

BARRY P. RAND

Department of Electrical and Computer Engineering & Andlinger Center for Energy and the Environment
Princeton University, Princeton, NJ 08544
Office: +1 609-258-7692 email: brand@princeton.edu

EDUCATION AND TRAINING

2003-2006: **Ph.D.** in Electrical Engineering – Princeton University, Princeton, NJ
Thesis title: The physics and optimization of organic thin film photovoltaic cells
Thesis advisor: Prof. Stephen R. Forrest; Minor: Chemistry
2001-2003: **M.A.** in Electrical Engineering – Princeton University, Princeton, NJ
1997-2001: **B.E.** in Electrical Engineering – The Cooper Union for the Advancement of Science and Art, New York, NY

RESEARCH AND PROFESSIONAL EXPERIENCE

1/2023 – present: **Professor**, Princeton University, Department of Electrical and Computer Engineering & Andlinger Center for Energy and the Environment
2/2019 – 1/2023: **Associate Professor**, Princeton University, Department of Electrical Engineering & Andlinger Center for Energy and the Environment
7/2013-1/2019: **Assistant Professor**, Princeton University, Department of Electrical Engineering & Andlinger Center for Energy and the Environment
4/2012-6/2013: **Principal Scientist**, imec, Leuven, Belgium
2007-3/2012: **Senior Researcher**, imec, Leuven, Belgium
2001-2006: **Ph.D. Thesis**, Princeton University, Princeton, NJ
Summer 2000, 2001: **Summer Research Intern**, IBM T.J. Watson Research Center, Yorktown Heights, NY

SELECTED HIGHLIGHTS

- Co-editor of a comprehensive book entitled “Organic Solar Cells: Fundamentals, Devices, and Upscaling” (15 chapters)
- Editor, *Organic Electronics*, 2019-present
- Editorial Board, *Nano Research Energy* (2023-present); *Small Structures* (2023-present); *Journal of Optics* (2015-present); *SN Applied Sciences* (2018-present); *Organic Electronics* (2016-2018)
- Guest co-editor of a Special Issue on “Halide Perovskites for Photonics and Optoelectronics” for *Optical Materials Express*, 2022.
- Guest co-editor of a Special Issue on “Advanced Solar Cell Technology” for the *Journal of Optics*, 2017.
- Guest co-editor of a Special Issue on “Next-Generation Organic and Hybrid Solar Cells” for the *IEEE Journal of Selected Topics in Quantum Electronics*, 2010.
- Conference organizer for 16 separate symposia at various conferences (SPIE, IEEE PVSC, MRS, OSA, APS) spanning topics (organic photonics, plasmonics, thin film inorganic solar cells, etc.)
- 195 papers in refereed journals; 7 in refereed conference proceedings
- 101 invited talks (1 Plenary & 4 Keynote) at conferences, workshops, and summer schools
- 60 seminars and colloquia at universities, national labs, and companies
- 24 issued U.S. patents – 5 in application
- *h*-index – 74 with 23329 citations [Google Scholar, 4/1/2024]

HONORS AND AWARDS

Gordon and Betty Moore Foundation Experimental Physics Investigators Initiative award (2023)

innoLAE Speaker Prize (2022)
 ONR Young Investigator Program (2016)
 DARPA Young Faculty Award (2015)
 DuPont Young Professor Award (2015)
 3M Nontenured Faculty Award (2014)
 Princeton Engineering Commendation List for Outstanding Teaching (9 times)
 Total Young Investigator Award, E-MRS, Nice, France (2011)
 Cooper Union Abraham Pletman Prize (2001)
 First Place, IEEE Region 1 Student Paper Contest (2001)
 IBM Research Design Challenge Winner (2000)
 Eta Kappa Nu, Electrical Engineering Honor Society member
 Tau Beta Pi, Engineering Honor Society member
 IBM T.J. Watson Memorial Scholarship recipient, 1997-2001
 Cooper Union full-tuition scholarship recipient, 1997-2001

TEACHING EXPERIENCE*

F23:	ECE308 – “ <i>Electronic and Photonic Devices</i> ” – undergraduate level
F17/S19/F19/S23:	ENE/ECE431 – “ <i>Solar Energy Conversion</i> ” – undergraduate level – Feedback from students placed this course on the “ <u>Princeton Engineering List for Outstanding Teaching</u> ” in F17/S19
F15/F16/F18:	ELE341 – “ <i>Solid-State Devices</i> ” – undergraduate level – Feedback from students placed this course on the “ <u>Princeton Engineering List for Outstanding Teaching</u> ” in F16/F18
F22:	ECE445 – “ <i>Solid-State Electronic Devices</i> ” – undergraduate/graduate level
S20:	ELE203 – “ <i>Electronic Circuit Design, Analysis and Implementation</i> ” – undergraduate level
F14:	ELE540 – “ <i>Organic Materials for Photonics & Electronics</i> ” – graduate level – Feedback from students placed this course on the “ <u>Princeton Engineering List for Outstanding Teaching</u> ”
S14/S16/S18/S21:	ELE/ENE557 – “ <i>Solar Cells: Physics, Materials, and Technology</i> ” – graduate level – Feedback from students placed this course on the “ <u>Princeton Engineering List for Outstanding Teaching</u> ” in S14/S16/S18/S21

*See also Schools and Workshops under “Selected Presentations”

EDITORIAL ACTIVITIES

13. Member of the Editorial Board, *Nano Research Energy*, 2023-present
12. Member of the Editorial Board, *Small Structures*, 2023-present
11. Guest co-editor of a Special Issue on “Halide Perovskites for Photonics and Optoelectronics” for *Optical Materials Express*, 2022.
10. Editor, *Organic Electronics*, 2019-present
9. Member of the Editorial Board, *SN Applied Sciences*, 2018-present
8. Associate Editor, *Organic Electronics*, 2016-2018
7. Guest co-editor of a Special Issue on “Advanced Solar Cell Technology” for the *Journal of Optics*, 2017.
6. Member of the Editorial Board, *Journal of Optics*, 2015-present
5. “Organic Solar Cells: Fundamentals, Devices, and Upscaling,” edited by B.P. Rand and H. Richter, Pan Stanford Publishing, ISBN-13: 978-9814463652 (2014).
4. “Organic Photonics VI,” edited by B.P. Rand, C. Adachi, D. Cheyns, and V. Van Elsbergen (Proceedings of SPIE, Volume 9137, 2014).
3. “Organic Photonics V,” edited by B.P. Rand, C. Adachi, and V. Van Elsbergen (Proceedings of SPIE, Volume 8435, 2012).

2. Guest co-editor of a Special Issue on “Next-Generation Organic and Hybrid Solar Cells” for the *IEEE Journal of Selected Topics in Quantum Electronics*, 16 (6), Nov/Dec 2010.
1. "Organic Materials and Devices for Sustainable Energy Systems", edited by J. Xue, R.J. Holmes, B.P. Rand, and C. Adachi (Mater. Res. Soc. Symp. Proc. Volume 1212, Warrendale, PA, 2010).

