

## ***Dr. Matthew Brahlek***

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### **Professional Preparation**

2018.06-	<b>R&amp;D Staff Scientist</b> —Oak Ridge National Laboratory (ORNL)
2014.11-2018.06	<b>Post-doctoral Scholar</b> —Materials Science and Engineering—Penn State University
2009.09-2014.11	<b>Ph.D.</b> Physics—Rutgers University ( <b>2015 Richard J. Plano Dissertation Prize</b> )
2006.09-2009.05	<b>B.S.</b> Physics—Florida Atlantic University ( <i>summa cum laude</i> , GPA-3.94)
2004.09-2006.05	<b>A.A.</b> Physics—Palm Beach State College ( <i>summa cum laude</i> , GPA-3.86)

### **Awards and Honors**

- 2023 **ORNL, Materials Science & Tech. Division Early Career Research Award**
- 2023 **Department of Energy Early Career Research Project Award**
- 2018 QuantEmX Scientist Exchange Award
- 2015 **Rutgers University Richard J. Plano Dissertation Prize**
- 2014 **Rutgers University Dean's Research Award**
- 2014 The American Physical Society-Ovshinsky Student Travel Award
- 2013 Laboratory for Surface Modification Symposium Best Oral Presentation Award
- 2009-10 Rutgers University GAANN Fellow
- 2008 Florida Atlantic University Undergraduate Award in Physics
- 2004-08 Palm Beach State College Presidential Scholar/Florida Bright Futures Scholar

### **Leadership**

- Mentoring: defined, and oversaw completion of scientific projects for postdocs, graduate researchers, undergraduate researchers, and high school students.
- Collaborated (resulting in publications) with more than 60 research groups/PIs
- Service/Outreach:
  - NASA Space Center Houston/Girls STEM Academy/Exploration Academy outreach project “Quantum Materials in Space” launched on SpaceX CRS-23 Mission to the International Space Station (2022)
  - Mentor—Science Undergraduate Laboratory Internships (SULI) Oak Ridge National Laboratory (08.2020-05.2022)
  - Mentor—Appalachian Regional Commission (ARC)/Oak Ridge National Laboratory (ORNL) High School Summer Math-Science-Technology (2018/2019/2022/2023/2024)
  - Reviewer—DOE Office of Science Graduate Student Research (SCGSR) (2018)
  - *Ask a Scientist* Panel—Centre County PA’s Grange Fair (2017)
  - Penn State Freshmen Seminar Lecture in Mat. Sci.—*Nobel Prize: Topological Insulators in a Nutshell* (2016)
  - Discussion Panel—Drexel University: Materials Research Society Career Panel (2016)
  - Discussion Leader—Palm Beach State College: Graduate School in Science and Engineering (2016)
  - Review Committee—Rutgers Research Experience for Undergraduates (2014)
  - Organization Committee—Student Seminar in Physics and Astronomy at Rutgers (2011-12)
  - Vice President—Graduate Student Organization Rutgers University (2012-13)

### **Teaching Experience**

Penn State University	Fall-2016 & Fall-2015	Co-instructor—Graduate Solid-State Materials
Rutgers University	Fall-2010 & Spring-2011	Teaching Asst.—Honors Physics & Physics for Eng.
Florida Atlantic Uni.	Fall-2010 & Spring-2011	Teaching Asst.—General Physics I & II
Palm Beach State Coll.	2005-2009	Student Learning Center—Math & Physics Tutor

