

Hybrid Solar Cells, B. Ehrler (2017-2022)

Biography



Bruno Ehrler is leading the Hybrid Solar Cells group at AMOLF in Amsterdam since 2014 and is also honorary professor at the University of Groningen since 2020. His group focuses on the materials science of perovskite semiconductors, the most promising material for future solar cells. His interest is both on the fundamental level, and on device applications. His group developed several techniques to study ion migration in perovskite semiconductors, which is on the one hand the main cause of their degradation, on the other hand a mechanism by which novel devices such as artificial synapses could be developed.

Ehrler is recipient of an ERC Starting Grant and a NWO Vidi grant, advisory board member of the Dutch Chemistry Council and the editorial board of ACS Energy Letters, recipient of the WIN Rising Star award, and senior conference editor for nanoGe. He is leading the SolarLab program, the 40 M€ fundamental science program of the SolarNL project (total program value 898 M€, see SolarNL.eu). Before moving to Amsterdam, he was a research fellow in the Optoelectronics Group at Cambridge University following post-doctoral work with Professor Sir Richard Friend. During this period, he worked on quantum dots, doped metal oxides and singlet fission photovoltaics. He obtained his PhD from the University of Cambridge in 2012 under the supervision of Professor Neil Greenham, studying hybrid solar cells from organic semiconductors and inorganic quantum dots. He received his MSci from the University of London (Queen Mary) studying micro-mechanics in the group of Professor David Dunstan.

Group output

Peer reviewed Publications 2017-2022

2017

1. T. Wang, B. Daiber, J. M. Frost, S. A. Mann, E. C. Garnett, A. Walsh, B. Ehrler, *Indirect to direct bandgap transition in methylammonium lead halide perovskite*, Energy & Environmental Science **10**, 509-515 (2017).
2. L. M. Pazos-Outón, J. M. Lee, M. FH. Futscher, A. Kirch, M. Tabachnyk, R.H. Friend, B. Ehrler, *A Silicon–Singlet Fission Tandem Solar Cell Exceeding 100% External Quantum Efficiency with High Spectral Stability*, ACS Energy Letters **2**, 476-480 (2017).
3. J. M. Lee, M. H. Futscher, L. M. Pazos-Outón, B. Ehrler, *Highly transparent singlet fission solar cell with multistacked thin metal contacts for tandem applications*, Progress in Photovoltaics: Research and Applications **25**, 936-941 (2017).
4. M. Futscher and B. Ehrler, *Modeling the Performance Limitations and Prospects of Perovskite/Si Tandem Solar Cells under Realistic Operating Conditions*, ACS Energy Letters **2**, 2089–2095 (2017).

2018

1. M. Futscher, A. Rao and B. Ehrler, *The Potential of Singlet Fission Photon Multipliers as an Alternative to Silicon-based Tandem Solar Cells*, ACS Energy Lett. **3**, 10: 2587-2592 (2018). Gold OA

2. S.W. Tabernig, B. Daiber, T. Wang and B. Ehrler, Enhancing silicon solar cells with singlet fission: the case for Foerster resonant energy transfer using a quantum dot intermediate, *J. Photonics Energy* **8**, 2, Article number: 022008: 1-12 (2018). **Gold OA**
3. L. Song, T. Wang, V. Koerstgens, W.J. Wang, N. Saxena, C.J. Schaffer, T. Froeschl, N. Huesing and S. Bernstorff, Wet Imprinting of Channel-Type Superstructures in Nanostructured Titania Thin Films at Low Temperatures for Hybrid Solar Cells, *ChemSusChem* **11**, 7: 1179-1186 (2018).
4. A. Karani, L. Yang, S. Bai, M. Futscher, H. J. Snaith, B. Ehrler, N. C. Greenham and D. Di, Perovskite/Colloidal Quantum Dot Tandem Solar Cells: Theoretical Modeling and Monolithic Structure, *ACS Energy Lett.* **3**, 869-874 (2018). **Gold OA**