SCIENTIFIC MEETING ORGANIZATION

Organizer

16. Conference co-chair for Organic Photovoltaics XXV, SPIE Optics + Photonics 2024, San Diego, CA, August 2024.
15. Conference co-chair for Organic Photovoltaics XXIV, SPIE Optics + Photonics 2023, San Diego, CA, August 2023.
14. Co-organizer of “Symposium EL17: Halide Perovskite and Other Low-Dimensional Light Emitters—Synthesis, Defect Passivation and Optoelectronic Applications,” 2023 MRS Spring Meeting, San Francisco, CA, April 2023.
13. Co-organizer of focus topic (FT) “Metal Halide Perovskites – from Fundamentals to Applications” at 2023 APS March Meeting, Las Vegas, NV, March 2023.
12. Co-organizer of “Symposium EQ05: Contacts and Interfaces in Optoelectronic Devices,” 2022 MRS Fall Meeting, Boston, MA, Nov/Dec 2022.
11. Conference co-chair for Organic Photovoltaics XXIII, SPIE Optics + Photonics 2022, San Diego, CA, August 2022.
10. Co-organizer of “Symposium FF04: Crystal Engineering of Functional Materials: Solution-Based Strategies,” 2019 MRS Fall Meeting, Boston, MA, Nov/Dec 2019.
9. Co-organizer of “Symposium EP2: Excitonic Materials—Physics, Characterization and Devices,” 2018 MRS Spring Meeting, Phoenix, AZ, April 2018.
8. Co-chair for Solid-State and Organic Lighting (SOLED), Light, Energy and the Environment Congress, a topical meeting of the OSA, Boulder, CO, November 2017.
7. Sub-area chair for Area 6.2: Organic Solar Cells, 44th IEEE Photovoltaic Specialist Conference, Washington, DC, June, 2017.
6. Co-chair for Solid-State and Organic Lighting (SOLED), Light, Energy and the Environment Congress, a topical meeting of the OSA, Leipzig, Germany, November 2016.
5. Co-chair of “Organic Photonics (EPE113),” SPIE Photonics Europe, Brussels, Belgium, April 2014.
4. Co-organizer of “Symposium W: Next-Generation Inorganic Thin Film Photovoltaics,” 2013 MRS Fall Meeting, Boston, MA, December 2013.
3. Co-organizer of “Symposium O: Applied Nanoplasmonics: Nanoplasmonic Functional Materials and Devices,” E-MRS 2012 Spring Meeting, Strasbourg, France, May 2012.
2. Co-chair of “Organic Photonics (EPE113),” SPIE Photonics Europe, Brussels, Belgium, April 2012.
1. Co-organizer of “Symposium S: Organic Materials and Devices for Sustainable Energy Systems,” 2009 MRS Fall Meeting, Boston, MA, December 2009.

Program Committee Member

26. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXVIII, SPIE Optics + Photonics 2024, San Diego, CA, August 2024.
25. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXVII, SPIE Optics + Photonics 2023, San Diego, CA, August 2023.
24. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXVI, SPIE Optics + Photonics 2022, San Diego, CA, August 2022.
23. Member of the program committee for the 2022 Novel Optical Materials and Applications Conference, OSA Advanced Photonics Congress, Maastricht, Netherlands, July 2022.
22. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXV, SPIE Optics + Photonics 2021, online, August 2021.

21. Member of the organizing committee for Organic Photovoltaics XXII, SPIE Optics + Photonics 2021, online, August 2021.
20. Member of the program committee for the 2021 Novel Optical Materials and Applications Conference, OSA Advanced Photonics Congress, Montreal, Canada, July 2021.
19. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXIV, SPIE Optics + Photonics 2020, online, August 2020.
18. Member of the organizing committee for Organic Photovoltaics XXI, SPIE Optics + Photonics 2020, online, August 2020.
17. Member of the program committee for the 2020 Novel Optical Materials and Applications Conference, OSA Advanced Photonics Congress, online, July 2020.
16. Member of the organizing committee for Organic Photovoltaics XX, SPIE Optics + Photonics 2019, San Diego, CA, August 2019.
15. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices XXIII, SPIE Optics + Photonics 2019, San Diego, CA, August 2019.
14. Member of the program committee for the 2019 Novel Optical Materials and Applications Conference, OSA Advanced Photonics Congress, San Francisco, CA, July/August 2019.
13. Member of the scientific committee for "Symposium C: Perovskite solar cells: Surface, interface and materials aspects" at the EMRS Fall Meeting 2018, Warsaw, Poland, September 2018.
12. Member of the program committee for the 2018 Novel Optical Materials and Applications Conference, OSA Advanced Photonics Congress, Zurich, Switzerland, July 2018.
11. Member of the organizing committee for Organic and Hybrid Light Emitting Materials and Devices, SPIE Optics + Photonics 2018, San Diego, CA, August 2018.
10. Member of the organizing committee for Organic Photovoltaics XIX, SPIE Optics + Photonics 2018, San Diego, CA, August 2018.
9. Member of the organizing committee for Organic Photovoltaics XVIII, SPIE Optics + Photonics 2017, San Diego, CA, August 2017.
8. Member of the organizing committee for Organic Photovoltaics XVII, SPIE Optics + Photonics 2016, San Diego, CA, August 2016.
7. Member of the program committee for Solid-State and Organic Lighting (SOLED), Light, Energy and the Environment Congress, a topical meeting of the OSA, Suzhou, China, November 2015.
6. Member of the organizing committee for Organic Photovoltaics XVI, SPIE Optics + Photonics 2015, San Diego, CA, August 2015.
5. Member of the organizing committee for Organic Photovoltaics XV, SPIE Optics + Photonics 2014, San Diego, CA, August 2014.
4. Member of the organizing committee for Organic Photovoltaics XIV, SPIE Optics + Photonics 2013, San Diego, CA, August 2013.
3. Member of the organizing committee for Organic Photovoltaics XIII, SPIE Optics + Photonics 2012, San Diego, CA, August 2012.
2. Member of the organizing committee for Area 6: Organic Photovoltaics, 38th IEEE Photovoltaic Specialist Conference, Austin, TX, June, 2012.
1. Member of the organizing committee for Organic Photovoltaics XII, SPIE Optics + Photonics 2011, San Diego, CA, August 2011.

REFEREED JOURNAL PUBLICATIONS

195. "Sublimed C₆₀ for efficient and repeatable perovskite-based solar cells," A.A. Said, E. Aydin, E. Ugur, Z. Xu, C. Deger, B. Vishal, A. Vlk, P. Dally, B.K. Yildirim, R. Azmi, J. Liu, E.A. Jackson, H.M. Johnson, M. Gui, H. Richter, A.R. Pininti, H. Bristow, M. Babics, A. Razzaq, T.G. Allen, M. Ledinský, I. Yavuz, **B.P. Rand**, S. De Wolf, *Nat. Commun.*, **15**, 708 (2024).