## Publications

Total publications: 114

Google Scholar-Total citations: 6643

h-index: 41

### Publications

#### Preprints

- [114] C. K. Edirisinghe, A. Rathore, T. Lee, D. Lee, A.-H. Chen, G. Baucom, E. Hershkovitz, A. Wijesinghe, P. Adhikari, S. Yeom, H. S. Lee, H.-K. Choi, H. Kim, M. Yoon, H. Kim, [M. Brahlek](#), H. Rho, J. S. Lee, *Controlling structural phases of Sn through lattice engineering*, **arXiv: 2407.17609** (2024).
- [113] I. Gray, Q. Deng, Q. Tian, M. Chilcote, [M. Brahlek](#), L. Wu, *Time-resolved magneto-optical Kerr effect in the altermagnet candidate MnTe*, **2404.05020** (2024).
- [112] J. Zhang, T. Yilmaz, J. W. R. Meier, Y.-Y. Pai, J. Lapano, H. Li, K. Kaznatcheev, E. Vescovo, A. Huon, [M. Brahlek](#), T. Z. Ward, B. Lawrie, R. G. Moore, H. N. Lee, Y. L. Wang, H. Miao, B. Sales, *Flat Band Induced Negative Magnetoresistance in Multi-Orbital Kagome Metal*, **arXiv:2105.08888** (2024).
- [111] G. Rimal, Y. Liu, [M. Brahlek](#), S. Oh, *Thickness-dependent, tunable anomalous Hall effect in hydrogen-reduced PdCoO<sub>2</sub> thin films*, **arXiv:2306.01979** (2024).
- [110] D.J.P. de Sousa, S. Lee, Q. Lu, R. G. Moore, [M. Brahlek](#), J. Wang, G. Bian, T. Low, *Ferroelectric Semimetals with  $\alpha$ -Bi/SnSe van der Waals heterostructures and its Topological Currents*, **arXiv:2311.18026** (2024).

#### Published

- [109] Qi. Lu, P.V. Reddy, H. Jeon, A. R. Mazza, [M. Brahlek](#), W. Wu, S. A. Yang, J. Cook, C. Conner, X. Zhang, A. Chakraborty, Y.-T. Yao, H.-J. Tien, C.-H. Tseng, P.-Y. Yang, S.-W. Lien, H. Lin, T.-C. Chiang, G. Vignale, A.-P. Li, T.-R. Chang, R. G. Moore, G. Bian, *Realization of a two-dimensional Weyl semimetal and topological Fermi strings*, **Nature Communications** 15, 1, 6001 (2024).
- [108] W. Ko, S.-H. Kang, J. Lapano, H. Chang, J. Teeter, [M. Brahlek](#), M. Yoon, R. G. Moore, A.-P. Li, *Interplay between Topological States and Rashba States as Manifested on Surface Steps at Room Temperature*, **ACS Nano** 18, 18405-18411 (2024).
- [107] [M. Brahlek](#), J. D. Roth, L. Zhang, M. Briggeman, P. Irvin, J. Lapano, J. Levy, T. Biro, R. Engel-Herbert, *Hidden transport phenomena in an ultraclean correlated metal*, **Nature Communication** 15, 5304 (2024).
- [106] M. Chilcote, A. R. Mazza, Q. Lu, I. Gray, Q. Tian, Q. Deng, D. Moseley, A.-H. Chen, J. Lapano, J. S. Gardner, G. Eres, T. Z. Ward, E. Feng, H. Cao, V. Lauter, M. A. McGuire, R. Hermann, D. Parker, M.-G. Han, A. Kayani, G. Rimal, L. Wu, T. R. Charlton, R. G. Moore, [M. Brahlek](#), *Stoichiometry-Induced Ferromagnetism in Altermagnetic Candidate MnTe*, **Advanced Functional Materials** 202405829 (2024).
- [105] A. R. Mazza, J. Yan, S. Middey, J. S. Gardner, A.-H. Chen, [M. Brahlek](#), T. Z. Ward, *Embracing Disorder in Quantum Materials Design*, **Applied Physics Letters** 124, 230501 (2024).
- [104] D. Zhang, K. J. Harmon, M. J. Zachman, P. Lu, D. Kim, Z. Zhang, N. Cucciniello, R. Markland, K. W. Ssenyimba, H. Zhou, Y. Cao, [M. Brahlek](#), H. Zheng, M. M. Schneider, A. R. Mazza, Z. Hughes, C. Somodi, B. Freiman, S. Pooley, S. Kunwar, P. Roy, Q. Tu, R. J. McCabe, A. Chen, *High-throughput combinatorial approach expedites the synthesis of a lead-free relaxor ferroelectric system*, **InfoMat** e12561 (2024).
- [103] A.-H. Chen, Q. Lu, E. Hershkovitz, M. L. Crespillo, A. R. Mazza, T. Smith, T. Z. Ward, G. Eres, S. Gandhi, M. M. Mahfuz, V. Starchenko, K. Hattar, J. S. Lee, H. Kim, R. G. Moore, [M. Brahlek](#),

*Interfacially enhanced superconductivity in Fe(Te,Se)/Bi<sub>4</sub>Te<sub>3</sub> heterostructures*, **Advanced Materials** 36, 1, 2401809 (2024).