2019

1. L.A. Muscarella, E.M. Hutter, S. Sanchez, C.D. Dieleman, T.J. Savenije, A. Hagfeldt, M. Saliba and B. Ehrler, *Crystal Orientation and Grain Size: Do They Determine Optoelectronic Properties of MAPbI₃ Perovskite?*, *J. Phys. Chem. Lett.* **10**, 6010-6018 (2019) **Gold OA**
2. M. Futscher, J. M. Lee, L. McGovern, L.A. Muscarella, T. Wang, M.I. Haider, A. Fakhruddin, L. Schmidt-Mende and B. Ehrler, *Quantification of Ion Migration in CH₃NH₃PbI₃ Perovskite Solar Cells by Transient Capacitance Measurements*, *Mater. Horiz.* **6**, 1497–1503, (2019). **Green OA**
3. L.A. Muscarella, D. Petrova, R. Jorge Cervasio, A. Farawar, O. Lugier, C. McLure, M.J. Slaman, J. Wang, B. Ehrler, E. von Hauff and R.M. Williams, *Air-stable and oriented mixed lead halide perovskite (FA/MA) by one-step deposition method using zinc iodide and chloroamine additive*, *ACS Appl. Mater. Interfaces* **11**, 17555–17562, (2019). **Gold OA**
4. J. Zhang, M. Futscher, V. Lami, F.U. Kosasih, C. Cho, Q. Gu, A. Sadhanala, A.J. Pearson, B. Kan, G. Divitini, X. Wan, D. Credgington, N.C. Greenham, Y. Chen, C. Ducati, B. Ehrler, Y. Vaynzof, R.H. Friend and A.A. Bakulin, *Sequentially Deposited versus Conventional Nonfullerene Organic Solar Cells: Interfacial Trap States, Vertical Stratification, and Exciton Dissociation*, *Adv. Energy Mater.*, 1902145: 1-9, (2019). **Gold OA**
5. S. Jariwala, H. Sun, G.W.P. Adhyaksa, A. Lof, L.A. Muscarella, B. Ehrler, E.C. Garnett and D.S. Ginger, *Local Crystal Misorientation Influences Non-radiative Recombination in Halide Perovskites*, *Joule* **3**, (12), 3048–3060, (2019) **Green OA**
6. M. Xiao, D. Shen, M. Futscher, B. Ehrler, K.P. Musselman, W. Duley, and N.Y. Zhou, *Threshold Switching in Single Metal-Oxide Nanobelt Devices Emulating an Artificial Nociceptor*, *Adv. Electron. Mater.*, 1900595: 1–12, (2019). **Niet OA**
7. V.M. Caselli, M. Fischer, D. Meggiolaro, E. Mosconi, F. De Angelis, S.D. Stranks, A. Baumann, V. Dyakonov, E.M. Hutter, and T.J. Savenije, *Charge Carriers Are Not Affected by the Relatively Slow-Rotating Methylammonium Cations in Lead Halide Perovskite Thin Films*, *J. Phys. Chem. Lett.* **10**, (17), 5128–5134, (2019). **Gold OA**
8. Tulus, S. Olthof, M. Marszalek, A. Peukert, L.A. Muscarella, B. Ehrler, O. Vukovic, Y. Galagan, S.C. Boehme, and E. von Hauff, *Control of Surface Defects in ZnO Nanorod Arrays with Thermally Deposited Au Nanoparticles for Perovskite Photovoltaics*, *ACS Appl. Energy Mater.* **2**, (5), 3736–3748, (2019). **Gold OA**
9. A. Kooijman, L.A. Muscarella, and R.M. Williams, *Perovskite Thin Film Materials Stabilized and Enhanced by Zinc(II) Doping*, *Appl. Sci.* **9**, 1678: 1-15, (2019). **Gold OA**

2020

1. J. Niederhausen, R.W. MacQueen, E. Özko, C. Gersmann, M.H. Futscher, M. Liebhaber, D. Friedrich, M. Borgwardt, K.A. Mazzio, P. Amsalem, M.H. Nguyen, B. Daiber, M. Mews, J. Rappich, F. Ruske, R. Eichberger, B. Ehrler and K. Lips, *Energy-Level Alignment Tuning at Tetracene/c-Si Interfaces*, *J. Phys. Chem. C* **124**, (51), 27867-27881 (2020)
2. V.M. Caselli, Z. Wei, M.M. Ackermans, E.M. Hutter, B. Ehrler and T.J. Savenije, *Charge Carrier Dynamics upon Sub-bandgap Excitation in Methylammonium Lead Iodide Thin Films: Effects of Urbach Tail, Deep Defects, and Two-Photon Absorption*, *ACS Energy Lett.* **5**, (12), 3821-3827 (2020) **Hybrid OA**.