194. "Evolution of the electronic and excitonic properties in 2D Ruddlesden-Popper perovskites induced by bifunctional ligands," X. Zhong, X. Ni, A. Kaplan, X. Zhao, M. Ivancevic, M.L. Ball, Z. Xu, H. Li, **B.P. Rand**, Y.-L. Loo, J.-L. Brédas, A. Kahn, *Adv. Energy Mater.*, doi: 10/1002/aenm.202304345.
193. "Device performance of emerging photovoltaic materials (Version 4)," O. Almora, C.I. Cabrera, S. Erten-Ela, K. Forberich, K. Fukuda, F. Guo, J. Hauch, A.W.Y. Ho-Baillie, T.J. Jacobsson, R.A.J. Janssen, T. Kirchartz, N. Kopidakis, M.A. Loi, X. Mathew, D.B. Mitzi, M.K. Nazeeruddin, U.W. Paetzold, **B.P. Rand**, U. Rau, T. Someya, E. Unger, L. Vaillant-Roca, C.J. Brabec, *Adv. Energy Mater.*, **14**, 2303173 (2024).
192. "Mitigating iodine diffusion by a MoO₃-organic composite hole transport layer for stable perovskite solar cells," J. Hong, Z. Xu, D. Lungwitz, J. Scott, H.M. Johnson, Y.-H. Kim, A. Kahn, **B.P. Rand**, *ACS Energy Lett.*, **8**, 4984 (2023).
191. "Substrate-embedded metal meshes for ITO-free organic light emitting diodes," M. Zarei, J.C. Loy, M. Li, Z. Zhou, S. Sinha, M. LeMieux, S.B. Walker, **B.P. Rand**, P.W. Leu, *Opt. Express*, **31**, 34697 (2023).
190. "Reverse-bias resilience of monolithic perovskite/silicon tandem solar cells," Z. Xu, H. Bristow, M. Babics, B. Vishal, E. Aydin, R. Azmi, E. Ugur, B.K. Yildirim, J. Liu, R.A. Kerner, S. De Wolf, **B.P. Rand**, *Joule*, **7**, 1992 (2023).
189. "Facile direct printing of DPP-based polymers for organic field-effect transistors and logic gates," J. Hong, J. Kim, Z. Li, C. Cong, **B.P. Rand**, S.Y. Nam, S.H. Kim, Y.-H. Kim, *ACS Appl. Electron. Mater.*, **5**, 4114 (2023).
188. "Impact of molecular geometry and functionalization on solution complexation of coronene-based buckybowl and fullerenes," M.R. Ivancevic, M.L. Ball, V. Bhat, J.A. Wisch, S.R. Parkin, C. Risko, **B.P. Rand**, Y.-L. Loo, *Chem. Mater.*, **35**, 5524 (2023).
187. "Thin film organic heteroepitaxy," J.T. Dull, X. He, J. Viereck, Q. Ai, R. Ramprasad, M.C. Otani, J. Sorli, J.W. Brandt, B.P. Carrow, A.D. Tinoco, Y.-L. Loo, C. Risko, S. Rangan, A. Kahn, **B.P. Rand**, *Adv. Mater.*, **35**, 2302871 (2023).
186. "Triiodide attacks the organic cation in hybrid lead halide perovskites: Mechanism, and suppression," J. Hu, Z. Xu, T.L. Murrey, I. Pelczar, A. Kahn, J. Schwartz, **B.P. Rand**, *Adv. Mater.*, **35**, 2303373 (2023).
185. "Thermal properties of polymer hole-transport layers influence the efficiency roll-off and stability of perovskite light-emitting diodes," L. Zhao, D.D. Astridge, W.B. Gunnarsson, Z. Xu, J. Hong, J. Scott, S. Kacmoli, K. Al Kurdi, S. Barlow, S.R. Marder, C.F. Gmachl, A. Sellinger, **B.P. Rand**, *Nano Lett.*, **23**, 4785 (2023).
184. "Origins of photoluminescence instabilities at halide perovskite/organic hole transport layer interfaces," Z. Xu, D.D. Astridge, R.A. Kerner, X. Zhong, J. Hu, J. Hong, J.A. Wisch, K. Zhu, J.J. Berry, A. Kahn, A. Sellinger, **B.P. Rand**, *J. Am. Chem. Soc.*, **145**, 11846 (2023).
183. "Toward nonepitaxial laser diodes," W.B. Gunnarsson, K. Roh, L. Zhao, J.P. Murphy, A.J. Grede, N.C. Giebink, **B.P. Rand**, *Chem. Rev.*, **123**, 7548 (2023).
182. "Radiative pumping of exciton-polaritons in 2D hybrid perovskites," P. Deshmukh, L. Zhao, S. Satapathy, M. Khatoniar, B. Datta, **B.P. Rand**, V. Menon, *Opt. Mater. Express*, **13**, 1655 (2023).
181. "Dispersive charge transfer state electroluminescence in organic solar cells," R. Lampande, A. Pizano, M. Gui, R. Cawthorn, **B.P. Rand**, N.C. Giebink, *Adv. Energy Mater.*, **13**, 2300394 (2023).
180. "Current status and future potential of rooftop solar adoption in the United States," A.C. Lemay, S. Wagner, **B.P. Rand**, *Energy Policy*, **177**, 113571 (2023).
179. "Electrochemical doping of halide perovskites by noble metal interstitial cations," R.A. Kerner, A.V. Cohen, Z. Xu, A.R. Kirmani, S.Y. Park, S.P. Harvey, J.P. Murphy, R.C. Cawthorn, N.C. Giebink, J.M. Luther, K. Zhu, J.J. Berry, L. Kronik, **B.P. Rand**, *Adv. Mater.*, **35**, 2302206 (2023).
178. "Plasmon mediated near-field energy transfer from solid-state, electrically injected excitons to solution phase chromophores," J.A. Wisch, X. Liu, P.J. Sarver, C.N. Prieto Kullmer, A. Millet, D.W.C. MacMillan, **B.P. Rand**, *Adv. Funct. Mater.*, **33**, 2214367 (2023).
177. "Voltage-dependent excitation dynamics in UV-absorbing organic photovoltaics with efficient charge transfer exciton emission," Q.C. Burlingame, X. Liu, M.L. Ball, **B.P. Rand**, Y.-L. Loo, *Energy Environ. Sci.*, **16**, 1742 (2023).

176. "Photochemical decomposition of Y-series non-fullerene acceptors is responsible for degradation of high-efficiency organic solar cells," T. Liu, Q.C. Burlingame, M.R. Ivancevic, X. Liu, J. Hu, **B.P. Rand**, Y.-L. Loo, *Adv. Energy Mater.*, **13**, 2300046 (2023).
175. "Multimodal characterization of crystal structure and formation in rubrene thin films reveals erasure of orientational discontinuities," J.A. Tan, J.T. Dull, S.E. Zeltmann, J.A. Tulyagankhodjaev, H.M. Johnson, A. Liebman-Pelaez, B.D. Folie, S.A. Donges, O. Khatib, J.G. Raybin, T.D. Roberts, L.M. Hamerlynck, C.P.N. Tanner, J. Lee, C. Ophus, K.C. Bustillo, M.B. Raschke, H. Ohldag, A.M. Minor, **B.P. Rand**, N.S. Ginsberg, *Adv. Funct. Mater.*, **33**, 2207867 (2023).
174. "Halogen redox shuttle explains voltage-induced halide redistribution in mixed-halide perovskite devices," Z. Xu, R.A. Kerner, S.P. Harvey, K. Zhu, J.J. Berry, **B.P. Rand**, *ACS Energy Lett.*, **8**, 513 (2023).
173. "Device performance of emerging photovoltaic materials (Version 3)," O. Almora, D. Baran, G.C. Bazan, C.I. Cabrera, S. Erten-Ela, K. Forberich, F. Guo, J. Hauch, A.W.Y. Ho-Baillie, T.J. Jacobsson, R.A.J. Janssen, T. Kirchartz, N. Kopidakis, M.A. Loi, R.R. Lunt, X. Mathew, M.D. McGehee, J. Min, D.B. Mitzi, M.K. Nazeeruddin, J. Nelson, A.F. Nogueira, U.W. Paetzold, **B.P. Rand**, U. Rau, H.J. Snaith, E. Unger, L. Vaillant-Roca, C. Yang, H.-L. Yip, C.J. Brabec, *Adv. Energy Mater.*, **13**, 2203313 (2023).
172. "Highly transparent, scalable, and stable perovskite solar cells with minimal aesthetic compromise," T. Liu, X. Zhao, P. Wang, Q.C. Burlingame, J. Hu, K. Roh, Z. Xu, **B.P. Rand**, M. Chen, Y.-L. Loo, *Adv. Energy Mater.*, **13**, 2200402 (2023).
171. "Quantifying the effect of energetic disorder on organic solar cell energy loss," S.-U.-Z. Khan, J. Bertrandie, M. Gui, A. Sharma, W. Alsufyan, J.F. Gorenflot, F. Laquai, D. Baran, **B.P. Rand**, *Joule*, **6**, 2821 (2022).
170. "From amorphous to polycrystalline rubrene: Charge transport in organic semiconductors paralleled with silicon," J. Euvrard, O. Gunawan, A. Kahn, **B.P. Rand**, *Adv. Funct. Mater.*, **32**, 2206438 (2022).
169. "A comprehensive picture of roughness evolution in organic crystalline growth: The role of molecular aspect ratio," J.T. Dull, X. Chen, H.M. Johnson, M.C. Otani, F. Schreiber, P. Clancy, **B.P. Rand**, *Mater. Horiz.*, **9**, 2752 (2022).
168. "Hot-casting assisted liquid additive engineering for efficient and stable perovskite solar cells," H. Min, J. Hu, Z. Xu, T. Liu, S.-U.-Z. Khan, K. Roh, Y.-L. Loo, **B.P. Rand**, *Adv. Mater.*, **34**, 2205309 (2022).
167. "Untying the cesium "not": Cesium-iodoplumbate complexation in perovskite solution-processing inks has implications for crystallization," Y. Eatmon, O. Romiluyi, C. Ganley, R. Ni, I. Pelczar, P. Clancy, **B.P. Rand**, J. Schwartz, *J. Phys. Chem. Lett.*, **13**, 6130 (2022).
166. "Iodine electrochemistry dictates voltage-induced halide segregation thresholds in mixed-halide perovskite devices," Z. Xu, R.A. Kerner, J.J. Berry, **B.P. Rand**, *Adv. Funct. Mater.*, **32**, 2203432 (2022).
165. "Nonradiative recombination via charge-transfer-exciton to polaron energy transfer limits photocurrent in organic solar cells," S.-U.-Z. Khan, M. Gui, X. Liu, N.C. Giebink, A. Kahn, **B.P. Rand**, *Adv. Energy Mater.*, **12**, 2200551 (2022).
164. "Halide perovskites for photonics and optoelectronics: Introduction to special issue," K. Wang, X. Gong, Y.S. Zhao, S. Makarov, **B.P. Rand**, L. Dou, *Opt. Mater. Express*, **12**, 1764 (2022).
163. "Improved charge balance in green perovskite light-emitting diodes with atomic-layer-deposited Al₂O₃," W.B. Gunnarsson, Z. Xu, N.K. Noel, **B.P. Rand**, *ACS Appl. Mater. Interfaces*, **14**, 34247 (2022).
162. "Consensus statement: Standardized reporting of power-producing luminescent solar concentrator performance," C. Yang, H.A. Atwater, M.A. Baldo, D. Baran, C.J. Barile, M.C. Barr, M. Bates, M.G. Bawendi, M.R. Bergren, B. Borhan, C.J. Brabec, S. Brovelli, V. Bulovic, P. Ceroni, M.G. Debije, J.-M. Delgado-Sanchez, W.-J. Dong, P.M. Duxbury, R.C. Evans, S.R. Forrest, D.R. Gamelin, N.C. Giebink, X. Gong, G. Griffini, F. Guo, C.K. Herrera, A.W.Y. Ho-Baillie, R.J. Holmes, S.-K. Hong, T. Kirchartz, B.G. Levine, H. Li, Y. Li, D. Liu, M.A. Loi, C.K. Luscombe, N.S. Makarov, F. Mateen, R. Mazzaro, H. McDaniel, M.D. McGehee, F. Meinardi, A. Menendez-Velazquez, J. Min, D.B. Mitzi, M. Moemeni, J.H. Moon, A. Nattestad, M.K. Nazeeruddin, A.F. Nogueira, U.W. Paetzold, D.L. Patrick, A. Pucci, **B.P. Rand**, E. Reichmanis, B.S. Richards, J. Roncali, F. Rosei, T.W. Schmidt, F. So, C.-C. Tu, A. Vahdani,