- [102] T. Z. Ward, R. Wilkerson, B. L. Musicó, A. Foley, [M. Brahlek](#), W. J. Weber, K. E. Sickafus, A. Mazza, *High entropy ceramics for applications in extreme environments*, **Journal of Physics: Materials** 7 021001 (2024).
- [101] J. Yan, A. Kumar, M. Chi, [M. Brahlek](#), T. Z. Ward, M. A. McGuire, *Orbital degree of freedom in high entropy oxides*, **Physical Review Materials** 8, 024404 (2024).

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- [100] D. Jain, H. T. Yi, A. R. Mazza, K. Kisslinger, M.-G. Han, [M. Brahlek](#), S. Oh, *Buffer-layer-controlled nickeline vs zinc-blende/wurtzite-type MnTe growths on c-plane Al<sub>2</sub>O<sub>3</sub> substrates*, **Physical Review Materials** 8, 014203 (2024).
- [99] Y.-Y. Pai, C. E. Marvinney, G. Pokharel, J. Xing, H. Li, X. Li, M. Chilcote, [M. Brahlek](#), L. Lindsay, H. Miao, A. S. Sefat, D. Parker, S. D. Wilson, J. S. Gardner, L. Liang, B. J. Lawrie, *Angular-Momentum Transfer Mediated by a Vibronic-Bound-State*, **Advanced Science** 11, 2304698 (2024).
- [98] P. Adhikari, A. Wijesinghe, A. Rathore, T. J. Yoo, G. Kim, S. Yeom, H.-T. Lee, A. R. Mazza, C. Sohn, H.-R. Park, M. Yoon, [M. Brahlek](#), H. Kim, J. S. Lee, *Structural anisotropy in Sb thin films*, **APL Materials** 12, 011116 (2024).
- [97] [M. Brahlek](#), A. R. Mazza, A. Annaberdiyev, M. Chilcote, G. Rimal, G. B. Halász, A. Pham, Y.-Y. Pai, J. T. Krogel, J. Lapano, B. J. Lawrie, G. Eres, J. McChesney, T. Prokscha, A. Suter, S. Oh, J. W. Freeland, Y. Cao, J. S. Gardner, Z. Salman, R. G. Moore, P. Ganesh, T. Z. Ward, *Emergent magnetism with continuous control in the ultrahigh-conductivity layered oxide PdCoO<sub>2</sub>*, **Nano Letters** 23, 16, 7279-7287 (2023).
- [96] R. G. Moore, T. Smith, X. Yao, Y.-Y. Pai, M. Chilcote, H. Miao, S. Okamoto, S. Oh, [M. Brahlek](#), *Monolayer superconductivity and tunable topological electronic structure at the Fe(Te,Se)/Bi<sub>2</sub>Te<sub>3</sub> interface*, **Advanced Materials** 35, 22, 2210940 (2023).
- [95] [M. Brahlek](#), R. G. Moore, *Surface-state limbo*, **Nature Physics** 4, 1-2 (2023).  
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- [94] A. R. Mazza, E. Skoropata, J. Lapano, M. A. Chilcote, C. Jorgensen, N. Tang, Z. Gai, J. Singleton, [M. Brahlek](#), D. A. Gilbert, T. Z. Ward, *Hole doping in compositionally complex correlated oxide enables tunable exchange biasing*, **APL Materials** 11, 031118 (2023).
- [93] A. R. Mazza, S. R. Acharya, P. Wąsik, J. Lapano, J. Li, B. L. Musico, V. Keppens, C. T. Nelson, A. F. May, [M. Brahlek](#), C. Mazzoli, J. Pellicciari, V. Bisogni, V. R. Cooper, T. Z. Ward, *Variance induced decoupling of spin, lattice, and charge ordering in perovskite nickelates*, **Phys. Rev. Research** 5, 013008 (2023).
- [92] G. Rimal, A. R. Mazza, [M. Brahlek](#), S. Oh, *Diffusion-assisted molecular beam epitaxy of CuCrO<sub>2</sub> thin films*, **JVSTA** 40, 060401 (2022).
- [91] [M. Brahlek](#), M. Gazda, V. Keppens, A. R. Mazza, S. J. McCormack, A. Mielewczyk-Gryń, B. Musico, K. Page, C. M. Rost, S. B. Sinnott, C. Toher, T. Z. Ward, A. Yamamoto, *What is in a name: Defining "high entropy" oxides*, **APL Materials** 10, 110902 (2022).
- [90] X. Yao, A. R. Mazza, M.-G. Han, H. T. Yi, D. Jain, [M. Brahlek](#), S. Oh, *Superconducting Fourfold Fe(Te,Se) Film on Sixfold Magnetic MnTe via Hybrid Symmetry Epitaxy*, **Nano Letters** 18, 7522–7526 (2022).
- [89] G. Ahn, M. Zingl, S. J. Noh, [M. Brahlek](#), J. D. Roth, R. Engel-Herbert, A. J. Millis, and S. J. Moon, *Low-energy interband transition in the infrared response of the correlated metal SrVO<sub>3</sub> in the ultraclean limit*, **Phys. Rev. B** 106, 085133 (2022).