3. B. Daiber, S. Maiti, S.M. Ferro, J. Bodin, A. F. J. van den Boom, S.L. Luxembourg, S. Kinge, S.P. Pujari, H. Zuilhof, L.D.A. Siebbeles and B. Ehrler, *Change in Tetracene Polymorphism Facilitates Triplet Transfer in Singlet Fission-Sensitized Silicon Solar Cells*, *J. Phys. Chem. Lett.* **11**, (20), 8703-8709 (2020) **Hybrid OA**.
4. E.C. Garnett, B. Ehrler, A. Polman and E. Alarcón-Lladó, *Photonics for Photovoltaics – advances and opportunities*, *ACS Photonics* **8**, (1), 61-70 (2020) **Hybrid OA**.
5. H.M. Doeleman, C.D. Dieleman, C. Mennes, B. Ehrler and A.F. Koenderink, *Observation of Cooperative Purcell Enhancements in Antenna-Cavity Hybrids*, *ACS Nano* **14**, (9), 12027-12036 (2020) **Hybrid OA**.
6. L.A. Muscarella, E.M. Hutter, F. Wittmann, Y.W. Woo, Y.-K. Jung, L. McGovern, J. Versluis, A. Walsh, H.J. Bakker and B. Ehrler, *Lattice Compression Increases the Activation Barrier for Phase Segregation in Mixed-Halide Perovskites*, *ACS Energy Lett.* **5**, (10), 3152-3158 (2020) **Hybrid OA**.
7. B. Ehrler, E. Alarcón-Lladó, S.W. Tabernig, T. Veeken, E.C. Garnett and A. Polman, *Photovoltaics Reaching for the Shockley–Queisser Limit*, *ACS Energy Lett.* **5**, (9), 3029-3033 (2020).
8. A.M. Alvertis, R. Pandya, L.A. Muscarella, N. Sawhney, M. Nguyen, B. Ehrler, A. Rao, R.H. Friend, A.W. Chin and B. Monserrat, *Impact of exciton delocalization on exciton-vibration interactions in organic semiconductors*, *Phys. Rev. B* **102**, (8), 081122(R): 1-7 (2020) **Green OA**.
9. L. McGovern, M.H. Futscher, L.A. Muscarella and B. Ehrler, *Understanding the Stability of MAPbBr₃ versus MAPbI₃: Suppression of Methylammonium Migration and Reduction of Halide Migration*, *J. Phys. Chem. Lett.* **11**, (17), 7127-7132 (2020) **Hybrid OA**.
10. S. Maiti, S.M. Ferro, D. Poonia, B. Ehrler, S. Kinge and L.D.A. Siebbeles, *Efficient Carrier Multiplication in Low Band Gap Mixed Sn/Pb Halide Perovskites*, *J. Phys. Chem. Lett.* **11**, (15), 6146-6149 (2020) **Hybrid OA**.
11. E.M. Hutter, L.A. Muscarella, F. Wittmann, J. Versluis, L. McGovern, H.J. Bakker, Y.W. Woo, Y.-K. Jung, A. Walsh and B. Ehrler, *Thermodynamic Stabilization of Mixed-Halide Perovskites against Phase Segregation*, *Cell Rep. Phys. Sci.* **1**, 100120: 1-11 (2020) **Gold OA**.
12. M.H. Futscher, M.K. Gangishetty, D.N. Congreve and B. Ehrler, *Manganese Doping Stabilizes Perovskite Light-Emitting Diodes by Reducing Ion Migration*, *ACS Appl. Electron. Mater.* **2**, (6), 1522-1528 (2020) **Hybrid OA**.
13. C.D. Dieleman, W. Ding, L. Wu, N. Thakur, I. Bepalov, B. Daiber, Y. Ekinci, S. Castellanos and B. Ehrler, *Universal Direct Patterning of Colloidal Quantum Dots by (Extreme) Ultraviolet and Electron Beam Lithography*, *Nanoscale* **12**, (20), 11306-11316 (2020) **Hybrid OA**.
14. B. Ehrler and E.M. Hutter, *Routes toward Long-Term Stability of Mixed-Halide Perovskites*, *Matter* **2**, (4), 800-802 (2020).
15. B. Daiber, S.P. Pujari, S. Verboom, S.L. Luxembourg, S.W. Tabernig, M.H. Futscher, J. Lee, H. Zuilhof and B. Ehrler, *A Method to detect triplet exciton transfer from singlet fission into silicon solar cells: comparing different surface treatments*, *J. Chem. Phys.* **152**, 114201: 1-8 (2020) **Hybrid OA**.
16. E.M. Hutter, T. Kirchartz, B. Ehrler, D. Cahen and E. von Hauff, *Pitfalls and prospects of optical spectroscopy to characterize perovskite-transport layer interfaces*, *Appl. Phys. Lett.* **116**, (10), 100501: 1-8 (2020) **Green OA**.
17. T.J. Savenije, D. Guo, V.M. Caselli and E.M. Hutter, *Quantifying Charge-Carrier Mobilities and Recombination Rates in Metal Halide Perovskites from Time-Resolved Microwave Photoconductivity Measurements*, *Adv. Energy Mater.* **10**, (26), 1903788: 1-12 (2020) **Green OA**.
18. M.H. Futscher, M.K. Gangishetty, D.N. Congreve and B. Ehrler, *Quantifying mobile ions and electronic defects in perovskite-based devices with temperature-dependent capacitance measurements: Frequency vs time domain*, *J. Chem. Phys.* **152**, (4), 044202: 1-9 (2020) **Hybrid OA**.
19. M. Xiao, D. Shen, M.H. Futscher, B. Ehrler, K.P. Musselman, W. Duley and N.Y. Zhou, *Threshold Switching in Single Metal-Oxide Nanobelt Devices Emulating an Artificial Nociceptor*, *Adv. Electron. Mater.* **6**, (1), 1900595: 1-12 (2020).