- W.G.J.H.M. van Sark, R. Verduzco, A. Vomiero, W.W.H. Wong, K. Wu, H.-L. Yip, X. Zhang, H. Zhao, R.R. Lunt, *Joule*, **6**, 8 (2022).
161. "Powerful organic molecular oxidants and reductants enable ambipolar injection in a large-gap organic homojunction diode," H.L. Smith, J.T. Dull, S.K. Mohapatra, K. Al Kurdi, S. Barlow, S.R. Marder, **B.P. Rand**, A. Kahn, *ACS Appl. Mater. Interfaces*, **14**, 2381 (2022).
 160. "Electrochemically n-doped CsPbBr₃ nanocrystal thin films," S. Heo, K. Roh, F. Zhang, S.E. Tignor, A.B. Bocarsly, A. Kahn, **B.P. Rand**, *ACS Energy Lett.*, **7**, 211 (2022).
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REFEREED CONFERENCE PROCEEDINGS

7. "Diffusion and photon recycling in halide perovskite thin films: Insights from experiment and theory," A. Sridharan, N.K. Noel, **B.P. Rand**, S. Kéna-Cohen, *Proc. SPIE 11464, Physical Chemistry of Semiconductor Materials and Interfaces IX*, 114640J (2020).
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5. "Architectural tradeoffs for biodegradable computing," T.-J. Chang, Z. Yao, P.J. Jackson, **B.P. Rand**, D. Wentzlaff, *Proceedings of the 50th Annual IEEE/ACM International Symposium on Microarchitecture*, 706-717 (2017).
4. "Exploring the exciton dissociation process at a donor-acceptor heterojunction in both time and space via an induced Stark shift," N.C. Giebink, **B.P. Rand**, D. Cheyns, J. Genoe, *Proc. SPIE 8435, Organic Photonics V*, 84350L (2012).
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1. “Origin of the open-circuit voltage in organic solar cells,” J. Xue, **B.P. Rand**, S.R. Forrest, *Proc. SPIE* 6334, *Organic Photovoltaics VII*, 63340K (2006).

BOOKS AND BOOK CHAPTERS

2. [CHAPTER] “Organic photovoltaics (OPVs): Device physics” by M.A. Fusella, Y.L. Lin, **B.P. Rand**, in “Handbook of Organic Materials for Electronic and Photonic Devices, Second Edition,” edited by O. Ostroverkhova, Woodhead Publishing, ISBN-13: 978-0081022849 (2019).
1. [BOOK] “Organic Solar Cells: Fundamentals, Devices, and Upscaling,” edited by **B.P. Rand** and H. Richter, Pan Stanford Publishing, ISBN-13: 978-9814463652 (2014).

NEWS ARTICLES

3. “A bit of gain, electrically injected,” **B.P. Rand**, N.C. Giebink, *Nat. Photon.*, **18**, 107 (2024).
2. “Crystalline order offers access to high speeds for organic transistors,” J. Euvrard, **B.P. Rand**, *Nature*, **606**, 661 (2022).
1. “Alleviating halide perovskite surface defects,” L. Zhao, **B.P. Rand**, *Matter*, **4**, 2104 (2021).

SELECTED PRESENTATIONS

Conferences (80 invited, 1 plenary, 4 keynote, 6 contributed)

- I80. (INVITED) “Organic thin film crystal growth: formation and propagation,” **B.P. Rand**, 26th International Conference on Science and Technology of Synthetic Electronic Materials (ICSM 2024), Dresden, Germany, June 2024.
- I79. (INVITED) “Halide phase separation in halide perovskites: origins and solutions,” **B.P. Rand**, 2024 Gordon Research Conference on Unconventional Semiconductors and Their Applications, Easton, MA, June 2024.
- I78. (INVITED) “Order, disorder, and energy loss in organic photovoltaics,” **B.P. Rand**, 245th Meeting of The Electrochemical Society, San Francisco, CA, May 2024.
- I77. (INVITED) “Progress toward halide perovskite laser diodes,” **B.P. Rand**, CLEO 2024, Charlotte, NC, May 2024.
- I76. (INVITED) “Organic semiconductor thin film crystal growth: formation and propagation,” **B.P. Rand**, 2024 MRS Spring Meeting, Seattle, WA, April 2024.
- I75. (INVITED) “Unforeseen ink chemistry: Solutions for perovskite solar cells,” **B.P. Rand**, 8th International Conference on Next Generation Solar Energy (NGSE8), Erlangen, Germany, December 2023.
- I74. (INVITED) “Unforeseen ink chemistry: Solutions for perovskite solar cells,” **B.P. Rand**, 2023 ACS Fall Meeting, San Francisco, CA, August 2023.
- I73. (INVITED) “Organic semiconductor thin film crystal growth, homoepitaxy and heteroepitaxy,” **B.P. Rand**, Telluride Science and Innovation Center (TSIC), Workshop on Hierarchical Assembly and Function of Organic and Hybrid Materials, Telluride, CO, July 2023.
- I72. (KEYNOTE) “Unforeseen ink chemistry: Solutions for perovskite solar cells,” **B.P. Rand**, 2023 *EcoMat* Conference 2023, Hong Kong, June 2023.
- I71. (INVITED) “Metal halide perovskite LEDs as bright thin film emitters,” **B.P. Rand**, 2023 MRS Spring Meeting, San Francisco, CA, April 2023.
- I70. (INVITED) “Toward bright metal halide perovskite LEDs,” **B.P. Rand**, International Conference of Electroluminescence and Optoelectronic Devices (ICEL), London, UK, December 2022.
- I69. (INVITED) “Flexible and color tunable metal halide perovskite light emitting diodes using bulky organoammonium additives,” **B.P. Rand**, Virtual Strain and 2D Perovskites nanoGE meeting, July 2022.