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- [88] B. Sbierski, M. Geier, A.-P. Li, [M. Brahlek](#), R. G. Moore, J. E. Moore, *Identifying Majorana vortex modes via non-local transport*, **Physical Review B** 106 (3), 035413 (2022).

- [87] A. R. Mazza, J. Lapano, H. M. Meyer III, C. T. Nelson, T. Smith, Y.-Y. Pai, K. Noordhoek, B. J. Lawrie, T. R. Charlton, R. G. Moore, T. Z. Ward, M.-H. Du, G. Eres, [M. Brahlek](#), *Surface-Driven Evolution of the Anomalous Hall Effect in Magnetic Topological Insulator  $MnBi_2Te_4$  Thin Films*, **Advanced Functional Materials** 32, 2202234 (2022).  
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- [86] M. A. McGuire, Y.-Y. Pai, [M. Brahlek](#), S. Okamoto, R. G. Moore, *Electronic and topological properties of the van der Waals layered superconductor  $PtTe$* , **Physical Review B** 105, 184514 (2022).
- [85] A. R. Mazza, E. Skoropata, Y. Sharma, J. Lapano, T. W. Heitmann, B. L. Musico, V. Keppens, Z. Gai, J. W. Freeland, T. R. Charlton, [M. Brahlek](#), A. Moreo, E. Dagotto, T. Z. Ward, *Designer Magnetism in High Entropy Oxides*, **Advanced Science**, 9, 10, 2200391 (2022).  
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- [84] Y. Sharma, M.-C. Lee, K. C. Pitike, K. K. Mishra, Q. Zheng, X. Gao, B. L. Musico, A. R. Mazza, R. S. Katiyar, V. Keppens, [M. Brahlek](#), D. A. Yarotski, R. P. Prasankumar, A. Chen, V. R. Cooper, T. Z. Ward, *High Entropy Oxide Relaxor Ferroelectrics*, **ACS Applied Materials & Interfaces** 14, 11962 (2022).
- [83] A. R. Mazza, Q. Lu, G. Hu, H. Li, J. F. Browning, T. R. Charlton, [M. Brahlek](#), P. Ganesh, T. Zac Ward, H. N. Lee, G. Eres, *Reversible Hydrogen-Induced Phase Transformations in  $La_{0.7}Sr_{0.3}MnO_3$  Thin Films Characterized by In Situ Neutron Reflectometry*, **ACS Applied Materials & Interfaces** 14, 10898 (2022).
- [82] J. Zhang, Y.-Y. Pai, J. Lapano, A. R. Mazza, H. N. Lee, R. Moore, B. J. Lawrie, T. Z. Ward, G. Eres, V. R. Cooper, [M. Brahlek](#), *Design and realization of Ohmic and Schottky interfaces for oxide electronics*, **Small Science** 2, 2100087 (2021).  