20. M.A. Ruiz-Preciado, D.J. Kubicki, A. Hofstetter, L. McGovern, M.H. Futscher, A. Ummadisingu, Gershoni-Poranne, S.M. Zakeeruddin, B. Ehrler, L. Emsley, J.V. Milić and M. Grätzel, *Supramolecular Modulation of Hybrid Perovskite Solar Cells via Bifunctional Halogen Bonding Revealed by Two-Dimensional ^{19}F Solid-State NMR Spectroscopy*, *J. Am. Chem. Soc.* **142**, (3), 1645-1654 (2020).
21. J.V. Milić, B. Ehrler, C. Molina, M. Saliba, and J. Bisquert, *Online Meetings in Times of Global Crisis: Toward Sustainable Conferencing*, *ACS Energy Lett.*, **5**, (6), 2024–2026 (2020) Hybrid.

2021

1. L. McGovern, G. Grimaldi, M.H. Futscher, E.M. Hutter, L.A. Muscarella, M.C. Schmidt and B. Ehrler, *Reduced Barrier for Ion Migration in Mixed-Halide Perovskites*, *ACS Appl. Energy Mater.* **4**, (12), 13431-13437 (2021) Hybrid OA
2. G. Grimaldi, L. S. D. Antony, L. Helmbrecht, A. van der Weijden, S.W. van Dongen, I. Schuringa, J. Borchert, E. Alarcón-Lladó, W.L. Noorduin and B. Ehrler, *Microstructuring of 2D perovskites via ion-exchange fabrication*, *Appl. Phys. Lett.* **119**, (22), 223102: 1-8 (2021) Hybrid OA
3. B. Daiber, van den Hoven, M.H. Futscher and B. Ehrler, *Realistic Efficiency Limits for Singlet-Fission Silicon Solar Cells*, *ACS Energy Lett.* **6**, (8), 2800-2808 (2021), Hybrid OA
4. J. Diekmann, P. Caprioglio, M.H. Futscher, V.M. Le Corre, S. Reichert, F. Jaiser, M. Arvind, L. Perdigón Toro, E. Gutierrez-Partida, F. Peña-Camargo, C. Deibel, B. Ehrler, T. Unold, T. Kirchartz, D. Neher and M. Stollerfoht, *Pathways towards 30% Efficient Single-Junction Perovskite Solar Cells and the Role of Mobile Ions*, *Solar RRL* **5**, (8) 2100219: 1-13 (2021), Hybrid OA
5. P. Geiregat, C. Rodá, I. Tanghe, S. Singh, A. Di Giacomo, D. Lebrun, G. Grimaldi, J. Maes, D. van Thourhout, I. Moreels, A.J. Houtepen and Z. Hens, *Localization-limited exciton oscillator strength in colloidal CdSe nanoplatelets revealed by the optically induced stark effect*, *Light : Sci. Appl.* **10**, (1), 112: 1-11 (2021), Gold OA
6. L.A. Muscarella, E.M. Hutter, J.M. Frost, G. Grimaldi, J. Versluis, H.J. Bakker and B. Ehrler, *Accelerated Hot-Carrier Cooling in MAPbI₃ Perovskite by Pressure-Induced Lattice Compression*, *J. Phys. Chem. Lett.* **12**, (17), 4118-4124 (2021) Hybrid OA
7. L. Helmbrecht, M.H. Futscher, L.A. Muscarella, B. Ehrler and W.L. Noorduin, *Ion Exchange Lithography: Localized Ion Exchange Reactions for Spatial Patterning of Perovskite Semiconductors and Insulators*, *Adv. Mater.* **33**, (20) 2005291: 1-6 (2021) Hybrid OA
8. J.S. van der Burgt, C.D. Dieleman, E. Johlin, J.J. Geuchies, A.J. Houtepen, B. Ehrler and E.C. Garnett, *Integrating sphere Fourier microscopy of highly directional emission*, *ACS Photonics* **8**, (4), 1143-1151 (2021) Hybrid OA
9. S.M. Ferro, M. Wobben and B. Ehrler, *Rare-Earth Quantum Cutting in Metal Halide Perovskites – a Review*, *Mater. Horiz.* **8**, (4), 1072–1083, (2021) Green OA
10. L. McGovern, I. Koschany, G. Grimaldi, L.A. Muscarella and B. Ehrler, *Grain Size Influences Activation Energy and Migration Pathways in MAPbBr₃ Perovskite Solar Cells*, *J. Phys. Chem. Lett.* **12**, (9), 2423-2428 (2021) Hybrid OA
11. B. Ehrler, N. Yanai and L. Nienhaus, *Up- and down-conversion in molecules and materials*, *J. Chem. Phys.* **154**, (7), 070401: 1–7 (2021) Green OA
12. A. Günzler, E. Bermúdez-Ureña, L.A. Muscarella, M. Ochoa, E. Ochoa-Martínez, B. Ehrler, M. Saliba and U. Steiner, *Shaping Perovskites: In Situ Crystallization Mechanism of Rapid Thermally Annealed, Prepatterned Perovskite Films*, *ACS Appl. Mater. Interfaces* **13**, (5), 6854-6863 (2021) Hybrid OA
13. E.C. Garnett, B. Ehrler, A. Polman and E. Alarcón-Lladó, *Photonics for Photovoltaics – advances and opportunities*, *ACS Photonics* **8**, (1), 61-70, (2021), Hybrid OA
14. J.M. Fruhman, H.P.A.G. Astier, B. Ehrler, M.L. Böhm, L.F.L. Eyre, P.R. Kidambi, U. Sassi, D. De Fazio, J.P. Griffiths, A.J. Robson, B.J. Robinson, S. Hofmann, A.C. Ferrari, C.J.B. Ford, *High-yield parallel fabrication of quantum-dot monolayer single-electron devices displaying Coulomb staircase, contacted by graphene*, *Nature Communications* **12** (1), 1-10 (2021), Green OA