- I68. (INVITED) "Toward electrically-pumped metal halide perovskite lasers," **B.P. Rand**, Compound Semiconductor Week (CSW) 2022, Ann Arbor, MI, June 2022.
- I67. (INVITED) "Toward metal halide perovskite laser diodes," **B.P. Rand**, 2022 MRS Spring Meeting, Honolulu, HI, May 2022.
- I66. (INVITED) "Metal halide perovskite interfaces: Role in doping and degradation," **B.P. Rand**, 2022 MRS Spring Meeting, Honolulu, HI, May 2022.
- I65. (INVITED) "Can metal halide perovskite light emitting diodes be very bright?," **B.P. Rand**, 2022 Innovations in Large-Area Electronics Conference (innoLAE), February 2022. [Recipient of innoLAE speaker prize for this presentation]
- I64. (INVITED) "Towards bright halide perovskite light emitting diodes," **B.P. Rand**, 12th International Conference on Advanced Materials and Devices (ICAMD) 2021, December 2021.
- I63. (INVITED) "Formation, growth, and applications of microcrystalline organic semiconductors," **B.P. Rand**, 2021 MRS Fall Meeting, Boston, MA, December 2021.
- I62. (INVITED) "Metal halide perovskite interface reactivity: Towards understanding doping and degradation," **B.P. Rand**, 2021 MRS Fall Meeting, Boston, MA, December 2021.
- I61. (KEYNOTE) "Brighter metal halide perovskite light emitting diodes via heat management," **B.P. Rand**, Halide Perovskites International Conference (2D-HAPES2021), November 2021.
- I60. (INVITED) "High current operation of halide perovskite light emitting diodes," **B.P. Rand**, Korean Society of Industrial and Engineering Chemistry (KSIEC) 2021 Fall Meeting, November 2021.
- I59. (INVITED) "Thermal management as an enabler of bright and stable metal halide perovskite light emitting diodes," **B.P. Rand**, 2021 Virtual NanoGe Fall Meeting, October 2021.
- I58. (INVITED) "Formation, growth, and electronic properties of microcrystalline organic semiconductors," **B.P. Rand**, SPIE Optics + Photonics 2021, San Diego, CA, August 2021.
- I57. (INVITED) "Thermal management allows for brighter and more stable metal halide perovskite light emitting diodes," **B.P. Rand**, SPIE Optics + Photonics 2021, San Diego, CA, August 2021.
- I56. (INVITED) "Proper thermal management allows for brighter metal halide perovskite light emitting diodes," **B.P. Rand**, 2021 Virtual NanoGe Spring Meeting, March 2021.
- I55. (KEYNOTE) "Mitigating roll off to make brighter metal halide perovskite light emitting diodes," **B.P. Rand**, EcoMat Webinar, Nov 2020.
- I54. (INVITED) "Charge transfer states at the limits of structural order and offset energy," **B.P. Rand**, KAUST Research Conference: Emerging concepts in solar energy conversion – from computation to implementation, King Abdullah University of Science and Technology, Saudi Arabia, February 2020.
- I53. (INVITED) "Surface passivation and stability of metal halide perovskite LEDs," **B.P. Rand**, 2019 MRS Fall Meeting, Boston, MA, December 2019.
- I52. (PLENARY) "Toward efficient, flexible, color tunable, and stable metal halide perovskite light emitting diodes," **B.P. Rand**, International Conference on Electronic Materials Leading the Future (ICE-MLF 2019), Seoul, South Korea, November 2019.
- I51. (INVITED) "Surface passivation and stability of metal halide perovskite LEDs," **B.P. Rand**, 5th International Conference on Perovskite Solar Cells and Optoelectronics (PSCO-19), Lausanne, Switzerland, Sept/Oct 2019.
- I50. (INVITED) "Light emitting devices and lasers from metal halide perovskites," **B.P. Rand**, IEEE RAPID 2019, Miramar Beach, FL, August 2019.
- I49. (INVITED) "Flexible and color tunable metal halide perovskite light emitting diodes," **B.P. Rand**, SPIE Optics + Photonics 2019, San Diego, CA, August 2019.
- I48. (INVITED) "Metal halide perovskites: Surface passivation, stability and light emitting applications," **B.P. Rand**, SPIE Optics + Photonics 2019, San Diego, CA, August 2019.
- I47. (INVITED) "Efficient, color tunable, and flexible thin film perovskite light emitting devices," L. Zhao, **B.P. Rand**, OSA Advanced Photonics Congress, Burlingame, CA, July 2019.
- I46. (INVITED) "Efficient, color tunable, and flexible thin film perovskite light emitting devices," **B.P. Rand**, CLEO 2019, San Jose, CA, May 2019.