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- [81] A. R. Mazza, X. Gao, D. J. Rossi, B. L. Musico, T. W. Valentine, Z. Kennedy, J. Zhang, J. Lapano, V. Keppens, R. G. Moore, [M. Brahlek](#), C. M. Rost, T. Z. Ward, *Searching for superconductivity in high entropy oxide Ruddlesden–Popper cuprate films*, **JVSTA**, 40, 013404 (2022).
- [80] Y.-Y. Pai, C. E. Marvinney, M. A. Feldman, B. Lerner, Y. S. Phang, K. Xiao, J. Yan, L. Liang, [M. Brahlek](#), B. J. Lawrie, *Magnetostriction of  $\alpha$ - $RuCl_3$  flakes in the zigzag phase*, *The Journal of Physical Chemistry C*, 125, 46, 25687–25694 (2021).
- [79] J. Zhang, J. M. Ok, Y.-Y. Pai, J. Lapano, E. Skoropata, A. R. Mazza, H. Li, A. Huon, S. Yoon, B. Lawrie, [M. Brahlek](#), T. Z. Ward, G. Eres, H. Miao, H. N. Lee, *Extremely large magnetoresistance in high-mobility heterostructures*, **Physical Review B** 104, L161404 (2021).
- [78] J. Lapano, Y.-Y. Pai, A. R. Mazza, J. Zhang, T. Isaacs-Smith, P. Gemperline, L. Zhang, H. Li, H. N. Lee, H. Miao, G. Eres, M. Yoon, R. Comes, T. Z. Ward, B. J. Lawrie, M. McGuire, R. G. Moore, C. T. Nelson, A. May, [M. Brahlek](#), *Self-regulated growth of candidate topological superconducting parkerite by molecular beam epitaxy*, **APL Materials** 9, 101110 (2021).
- [77] A. R. Mazza, E. Skoropata, J. Lapano, J. Zhang, Y. Sharma, B. L. Musico, V. Keppens, Z. Gai, [M. Brahlek](#), A. Moreo, D. A. Gilbert, E. Dagotto, T. Z. Ward, *Charge doping effects on magnetic properties of single-crystal  $La_{1-x}Sr_x(Cr_{0.2}Mn_{0.2}Fe_{0.2}Co_{0.2}Ni_{0.2})O_3$  ( $0 \leq x \leq 0.5$ ) high-entropy perovskite oxides*, **Physical Review B** 104, 094204 (2021).
- [76] L. Alahmed, B. Nepal, J. Macy, W. Zheng, A. Sapkota, N. Jones, A. R. Mazza, [M. Brahlek](#), W. Jin, M. Mahjouri-Samani, S. S. L. Zhang, C. Mewes, L. Balicas, T. Mewes, P. Li, *Magnetism and Spin Dynamics in Room-Temperature van der Waals Magnet  $Fe_5GeTe_2$* , **2D Materials** 8, 4 045030 (2021).
- [75] S. Thapa, S. R. Provence, D. Jessup, J. Lapano, [M. Brahlek](#), J. T. Sadowski, P. Reinke, W. Jin, R. B. Comes, *Correlating surface stoichiometry and termination in  $SrTiO_3$  films grown by hybrid molecular beam epitaxy*, **J. of Vacuum Science & Technology A** 39, 053203 (2021).
- [74] C. Hua, G. B. Halász, E. Dumitrescu, [M. Brahlek](#), B. J. Lawrie, *Optical vortex manipulation for topological quantum computation*, **Physical Review B** 104, 104501 (2021).