2022

1. Tulus, L.A. Muscarella, Y. Galagan, S.C. Boehme and E. von Hauff, *Trap passivation and suppressed electrochemical dynamics in perovskite solar cells with C60 interlayers*, *Electrochim. Acta* **433**, 141215: 1-10 (2022)
2. J.J. Geuchies, R. Dijkhuizen, M. Koel, G. Grimaldi, I. du Fossé, W.H. Evers, Z. Hens and A.J. Houtepen, *Zero-Threshold Optical Gain in Electrochemically Doped Nanoplatelets and the Physics Behind It*, *ACS Nano* **16**, (11), 18777-18788 (2022) Hybrid OA
3. J.S. van der Burgt, F. Scalerandi, J. de Boer, S.A. Rigter and E.C. Garnett, *Perovskite Plasticity: Exploiting Instability for Self-Optimized Performance*, *Adv. Funct. Mater.* **32**, (39), 2203771: 1-7 (2022) Hybrid OA
4. L.A. Muscarella and B. Ehrler, *The influence of strain on phase stability in mixed-halide perovskites*, *Joule* **6**, (9), 2016-2031 (2022) Green OA
5. L.A. Muscarella, C.E.A. Cordaro, G. Krause, D. Pal, G. Grimaldi, L. S. D. Antony, D. Langhorst, A. Callies, B. Bläsi, O. Höhn, A.F. Koenderink, A. Polman and B. Ehrler, *Nanopatterning of Perovskite Thin Films for Enhanced and Directional Light Emission*, *ACS Appl. Mater. Interfaces* **14**, (33), 38067-38076 (2022) Hybrid OA
6. B. Ehrler, *Unleashing the power of materials science for a sustainable future*, *Matter* **5**, (8), 2386-2389 (2022) Green OA
7. M.L.S. van der Geest, L. McGovern, S. van Vliet, H.Y. Zwaan, G. Grimaldi, J. de Boer, R. Bliem, B. Ehrler and P.M. Kraus, *Extreme-Ultraviolet Excited Scintillation of Methylammonium Lead Bromide Perovskites*, *J. Phys. Chem. C* **126**, (30), 12554-12562 (2022) Hybrid OA
8. T. Veeken, B. Daiber, H. Agrawal, M. Aarts, E. Alarcón-Lladó, E.C. Garnett, B. Ehrler, J. van de Groep and A. Polman, *Directional quantum dot emission by soft-stamping on silicon Mie resonators*, *Nanoscale Adv.* **4**, (4), 1088-1097 (2022) Gold OA
9. L.A. Muscarella, A. Dučinskas, M. Dankl, M. Andrzejewski, N.P.M. Casati, U. Rothlisberger, J. Maier, M. Graetzel, B. Ehrler and J.V. Milić, *Reversible Pressure-Dependent Mechanochromism of Dion–Jacobson and Ruddlesden–Popper Layered Hybrid Perovskites*, *Adv. Mater.* **34**, 2108720: 1-10 (2022) Hybrid OA
10. E.M. Hutter, R. Sangster, C. Testerink, B. Ehrler and C.M.M. Gommers, *Metal halide perovskite toxicity effects on Arabidopsis thaliana plants are caused by iodide ions*, *iScience* **25**, (1), 103583: 1-9 (2022) Gold OA
11. C.D. Dieleman, J.S. van der Burgt, N. Thakur, E.C. Garnett and B. Ehrler, *Direct Patterning of CsPbBr₃ Nanocrystals via Electron-Beam Lithography*, *ACS Appl. Energy Mater.* **5**, (2), 1672-1680 (2022) Hybrid OA
12. V.M. Le Corre, J. Diekmann, F. Peña-Camargo, J. Thiesbrummel, N. Tokmoldin, E. Gutierrez-Partida, K.P. Peters, L. Perdigón Toro, M.H. Futscher, F. Lang, J. Warby, H.J. Snaith, D. Neher and M. Stollerfoht, *Quantification of Efficiency Losses Due to Mobile Ions in Perovskite Solar Cells via Fast Hysteresis Measurements*, *Solar RRL* **6**, 2100772: 1-10 (2022) Hybrid OA
13. B. Ehrler, A.W. Y. Ho-Baillie, E.M. Hutter, J.V. Milić, M.J.Y. Tayebjee and M.W.B. Wilson, *Scalable ways to break the efficiency limit of single-junction solar cells*, *Appl. Phys. Lett.* **120**, (1), 010402: 1-6 (2022) Green OA
14. L. Yang, C.W. Chua, Z. Yang, X.P. Ding, Y. Yong, A. Suwardi, M. Zhao, K.L. Ke, B. Ehrler and D. Di, *Photon-upconverters for blue organic light-emitting diodes: a low-cost, sky-blue example*, *Nanoscale Adv.* **4**, (5), 1318-1323 (2022) Gold OA