145. (INVITED) "Formation and device implications of microcrystalline organic semiconductor films and heterojunctions," **B.P. Rand**, 2019 MRS Spring Meeting, Phoenix, AZ, April 2019.
144. (INVITED) "Toward efficient, color tunable, flexible, and stable metal halide perovskite light emitting diodes," **B.P. Rand**, 2019 MRS Spring Meeting, Phoenix, AZ, April 2019.
143. (INVITED) "Solid state charge transfer at its limits," **B.P. Rand**, CIFAR Bio-inspired Solar Energy, Princeton, NJ, March 2019.
142. (INVITED) "Metal halide perovskite LEDs that are color tunable, flexible, and efficient," **B.P. Rand**, Z. Xiao, L. Zhao, R.A. Kerner, SPIE Optics + Photonics 2018, San Diego, CA, August 2018.
141. (INVITED) "Consequences of extreme levels of order and delocalized charge transfer states on organic solar cell function," **B.P. Rand**, 2018 Gordon Research Conference on Electronic Processes in Organic Materials, Barga, Italy, July 2018.
140. (INVITED) "Metal halide perovskites: light emitting devices and interface stability," **B.P. Rand**, CIMTEC 2018, 8th Forum on New Materials, Perugia, Italy, June 2018.
139. (INVITED) "Exploring the formation and growth of organic semiconductors with mm-scale grains," **B.P. Rand**, M.A. Fusella, K. Shayegan, J.T. Dull, Society for Information Display (SID) Display Week 2018, Los Angeles, CA, May 2018.
138. (INVITED) "Color tunable, flexible, and efficient light emitting diodes composed of metal halide perovskites," **B.P. Rand**, Z. Xiao, L. Zhao, R.A. Kerner, Society for Information Display (SID) Display Week 2018, Los Angeles, CA, May 2018.
137. (INVITED) "Efficient and color tunable light emitting devices from metal halide perovskites," **B.P. Rand**, 2018 MRS Spring Meeting, Phoenix, AZ, April 2018.
136. (INVITED) "Reduced energy loss and triplet-triplet annihilation to improve organic donor/acceptor solar cells," **B.P. Rand**, CIFAR Bio-inspired Solar Energy, Toronto, Canada, March 2018.
135. (INVITED) "Reducing energy losses and capitalizing on triplet-triplet annihilation at organic donor/acceptor interfaces," **B.P. Rand**, 2018 ACS Spring Meeting, New Orleans, LA, March 2018.
134. (INVITED) "Light emitting devices and lasers from metal halide perovskites," **B.P. Rand**, International Conference on Perovskite Photonics and Optoelectronics (PEROPTO18), Rennes, France, March 2018.
133. (INVITED) "Formation and growth of organic semiconductors with mm-scale grains," **B.P. Rand**, SPIE Optics + Photonics 2017, San Diego, CA, August 2017.
132. (INVITED) "Highly efficient perovskite LEDs from nanoscale perovskite crystallites," **B.P. Rand**, SPIE Optics + Photonics 2017, San Diego, CA, August 2017.
131. (INVITED) "Strategies for reducing energy loss and increasing efficiency of organic solar cells," M.A. Fusella, Y.L. Lin, **B.P. Rand**, SPIE Optics + Photonics 2017, San Diego, CA, August 2017.
130. (INVITED) "Metal halide perovskites: Processing, interfaces, and light emitting devices," **B.P. Rand**, OSA Advanced Photonics Congress, New Orleans, LA, July 2017.
129. (INVITED) "Very delocalized charge transfer states and exciton engineered organic solar cells," M.A. Fusella, Y.L. Lin, **B.P. Rand**, 2017 E-MRS Spring Meeting, Strasbourg, France, May 2017.
128. (INVITED) "Unlocking the efficiency potential of metal halide perovskite light emitting devices," **B.P. Rand**, Solid-State and Organic Lighting (SOLEL), Light, Energy and the Environment Congress, a topical meeting of the OSA, Leipzig, Germany, November 2016.
127. (INVITED) "Thin film electroluminescent devices: Improving outcoupling and employing new emitters," **B.P. Rand**, International Conference of Electroluminescence and Optoelectronic Devices (ICEL), Raleigh, NC, October 2016.
126. (INVITED) "Unlocking efficient perovskite-based light emitting devices," **B.P. Rand**, OSA Advanced Photonics Congress, Vancouver, Canada, July 2016.
125. (INVITED) "Consequences of extreme levels of order on organic solar cell function," **B.P. Rand**, 2016 MRS Spring Meeting, Phoenix, AZ, Mar/Apr 2016.
124. (INVITED) "Photovoltaic cells composed of microcrystalline organic semiconductor thin films," **B.P. Rand**, 2015 MRS Fall Meeting, Boston, MA, Nov/Dec 2015.

- I23. (INVITED) "Controlling excitons and structure within organic photovoltaic cells," **B.P. Rand**, IX International Congress on Chemical Sciences, Technology, and Innovation (Quimicuba 2015), Havana, Cuba, October 2015.
- I22. (INVITED) "Outcoupling enhancement of ITO-free white organic light-emitting diodes with air void-mediated scattering layer," T.-W. Koh, J. Spechler, C.B. Arnold, **B.P. Rand**, SPIE Optics + Photonics 2015, San Diego, CA, August 2015.
- I21. (INVITED) "Spray coating of organic semiconductors and carbon nanotube electrodes for solar cells," **B.P. Rand**, J.G. Tait, 227th Meeting of The Electrochemical Society, Chicago, IL, May 2015.
- I20. (INVITED) "Pushing structural limits to reveal fundamental mechanisms of organic solar cell operation," **B.P. Rand**, APS March Meeting, San Antonio, TX, March 2015.
- I19. (INVITED) "Leveraging structural control and cascade architectures as new paradigms for high efficiency thin film solar cells," **B.P. Rand**, KAUST Solar Future 2014, King Abdullah University of Science and Technology, Saudi Arabia, November 2014.
- I18. (INVITED) "Incorporating multiple absorbers to improve spectral absorption in high efficiency organic solar cells," **B.P. Rand**, D. Cheyns, K. Cnops, B. Verreert, SPIE Optics + Photonics 2014, San Diego, CA, August 2014.
- I17. (INVITED) "Structural control and fullerene-free cascade architectures for high efficiency organic solar cells," **B.P. Rand**, International Conference on the Science and Technology of Synthetic Metals (ICSM2014), Turku, Finland, June 2014.
- I16. (INVITED) "Using multiple absorbers for improved spectral absorption in high efficiency organic solar cells," **B.P. Rand**, D. Cheyns, K. Cnops, B. Verreert, 2014 E-MRS Spring Meeting, Lille, France, May 2014.
- I15. (INVITED) "Structural control and fullerene-free cascade architectures for high efficiency organic solar cells," **B.P. Rand**, 2014 MRS Spring Meeting, San Francisco, CA, April 2014.
- I14. (INVITED) "Spray coating of organic semiconductors and electrodes for solar cells and modules," **B.P. Rand**, J.G. Tait, 2013 MRS Fall Meeting, Boston, MA, December 2013.
- I13. (KEYNOTE) "Utilizing transition metal oxides in organic solar cells for enhanced functionality," **B.P. Rand**, International Conference of Young Researchers on Advanced Materials (ICYRAM), Singapore, July 2012.
- I12. (INVITED) "Degradation mechanisms of polymer:fullerene solar cells under systematically varied ageing conditions," **B.P. Rand**, E. Voroshazi, B. Verreert, C. Girotto, K. Vasseur, T. Aernouts, P. Heremans, International Summit on OPV Stability (ISOS-4) 2011, Denver, CO, December 2011.
- I11. (INVITED) "Ultrasonic spray coating of smooth films for large area polymer solar cells and modules," **B.P. Rand**, C. Girotto, D. Cheyns, L. van Willigenburg, R. Gehlhaar, 2011 MRS Fall Meeting, Boston, MA, November-December 2011.
- I10. (INVITED) "Ultrasonic spray coating for large area polymer solar cells and modules," **B.P. Rand**, International Workshop on Flexible and Plastic Electronics 2011 (IWFPE 2011), Muju, Korea, November 2011.
- I9. (INVITED) "The use of transition metal oxides for organic photovoltaic cells," **B.P. Rand**, Plastic Electronics 2011, Dresden, Germany, October 2011.
- C6. "Probing the influence of molecular orientation on planar heterojunction solar cell performance," **B.P. Rand**, D. Cheyns, B. Niesen, K. Vasseur, B. Verreert, J. Genoe, P. Heremans, 2011 E-MRS Spring Meeting, Nice, France, May 2011.
- I8. (INVITED) "The interaction of surface plasmons with organic semiconductors," **B.P. Rand**, B. Niesen, P. Van Dorpe, D. Cheyns, P. Heremans, SPIE Optics + Photonics 2010, San Diego, CA, August 2010.
- I7. (INVITED) "Increased exciton harvesting in organic thin film solar cells," **B.P. Rand**, APS March Meeting 2010, Portland, OR, March 2010.
- I6. (INVITED) "Sensitized phosphorescence and its application to bulk heterojunction solar cells," **B.P. Rand**, C. Girotto, A. Mityashin, A. Hadipour, P. Heremans, J. Genoe, SPIE Optics + Photonics 2009, San Diego, CA, August 2009.