- [73] X. Yao, M. Brahlek, H. T. Yi, D. Jain, A. R. Mazza, S. Oh, *Hybrid symmetry epitaxy of superconducting Fe(Te,Se) film on a topological insulator*, **Nano Letters** 21, 15, 6518–6524 (2021).
- [72] J. Lapano, O. Dyck, A. Lupini, W. Ko, H. Li, H. Miao, H. N. Lee, A.-P. Li, M. Brahlek, S. Jesse, R. G. Moore, *Van der Waals Epitaxy on Freestanding Monolayer Graphene Membrane by MBE*, **ACS Appl. Nano Mater.** 4, 8, 7607–7613 (2021).
- [71] G. Rimal, C. Schmidt, H. Hijazi, L. C. Feldman, Y. Liu, E. Skoropata, J. Lapano, M. Brahlek, D. Mukherjee, R. R. Unocic, M. F. Chisholm, Y. Sun, H. Yu, S. Ramanathan, C.-J. Sun, H. Zhou, S. Oh, *Effective reduction of thin films via hydrogenation and sign tunable anomalous Hall effect*, **Physical Review Materials** 5, L052001 (2021).
- [70] Q. Lu, H. Martins, J. M. Kahk, G. Rimal, S. Oh, I. Vishik, M. Brahlek, W. C. Chueh, J. Lischner, S. Nemsak, *Layer-resolved many-electron interactions in delafossite PdCoO<sub>2</sub> from standing-wave photoemission spectroscopy*, **Communications Physics** 4:143 (2021).
- [69] Y. Sharma, A. R. Mazza, B. L. Musico, E. Skoropata, R. Nepal, R. Jin, A.V. Ievlev, L. Collins, Z. Gai, A. Chen, M. Brahlek, V. Keppens, T. Z. Ward, *Magnetic Texture in Insulating Single Crystal High Entropy Oxide Spinel Films*, **ACS Applied Materials & Interfaces** 13, 15, 17971–17977 (2021).
- [68] E. Skoropata, A. Mazza, A. Herklotz, J. M. Ok, G. Eres, M. Brahlek, H. N. Lee, T. Z. Ward, *Post-synthesis Berry phase engineering in SrRuO<sub>3</sub> films*, **Physical Review B** 103 (8), 085121 (2021).
- [67] J. Lapano, L. Nuckols, A. R. Mazza, Y.-Y. Pai, J. Zhang, B. Lawrie, R. G. Moore, G. Eres, H. N. Lee, M.-H. Du, T. Z. Ward, J. S. Lee, W. J. Weber, Y. Zhang, M. Brahlek, *Adsorption-controlled growth of by molecular beam epitaxy exhibiting stoichiometry-controlled magnetism*, **Physical Review Materials** 4,11,111201 (2020).
- [66] D. Lovinger, M. Brahlek, P. Kissin, D. Kennes, A. Millis, R. Engel-Herbert, R. Averitt, *Influence of spin and orbital fluctuations on Mott-Hubbard exciton dynamics in LaVO<sub>3</sub> thin films*, **Physical Review B** 102 (11), 115143 (2020).
- [65] M. Brahlek, *Criteria for Realizing Room-Temperature Electrical Transport Applications of Topological Materials*, **Advanced Materials** 32 (50), 2005698 (2020).  
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- [64] M. Brahlek, J. Lapano, J. S. Lee, *Topological Materials by Molecular Beam Epitaxy*, **Journal of Applied Physics**, 128 (21), 210902 (2020)  
**Invited in the Special Issue on 2D Quantum Materials: Magnetism and Superconductivity.**
- [63] W. Zhang, A. R. Mazza, E. Skoropata, D. Mukherjee, B. L. Musico, J. Zhang, V. Keppens, L. Zhang, K. Kisslinger, E. Stavitski, M. Brahlek, J. W. Freeland, P. Lu, T. Z. Ward, *Applying configurational complexity to the 2D Ruddlesden-Popper crystal structure*, **ACS Nano** 14 (10), 13030-13037 (2020)
- [62] J. Lapano, A. R. Mazza, H. Li, D. Mukherjee, E. M. Skoropata, J. M. Ok, H. Miao, R. G. Moore, T. Z. Ward, G. Eres, H. N. Lee, M. Brahlek, *Strong spin-dephasing in a topological insulator-paramagnet heterostructure*, **APL Materials** 8 (9), 091113 (2020)
- [61] E. Skoropata, J. Nichols, J. M. Ok, R. V. Chopdekar, E. S. Choi, A. Rastogi, C. Sohn, X. Gao, S. Yoon, T. Farmer, R. D. Desautels, Y. Choi, D. Haskel, J. W. Freeland, S. Okamoto, M. Brahlek, H. N. Lee, *Interfacial tuning of chiral magnetic interactions for large topological Hall effects in LaMnO<sub>3</sub>/SrIrO<sub>3</sub> heterostructures*, **Science Advances** 6, 27 eaaz3902 (2020)
- [60] M. Brahlek, A. R. Mazza, K. Chaitanya Pitike, E. Skoropata, J. Lapano, G. Eres, V. R. Cooper, T. Z. Ward, *Unexpected crystalline homogeneity from the disordered bond network in La(Cr<sub>0.2</sub>Mn<sub>0.2</sub>Fe<sub>0.2</sub>Co<sub>0.2</sub>Ni<sub>0.2</sub>)O<sub>3</sub> films*, **Phys. Rev. Materials** 4, 054407 (2020)