Contributions to scientific books (chapters or entire book) 2017-2022

2022

1. B. Ehrler, Singlet Fission Solar Cells, in *Lissau, J.S., Madsen, M. (eds) Emerging Strategies to Reduce Transmission and Thermalization Losses in Solar Cells*. Springer, Cham, Springer Nature, 2022, 313–339

PhD theses 2017-2022

2019

1. *Photophysics of novel optoelectronic materials under hydrostatic pressure*, T. Wang, University of Amsterdam, March 2019.

2020

1. *Quantifying the efficiency and stability potential of perovskite-based devices*, Moritz Futscher, University of Amsterdam, January 2020.

2021

1. C.D. Dieleman, *Patterning Colloidal Nanocrystals with Light and Electrons*, University of Amsterdam, 30/06/2021, Embargo
2. B. Daiber, *Transfer of Triplet Excitons in Singlet Fission-Silicon Solar Cells: Experiment and Theory Towards Breaking the Detailed-Balance Efficiency Limit*, University of Groningen, 04/09/2021, Open Access

2022

1. L. McGovern, *Ion Migration in Lead Halide Perovskite Solar Cells*, University of Groningen, 2022-04-28 Embargo
2. L.A. Muscarella, *Strain effects on the optical properties of lead-halide perovskites*, University of Groningen, 2022-01-18 Embargo

Masters and Bachelors theses 2017-2022

2017

1. MSc thesis: *Singlet fission, energy transfer and computational methods*; Roan van Leeuwen, VU University Amsterdam (co-supervised with Ivan Infante, VU, 2017)
2. MSc thesis: *Size-Dependent Open-Circuit Voltage in Lead Sulfide Colloidal Quantum Dot Solar Cells*; Ruit Bosma, University of Amsterdam (2017)
3. MSc thesis: *Managing triplet excitons in singlet fission sensitized pentacene solar cells*; Lucie McGovern, Université Pierre et Marie Curie (2017)
4. MSc thesis: *Photon upconversion in an ionic liquid: A pressure study*; Arnoud Jongeling, Wageningen University and Research Centre (2017)
5. BSc thesis: *A computational study of the effects of soiling on different solar modules in the Netherlands*; Talia Martz-Oberlaender, Amsterdam University College (2017)
6. BSc thesis: *The effect of light diffuseness on the outdoor performance of thin film solar cells*; Toon Maassen, University of Amsterdam (2017)

2018

1. MSc thesis; *Singlet fission, energy transfer and computational methods*; Roan van Leeuwen, VU University Amsterdam (co-supervised with Ivan Infante, VU)
2. MSc thesis; *Förster resonance energy transfer from PbS quantum dots to silicon: The missing link towards singlet fission solar cells*; Stefan Tabernig, University of Amsterdam
3. MSc thesis: *Harnessing singlet exciton fission to enhance silicon solar cells through direct charge-transfer*; Koen van den Hoven, University of Amsterdam
4. BSc thesis; *Outdoor solar cell performance – Improving a diffuseness measurement tool*; Merlijn Kersten, University College Amsterdam.

2019

1. Joris Bodin, *Triplet Energy Transfer in Singlet Fission Silicon Solar Cells*, University of Amsterdam, July 2019 (master thesis).
2. Andrea Pollastri, *A novel multi-directional light detector for modelling the cost-efficiency benefits of bi-facial solar panels*, Amsterdam University College, June 2019 (bachelor thesis).
3. Fabian Ecker, *Investigating Triplet Transfer in Singlet Fission – Low Bandgap Semiconductor Bilayers using Magnetic Field Effects*, University of Konstanz, September 2019 (bachelor thesis).

2020

1. MSc Thesis: Mischa Hillenius: *Factors impacting the Kramers-Kronig compliance of impedance spectra from perovskite solar cells and the influence on equivalent circuit modelling*, VU, 11-2020.
2. MSc Thesis: Marnix M. Ackermans: *Direct or Indirect? Unraveling the bandgap nature of metal halide perovskites*, TUD, 8-2020.
3. MSc Thesis: Emil Kensington: *Using Carrier Multiplication to Maximise Luminescent Solar Concentrator-Silicon Solar Cell Efficiency*, UvA, 7-2020
4. MSc Thesis: Isabel Koschany: *Quantification of Ion migration in Perovskite solar cells with varying grain size*, UvA, 7-2020.
5. MSc Report: Roel van Herk: *Light Ambiance Detector Progress Development Report*, VU, 5-2020
6. MSc Literature thesis: Tom Strengers: *An overview of the Formamidinium Caesium double halide perovskite-charge transfer layer interface*, Uva/VU, 12-2020.
7. BSc Thesis: M. Jouke Blum: *Utilizing Machine Learning to Predict the Solar Spectrum from all Directions*, RUG, 10-2020.
8. BSc Thesis: Kaspar Wachinger: *Understanding seasonal variations in bifacial gain predictions by the Light Ambiance Detector in AMOLF's solar array*, AUC, 7-2020.