- I5. (INVITED) "Increased exciton diffusion length in organic solar cells via sensitized phosphorescence," **B.P. Rand**, 2008 MRS Fall Meeting, Boston, MA, December 2008.
- I4. (INVITED) "New processing techniques and device architectures for high efficiency organic solar cells," **B.P. Rand**, 2nd EuCheMS Chemistry Congress, Turin, Italy, September 2008.
- I3. (INVITED) "Exciton management in organic photovoltaic cells," **B.P. Rand**, 11th International Conference on the Electrical and Related Properties of Organic Solids (ERPOS-11), Piechowice, Poland, July 2008.
- I2. (INVITED) "Improvements to make organic-based solar cells viable," **B.P. Rand**, Plastic & Thin Films Photovoltaics, Prague, Czech Republic, December 2007.
- C5. "The source of the maximum open circuit voltage in molecular photovoltaic devices and implications for efficiency improvements," **B.P. Rand**, D.P. Burk, S.R. Forrest, 2006 MRS Fall Meeting, Boston, MA, December 2006.
- I1. (INVITED) "Organic photovoltaic cells: Strategies for increasing solar energy conversion efficiencies," **B.P. Rand**, S.R. Forrest, ACS National Meeting, San Francisco, CA, September 2006.
- C4. "Efficient, infrared-absorbing organic solar cells employing a tin phthalocyanine donor layer," **B.P. Rand**, J. Xue, S.R. Forrest, 2005 MRS Fall Meeting, Boston, MA, December 2005.
- C3. "Organic double-heterostructure photovoltaic cells employing thick tris(acetylacetonato) ruthenium(III) exciton blocking layers," **B.P. Rand**, J. Li, J. Xue, R.J. Holmes, M.E. Thompson, S.R. Forrest, 2005 MRS Fall Meeting, Boston, MA, December 2005.
- C2. "Long-range absorption enhancement in organic tandem thin film solar cells containing silver nanoclusters," **B.P. Rand**, P. Peumans, S.R. Forrest, 2004 MRS Fall Meeting, Boston, MA, December 2004.
- C1. "Thin film organic position sensitive detectors," **B.P. Rand**, J. Xue, M. Lange, S.R. Forrest, 2003 TMS Electronic Materials Conference, Salt Lake City, UT, June 2003.

Schools and Tutorials (8 invited)

- I8. (INVITED) "Metal halide perovskites for light emitting applications," Society for Information Display (SID) Display Week 2019, San Jose, CA, May 2019.
- I7. (INVITED) "Metal halide perovskites for light emitting applications," Society for Information Display (SID) Display Week 2018, Los Angeles, CA, May 2018.
- I6. (INVITED) GIAN Course on Organic Solar Cells, IIT Hyderabad, Hyderabad, India, January 2018.
- I5. (INVITED TUTORIAL) "Symposium W: Design and Processing of Organic, Polymer, and Dye Solar Cells - From Nanostructure Control of the Cell Architecture to Large-Area Module Upscaling," **B.P. Rand**, T. Brown, H. Hoppe, 2012 MRS Spring Meeting, San Francisco, CA, April 2012.
- I4. (INVITED) "The importance of structural, electrical, and optical control for optimizing organic solar cells," **B.P. Rand**, OPERA Winter School 2011, Fukuoka, Japan, January 2011.
- I3. (INVITED) "Organic solar cells," **B.P. Rand**, Third SINANO Device Modeling Summer School, Bertinoro, Italy, September 2008.
- I2. (INVITED) "Solar cells based upon small molecular weight semiconductors: device principles and design," **B.P. Rand**, International School on Organic Photovoltaics (ISOPHOS) 2007, Ventotene, Italy, September 2007.
- I1. (INVITED) "Organic solar cells and the effect of ordering on their performance," **B.P. Rand**, Second NAIMO Summer School, Norrköping, Sweden, June 2007.

Workshops, Symposia, and Political Events (13 invited)

- I13. (INVITED) "Organic molecular thin film crystal growth and epitaxy," Symposium in honor of Dr. Martin Pope, New York University, New York, NY, November 3, 2023.
- I12. (INVITED) "Solar Energy Research and Teaching at Princeton," Energy 2100: The Future of Solar Energy Workshop, Pennsylvania State University, State College, PA, December 12, 2019.
- I11. (INVITED) "Metal halide perovskites: Surface passivation, stability and light emitting applications," JPCL (*Journal of Physical Chemistry Letters*) Forum workshop "Physical Insights into Novel Materials," Changchun, China, November 2019.

110. (INVITED) “Exploring the role of charge transfer states at organic donor/acceptor interfaces,” EXTMOS EU-US Workshop, Princeton, NJ, July 2018.
19. (INVITED) “Formation and device implications of long-range-ordered organic semiconductor films and heterojunctions,” **B.P. Rand**, DFG Symposium for SFB 1249, Materials for Organic Electronics: Synthesis, Spectroscopy and Theory, University of Heidelberg, Germany, June 2018.
18. (INVITED) “External vs. internal OLED outcoupling strategies,” **B.P. Rand**, 2016 Solid-State Lighting R&D Workshop, Raleigh, NC, February 2016.
17. (INVITED) “Controlling excitons and structure within organic photovoltaic cells,” **B.P. Rand**, DFG Closing Symposium for SPP 1355, Bad Honnef, Germany, January 2015.
16. (INVITED) “Plasmon based losses in OLEDs,” **B.P. Rand**, 2014 Solid-State Lighting R&D Workshop, Tampa, FL, January 2014.
15. (INVITED) “An overview of ultrasonic spray coating for large area polymer solar cells and modules,” **B.P. Rand**, Photovoltaics at the nanoscale, Hasselt, Belgium, October 2011.
14. (INVITED) “Structural and photonic control of small molecular weight organic solar cells,” **B.P. Rand**, Organic solar cells: KAIST EEWS Workshop 2011, Daejeon, South Korea, June 2011.
13. (INVITED) “A researcher’s perspective – IMEC as a research infrastructure for training and knowledge production,” **B.P. Rand**, Research Infrastructures and the Regional Dimension of European Research Area (RIC 2009), Prague, Czech Republic, March 2009.
12. (INVITED) “Polymer and organic solar cells – Necessary improvements for a future technology,” **B.P. Rand**, Workshop: Thin Film PV – Needs and Desires from Industry, Dübendorf, Switzerland, October 2007.
11. (INVITED) “Opportunities and challenges for optical confinement and absorbance enhancement in organic solar cells,” **B.P. Rand**, First OrgaPVnet Workshop, Prague, Czech Republic, May 2007.

Seminars and Colloquia

60. Carnegie Mellon Univ., Dept of Materials Science and Engineering, Pittsburgh, PA, 22 March 2024.
59. Hong Kong Polytechnic University, Hong Kong, 21 June 2023.
58. Universal Display Corporation, Ewing, NJ, 28 Mar 2023.
57. University of Kentucky, Department of Chemistry, Lexington, KY, 24 Mar 2023.
56. Linköping University, Linköping, Sweden, 16 Feb 2023.
55. Gyeongsang National University (GNU) Chemistry Winter School, 28 Dec 2022.
54. Imperial College CPE Winter Symposium, London, UK, 8 Dec. 2022.
53. U.S. Manufacturing of Advanced Perovskites (US-MAP) webinar, 9 Nov 2022.
52. COPE Distinguished Lecture, Georgia Institute of Technology, Atlanta, GA, 13 Apr 2022.
51. Naval Research Lab, virtual online seminar, 5 Jan 2022.
50. University of Massachusetts Amherst, Amherst, MA, 1 Dec 2021.
49. KAUST Solar Center, Thuwal, Saudi Arabia, 15 Nov 2021.
48. KAUST, Materials Science & Engineering, Thuwal, Saudi Arabia, 11 Nov 2021.
47. University of Cambridge, Cavendish Laboratory, virtual online seminar, 26 Oct 2021.
46. MilliporeSigma, Green Chemistry Team, virtual online seminar, 21 Sept 2021.
45. Rutgers University, Department of Physics & Astronomy, virtual online seminar, 18 Feb 2021.
44. KAUST, Materials Science & Engineering, Thuwal, Saudi Arabia, 9 Feb 2020.
43. University of Tennessee, Materials Science & Engineering, Knoxville, TN, 14 Jan 2020.
42. Seoul National University, Seoul, South Korea, 13 Nov 2019.
41. CUNY Photonics Advanced Science Research Center, New York, NY, 21 Oct 2019.
40. University of Vermont, Burlington, VT, 27 March 2019.
39. The Pennsylvania State University, University Park, PA, 1 Nov 2018.
38. Duke University, Materials Science, Durham, NC, 26 Sept 2018.
37. ExxonMobil, Annandale, NJ, 15 August 2018.
36. University of Delaware, Newark, DE, 4 May 2018.
35. Stevens Institute of Technology, Hoboken, NJ, 16 February 2018.
34. University of Toronto, Toronto, Canada, 16 Nov 2017.

