of the Power Output in Surface-Passivated Triple-Cation Perovskite Solar Cells, 2020 47<sup>th</sup> *IEEE Photovoltaic Specialists Conference (PVSC)* 15 June-21 Aug. 2020, Calgary, AB, Canada.

2. **Motiur Rahman Khan**, K.S.R. Koteswara Rao and R. Menon, Probing of barrier induced deviations in current-voltage characteristics of polymer devices by impedance spectroscopy, 61<sup>st</sup> DAE Solid State Physics Symposium, KIT University, Bhubaneswar, Odisha, India (Dec 26–30, 2016). Published in *AIP Conference Proceedings*, 1832, 120035 (2017).
3. **Motiur Rahman Khan**, K.S.R. Koteswara Rao and R. Menon, Doping Dependent Charge Transport in Poly(3-methylthiophene) Based Devices, 60<sup>th</sup> DAE Solid State Physics Symposium, Amity University, Noida, UP, India (Dec 21–25, 2015). Published in *AIP Conference Proceedings*, 1731, 120014 (2016).