2021

1. Weiyi Ding, "Quantum Dots for E-beam lithography", Master thesis, University of Amsterdam, May 2021
2. Hsiumin Wu, "Effectiveness of a Machine Learning Algorithm and Four Narrow Band Sensors Facing Twelve Directions for Predicting the Ambient Spectrum", Bachelor thesis Liberal Arts and Sciences, Amsterdam University College, June 2021.
3. David Langhorst, "Light-outcoupling manipulation of perovskite LEDs via nona-patterning of the active layer", Master thesis Physics and astronomy: science for energy and sustainability, University of Amsterdam, August 2021.
4. Rens van Roosmalen, "Reduced ion migration in 2D/3D perovskite solar cells", Master thesis Chemistry, University of Amsterdam, June 2021.
5. Toon Maassen, "Looking Inside a Perovskite", Master thesis Physics and astronomy: science for energy and sustainability, University of Amsterdam, December 2021.
6. Menke Knol, "The effect of intermediate band trap centers on the charge-carrier dynamics in all-inorganic lead-halide perovskite thin films", Master thesis Applied physics, Delft University of Technology, December 2021.

2022

1. T. Maassen, 'Looking Inside a Perovskite': *analyzing the processes at the nickel oxide interface by measuring the photoluminescence of hole-only interdigitated back contact perovskite devices under bias*, master's thesis, Physics Masters, University of Amsterdam and Vrije Universiteit, The Netherlands, 01/2022.
2. F. Blom, *Formation of complex perovskite heterostructures: A step towards understanding the interfaces of perovskite solar cells*, master's thesis, Chemistry Masters, University of Amsterdam and Vrije Universiteit, The Netherlands, 07/2022.

3. O. van de Water, *Perovskite memristors for energy efficient computing*, master's thesis, Physics and Astronomy Masters, University of Amsterdam, The Netherlands, 07/2022.

Invited lectures at international conferences and meetings

2017

1. Rowland Center, Harvard University, November 27, 2017
2. WIN seminar, University of Waterloo, November 24, 2017
3. University of Toronto, Department of Chemistry, November 23, 2017
4. EMIL seminar, Helmholtz Center Berlin, November 9, 2017
5. EU PVSEC 2017, opening scientific plenary talk, September 25, 2017
6. Dutch Perovskite Workshop, Groningen, July 6, 2017
7. KNAW Chemistry Meeting, Amsterdam, April 10, 2017

2018

1. SPIE Optics + Photonics, *Ion Migration in Halide Perovskites*, San Diego, 21-08-2018
2. Frontiers in Nanoscience and Nanotechnology Symposium, *Beyond Solar Cell Efficiency Limits with Singlet Fission*, University of Waterloo, WIN Rising Star Award lecture, 6-06-2018
3. ISPF2 Singlet Fission conference, *Towards singlet-fission sensitized silicon solar cells*, Gothenburg, 18-04-2018

2019

1. Bruno Ehrler, *Towards efficient and stable perovskite/silicon tandem solar cells*, International Conference on Hybrid and Organic Photovoltaics (HOPV), Rome, Italy, May 2019.
2. Bruno Ehrler, *The efficiency potential of singlet fission solar cells*, MRS Spring meeting, Phoenix, USA, April 2019.
3. Bruno Ehrler, *Towards efficient and stable perovskite/silicon tandem solar cells*, Materials for Clean Energy Conference, London, United Kingdom, April 2019.
4. Bruno Ehrler, *Ion Migration in Halide Perovskites*, Quantsol Winter Workshop, Rauris, Austria, March 2019.

2020

1. Bruno Ehrler, "Kinetics and thermodynamics of phase segregation in mixed-halide perovskites" Online Meetup on Measurement of Perovskite Solar Cell by Impedance Spectroscopy and Transient Methods, 21-07-2020.
2. Benjamin Dailber, "Singlet fission - silicon solar cells" Internet Meetup on Photon Conversion, 2020.

2021

1. Bruno Ehrler, "*Dependence of Ion Migration on Structural Factors in Metal Halide Perovskites*", PERIMPED symposium, nanoGe Spring Meeting (online), 09/03/2021.
2. Bruno Ehrler, "*Carrier Multiplication to Enhance Solar Cell Efficiency*", Workshop Optics for Solar Energy, OSA Advanced Photonics Congress (online), 28/07/2021.
3. Bruno Ehrler, "*Carrier Multiplication to Enhance Solar Cell Efficiency*", 3rd European Workshop on Optics for Solar Energy, Berlin, 05/10/2021.
4. Bruno Ehrler, "*Carrier Multiplication to Enhance Solar Cell Efficiency*", Pacificchem (online), 17/12/2021.
5. Loreta A. Muscarella, "*Pressure-induced compression to manipulate phase-segregation in mixed-halide perovskites*", nanoGe HOPV21 MAESTRO Research Seminar (online), HOPV21, 24/05/2021.