33. NC State University, Raleigh, NC, 29 Sept 2017.
32. Lehigh University, Bethlehem, PA, 5 Sept 2017.
31. UC Irvine, Irvine, CA, 12 May 2017.
30. Luminit, Torrance, CA, 11 May 2017.
29. ExxonMobil, Annandale, NJ, 23 March 2017.
28. University of Southern California, Los Angeles, CA, 2 March 2017.
27. (COLLOQUIUM) Humboldt University of Berlin, Berlin, Germany, 17 Nov 2016.
26. 3M Corporation, St. Paul, MN, 31 May 2016.
25. Yale University, Chemical & Environmental Eng. Dept, New Haven, CT, 27 Jan 2016.
24. University of Wisconsin, Materials Science & Engineering, Madison, WI, 5 Nov 2015.
23. imec, Leuven, Belgium, 8 Sept 2015.
22. The Cooper Union, New York, NY, 14 Apr 2015.
21. DuPont, Experimental Station, DE, 26 Feb 2015.
20. (COLLOQUIUM) Case Western Reserve University, Physics Department, Cleveland, OH, 5 Feb 2015.
19. Universal Display Corporation, Ewing, NJ, 19 Jan 2015.
18. University of Delaware, Newark, DE, 28 Oct 2014.
17. Rutgers University, Piscataway, NJ, 21 Nov 2013.
16. Queens College CUNY, Physics Department, Queens, NY, 11 Nov 2013.
15. Columbia University, New York, NY, 13 Aug 2013.
14. Katholieke Universiteit Leuven, 21 May 2013.
13. BASF, Basel, Switzerland, 3 Feb 2012.
12. Seoul National University, Seoul, Korea, 14 Nov 2011.
11. BEANS Seminar, University of Tokyo, Tokyo, Japan, 17 Jan 2011.
10. Columbia University, New York, NY, 3 Sept 2010.
9. Massachusetts Institute of Technology, Cambridge, MA, 5 Dec 2008.
8. Universiteit Hasselt, Diepenbeek, Belgium, 26 Aug 2008.
7. Université de Mons-Hainaut, Mons, Belgium, 27 Nov 2007.
6. Bergische Universität Wuppertal, Wuppertal, Germany, 12 Sept 2007.
5. The Pennsylvania State University, University Park, PA, 16 Nov 2006.
4. National Institute of Standards and Technology, Gaithersburg, MD, 26 Oct 2006.
3. 3M Corporation, St. Paul, MN, 18 Oct 2006.
2. Brookhaven National Laboratory, Upton, NY, 11 Oct 2006.
1. Sandia National Laboratory, Albuquerque, NM, 5 Oct 2006.

ISSUED AND PENDING U.S. PATENTS

24. "Organic-inorganic hybrid perovskite nanocrystals and methods of making the same," **B.P. Rand**, R.A. Kerner, Z. Xiao, U.S. Patent #11,130,910, September 28, 2021.
23. "Solid-state organic intermediate-band photovoltaic devices," **B.P. Rand**, Y.L. Lin, U.S. Patent #10,903,439, January 26, 2021.
22. "Method and device for using an organic underlayer to enable crystallization of disordered organic thin films," **B.P. Rand**, M.A. Fusella, S. Yang, U.S. Patent #10,615,345, April 7, 2020.
21. "Organic photovoltaic cells with enhanced photocurrent," **B.P. Rand**, K. Cnops, U.S. Patent #10,468,615, November 5, 2019.
20. "Process for fabricating a porous film in a scattering layer," **B.P. Rand**, T.-W. Koh, U.S. Patent #9,985,251, May 29, 2018.
19. "High efficiency organic photovoltaic cells employing hybridized mixed-planar heterojunctions," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #9,112,164, August 18, 2015.
18. "Architectures and criteria for the design of high efficiency organic photovoltaic cells," **B.P. Rand**, S.R. Forrest, D.P. Burk, U.S. Patent #8,993,881, March 31, 2015.

17. "Light emitting diode and method for fabricating the same," **B.P. Rand**, C. Cavaco, U.S. Patent Application #8,987,749, March 24, 2015.
16. "Architectures and criteria for the design of high efficiency organic photovoltaic cells," **B.P. Rand**, S.R. Forrest, D.P. Burk, U.S. Patent #8,987,589, March 24, 2015.
15. "Organic photosensitive devices," **B.P. Rand**, S.R. Forrest, U.S. Patent #8,592,680, November 26, 2013.
14. "Method for fabricating organic optoelectronic devices," **B.P. Rand**, D. Cheyins, B. Kam, U.S. Patent #8,592,804, November 26, 2013.
13. "High efficiency organic photovoltaic cells employing hybridized mixed-planar heterojunctions," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #8,586,967, November 19, 2013.
12. "Organic photosensitive devices using subphthalocyanine compounds," **B.P. Rand**, S.R. Forrest, K.L. Mutolo, E. Mayo, M.E. Thompson, U.S. Patent #8,242,493, August 14, 2012.
11. "Organic photovoltaic cells utilizing ultrathin sensitizing layer," **B.P. Rand**, F. Yang, S.R. Forrest, U.S. Patent #8,013,240, September 6, 2011.
10. "Organic photosensitive devices using subphthalocyanine compounds," **B.P. Rand**, S.R. Forrest, K.L. Mutolo, E. Mayo, M.E. Thompson, U.S. Patent #7,973,307, July 5, 2011.
9. "Organic photovoltaic cells utilizing ultrathin sensitizing layer," **B.P. Rand**, S.R. Forrest, U.S. Patent #7,947,897, May 24, 2011.
8. "Stacked organic photosensitive devices," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #7,915,701, March 29, 2011.
7. "Organic photosensitive optoelectronic device having a phenanthroline exciton blocking layer," M.E. Thompson, J. Li, S.R. Forrest, **B.P. Rand**, U.S. Patent #7,893,352, February 22, 2011.
6. "Stacked organic photosensitive devices," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #7,816,715, October 19, 2010.
5. "Stacked organic photosensitive devices," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #7,375,370, May 20, 2008.
4. "Stacked organic photosensitive devices," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #7,326,955, February 5, 2008.
3. "Organic photosensitive cells having a reciprocal-carrier exciton blocking layer," **B.P. Rand**, S.R. Forrest, M.E. Thompson, U.S. Patent #7,230,269, June 12, 2007.
2. "Stacked organic photosensitive devices," J. Xue, S. Uchida, **B.P. Rand**, S.R. Forrest, U.S. Patent #7,196,366, March 27, 2007.
1. "Thin film organic position sensitive detectors," **B.P. Rand**, M. Lange, S.R. Forrest, U.S. Patent #6,995,445, February 7, 2006.

U.S. Patent Applications

5. "Organic/inorganic composite transport layers for blocking iodine diffusion in halide perovskite electronic devices," U.S. Application 18/096,274 January 12, 2023.
4. "Thermal management for perovskite electronic devices," **B.P. Rand**, L. Zhao, S.Y. Chou, International Patent Application #PCT/US2021/026153, October 14, 2021.
3. "Surface engineered organic-inorganic hybrid perovskite nanocrystals and applications thereof," **B.P. Rand**, Z. Xiao, International Patent Application #PCT/US2019/055836, June 18, 2020.
2. "Donor-acceptor interfaces for excitonic semiconductors," **B.P. Rand**, L. Zhao, International Patent Application #PCT/US2019/035933, February 27, 2020.
1. "Photovoltaic structures and method to produce the same," **B.P. Rand**, J. Genoe, P. Heremans, U.S. Patent Application #20090308456, December 17, 2009.