**Editors' Suggestion**

- [59] J. M. Ok, [M. Brahlek](#), W. S. Choi, K. M. Roccapiore, M. F. Chisholm, S. Kim, C. Sohn, E. Skoropata, S. Yoon, J. S. Kim, H. N. Lee, *Pulsed-laser epitaxy of metallic delafossite PdCrO<sub>2</sub> films*, **APL Materials** 8, 5, 051104 (2020)
- [58] Y. Sharma, Q. Zheng, A. R. Mazza, E. Skoropata, T. Heitmann, Z. Gai, B. Musico, P. F. Miceli, B. C. Sales, V. Keppens, [M. Brahlek](#), T. Z. Ward, *Magnetic anisotropy in single-crystal high-entropy perovskite oxide La(Cr<sub>0.2</sub>Mn<sub>0.2</sub>Fe<sub>0.2</sub>Co<sub>0.2</sub>Ni<sub>0.2</sub>)O<sub>3</sub> films*, **Phys. Rev. Materials** 4, 014404 (2020)
- [57] A. Rastogi, [M. Brahlek](#), J. M. Ok, Z. Liao, C. Sohn, S. Feldman, H. N. Lee, *Metal-insulator transition in (111) SrRuO<sub>3</sub> ultrathin films*, **APL Materials** 7, 091106 (2019)

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- [56] [M. Brahlek](#), G. Rimal, J. M. Ok, D. Mukherjee, A. R. Mazza, Q. Lu, H. N. Lee, T. Z. Ward, R. R. Unocic, G. Eres, S. Oh, *Growth of metallic delafossite PdCoO<sub>2</sub> by molecular beam epitaxy*, **Physical Review Materials** 3, 093401 (2019).
- [55] J. Lapano, [M. Brahlek](#), L. Zhang, J. Roth, A. Pogrebnyakov, R. Engel-Herbert, *Scaling growth rates for perovskite oxide virtual substrates on silicon*, **Nature communications** 10, 2464 (2019).
- [54] Z. Liao, [M. Brahlek](#), J. M. Ok, L. Nuckols, Y. Sharma, Q. Lu, Y. Zhang, H. N. Lee, *Pulsed-laser epitaxy of topological insulator Bi<sub>2</sub>Te<sub>3</sub> thin films*, **APL Materials** 7, 041101 (2019).
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- Editors' Choice for 2016-Solid State Communications**
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- Editors' Suggestion Physical Review Letters**
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- [3] Y. S. Kim, [M. Brahlek](#), N. Bansal, E. Edrey, G. A. Kapilevich, K. Iida, M. Tanimura, Y. Horibe, S. W. Cheong, S. Oh, *Thickness-dependent bulk properties and weak anti-localization effect in topological insulator  $Bi_2Se_3$* , **Physical Review B** 84, 073109 (2011).
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## Patents

- [8] [M. Brahlek](#), T. Z. Ward, *Method for facile contamination removal in lithographic applications*, Disclosure (2024)
- [7] [M. Brahlek](#), G. Eres, T. Z. Ward, J. Lapano, R. Moore, A.-H. Chen, Q. Lu *In-situ electronic contacts using Bi-Sn-In solder for UHV applications*, Disclosure (2024)
- [6] R. Moore, [M. Brahlek](#), *Rapid Prototyping Molecular Beam Epitaxy*, Provisional Patent (2022).
- [5] T. Z. Ward, A. Mazza, [M. Brahlek](#), E. Dagatto, *Method of designing magnetism in compositionally complex oxides*, US Patent App. 18118804 (2022).
- [4] R. Moore, J. Lapano, [M. Brahlek](#), *Templated growth of 2D materials on free-standing graphene*, Provisional Patent (2022).
- [3] [M. Brahlek](#), J. Lapano, T. Z. Ward, Gyula Eres, Gaurab Rimal, S. Oh, *Growth of Highly Conducting Epitaxial Delafossite Films by Combining Layer-by-Layer*, Provisional Patent (2020).
- [2] [M. Brahlek](#), E. Dumitrescu, G. Halasz, C. Hua, B. Lawrie, *Electro-optical circuit for performing topological quantum computation*, **201904469** Patent (2021).
- [1] S. Oh, [M. Brahlek](#), N. Koirala, M. Salehi, *Growth of high quality single crystalline thin films with the use of a temporal seed layer*, **15819477** (2018).