2022

1. B. Ehrler, *What can we learn from capacitance measurements about ion migration in metal halide perovskites?*, Quantsol Winter Workshop 2022, Rauris, Austria, 23/03/2022.
2. B. Ehrler, *The effect of strain on ion migration in metal halide perovskites*, HOPV 2022, Valencia, Spain, 24/05/2022.
3. B. Ehrler, *The effect of strain on perovskites*, NextGenPV 2022, Groningen, The Netherlands, 05/06/2022.
4. B. Ehrler, *Where nanoscale meets kilometer scale: perovskite material science to enable large-area solar power*, Nanotechnology Crossing Borders, Geleen, The Netherlands, 09/06/2022.

Academic teaching 2017-2022

2017

1. B. Ehrler, Jointly teaching MSc PV course, AMEP track at the University of Amsterdam (UvA).

2018

2. B. Ehrler, Jointly teaching MSc PV course, AMEP track at the University of Amsterdam (UvA).

2019

1. B. Ehrler, Co-teaching the organic photovoltaics MSc course at the Vrije University Amsterdam (VU).

2020

1. B. Ehrler, Guest lecture for the organic photovoltaics MSc course at the Vrije University Amsterdam (VU).

2021

1. Bruno Ehrler: Co-teaching “*Solar Cells / Photovoltaics Science and Energy*” course at the Rijksuniversiteit Groningen.
2. Imme Schuringa: Supervision during course ‘Research practicum’, Bachelor of Physics, year 2, Universiteit van Amsterdam. Two students per week, both groups one week each.

2022

1. B. Ehrler, co-teaching MSc and BSc level course *Solar Cells*, University of Groningen, The Netherlands (6 ECTS course).
2. Daphne Dekker, supervision during course ‘Research practicum’, Bachelor of Physics, year 2, Universiteit van Amsterdam. Two students for one week.

Selected awards & recognitions 2017-2022

2018

1. WIN Rising Star award from the Waterloo Institute for Nanotechnology to Bruno Ehrler
2. Best Poster award at the MRS Spring meeting to Benjamin Daiber

2019

1. Martinus van Marum prize, KHMW, Eline Hutter.
2. NWO Veni grant, Eline Hutter.
3. RSC Twitter Poster Conference Prize, Moritz Futscher.

2020

1. Cum Laude PhD for Moritz Futscher

2021

1. Loreta A. Muscarella, “*Travel Grants to 10 Young Scientists*” to participate at the Symposium on Earth-Abundant Materials for Future Photovoltaics, SeeFuturePV, 10/08/2021.
2. María C. Gélvez-Rueda, “*Next-Generation Materials for Sustainable Energy Technologies*”, Next Gen Science Section, participation in 70th Lindau Nobel Laureate Meeting (online), 01/07/2021.
3. Lucie McGovern, Best e-poster award, “*Grain Size Influences Activation Energy and Migration Pathways in MAPbBr₃ Perovskite Solar Cells*”, nanoGe Spring Meeting (online), 09/03/2021.

2022

1. L. McGovern, Best e-poster award, *Grain Size Influences Activation Energy and Migration Pathways in MAPbBr₃ Perovskite Solar Cells*, nanoGe Spring Meeting (online), 09/03/2021.
2. M.C. Gélvez Rueda, Best poster presentation award, *Building Spin-Selectivity in Hybrid Perovskites using Chiral Organic Molecules*, 15th International Conference on Hybrid and Organic Photovoltaics, 25/05/2022.

Valorization 2017-2022

1. Research contract with DSM, ECN and Oxford PV (NWO Topsector program) on the use of singlet fission for high-efficiency solar cells: knowledge transfer through workshops
2. Research contract with Toyota Motor Europe, and Surfrix (NWO Mat4Sus program) on the use of singlet fission for high-efficiency solar cells: knowledge transfer through workshops
3. Research contract with Shell, BASF, ExxonMobil, Toyota, Delmic, DENSSolutions (NWO KIC program) on light-driven chemistry: knowledge transfer through workshops
4. Research contract with TNO, VDL, SALDtech, HyET Solar, Delmic to develop roll-to-roll perovskite solar cells (NWO KIC program): knowledge transfer through workshops
5. Research contract with EDAX/ASI: development of Electron beam Back Scatter Diffraction (EBSD) imaging instrument for SEM. The total sales of products by EDAX and ASI based on demonstrator developed at AMOLF is multiple million euro/year, the added value to the Dutch economy is multiple million euro/year.
6. Application and granting by the National Growth Fund of the research, technology and industrial development program *Sustainable MaterialsNL*. Granted programs are: Circular plastics (2022, total budget 532 M€), Photovoltaics (2023, 898 M€), Batteries (2023, 822 M€) and Sustainable steel (2023, 177 M€). Total subsidy granted 952 M€, private investors contribute 1477 M€.