## Presentations

## Invited

- 2024.09 Invited Talk, International Conference on Molecular Beam Epitaxy, Matsue, Japan  
2024.08 Colloquium, Paul Scheer Institute, Villigen, Switzerland  
2024.08 Invited Talk, CNMS User Meeting, Knoxville TN  
2024.06 Invited Talk, 2024 Telluride Science Research Center on Quantum Materials for Emergent Applications in Quantum Science, Telluride, CO  
2024.02 Invited Talk, Oak Ridge Postdoc Association, Oak Ridge National Laboratory, Oak Ridge, TN  
2023.10 Colloquium, Physics Department, University of Alabama, Birmingham, AL  
2023.09 Colloquium, Physics Department, University of Missouri, Columbia, MO  
2023.09 Invited Poster, PI meeting, DOE-BES Experimental Condensed Matter Physics  
2023.09 Invited Talk, 2023, North American MBE Conference, Madison WI  
2023.01 Invited Talk, Electronic Materials Conference, Orlando FL  
2022.09 Invited Poster, 2022, Symposium on Quantum Materials Synthesis, Maui, Ha  
2022.06 Invited Talk, 2022 Telluride Science Research Center on The Role of Configurational Complexity in Functional High Entropy Oxides, Telluride, CO  
2022.06 Invited Talk, 2022 Penn Workshop on New Developments in Topological & Correlated Materials, University of Penn., Philadelphia, PA  
2022.01 Invited Talk, Electronic Materials Conference, Orlando FL  
2021.11 Invited Talk, Penn State Materials Science and Engineering, State College, PA  
2021.07 Invited Talk, Center for Predictive Simulations of Functional Materials, Oak Ridge National Laboratory, Oak Ridge, TN (Virtual)  
2021.05 APS/CNM User Meeting on Interpreting Hierarchical Data at Nanocenters and X-ray Users Facilities, Lemont, IL (Virtual)  
2021.01 Invited Talk, Electronic Materials Conference, Orlando FL(Virtual)  
2020.03 Invited Talk, Physics Department, University of Tennessee Knoxville, Knoxville, TN (Virtual)  
2020.10 Invited Talk, Physics Department, Southern Illinois University, Carbondale, Carbondale, IL (Virtual)  
2020.06 Invited Talk, Materials Science and Technology Division- Theory Group Seminar Series, Oak Ridge National Laboratory, Oak Ridge TN (Virtual)  
2019.11 Colloquium, Physics Department, Auburn University, Auburn, AL  
2019.07 Invited Talk, International Conference on Crystal Growth and Epitaxy 2019, Key Stone CO  
2019.07 Invited Talk, Materials Science and Technology Division- Theory Group Seminar Series, Oak Ridge National Laboratory, Oak Ridge TN  
2019.04 Invited Talk, Center for Nanophase Materials Science- CNMS Seminar Series Oak Ridge National Laboratory, Oak Ridge TN  
2017.12 Invited Talk, Oak Ridge National Laboratory, Oak Ridge TN  
2017.11 Colloquium, Materials Science and Engineering, University of Florida, Gainesville, FL  
2017.03 Colloquium, Physics Department, New York University, New York City, NY  
2017.02 Colloquium, Physics Department, Brown University, Providence, RI  
2017.01 Colloquium, Materials Science and Engineering, Uni. of Pennsylvania, Philadelphia, PA  
2017.01 Invited Talk, Electronic Materials Conference, Orlando FL  
2016.10 Richard J. Plano Lecture, Physics Department, Rutgers University, Piscataway, NJ.  
2016.09 Seminar, Materials Science and Engineering, Drexel University, Philadelphia, PA  
2016.07 Seminar, Millennium Sci. Cafe— Pennsylvania State University  
2016.03 Seminar, Current Topics in Physics, Palm Beach State College  
2016.03 Seminar, Honors College Seminar, Palm Beach State College  
2015.10 Seminar, Materials Day—Pennsylvania State University  
2014.05 Seminar, Materials Science and Engineering—University of California Santa Barbara  
2014.05 Seminar, US Army Research Laboratory

## Current Funding

### **Department of Energy-Basic Energy Science**

*Early Career Award*

*“Epitaxially Imposed Control of Chiral Transport Phenomena”*

500K/year; PI

### **Department of Energy-Basic Energy Science/ASCR/HEP**

*Quantum Science Center*

25 million/year; CoPI

### **Laboratory Directed Research and Development/ORNL**

*“Autonomous Ecosystems for Accelerating Materials Design and Discovery”*

560K/year; CoPI

### **Laboratory Directed Research and Development/ORNL**

*“Chiral Materials for Next Generation Quantum Transduction”*

200K/year; PI

### **Department of Energy-Basic Energy Science**

#### **Quantum Information Science**

*“Multiscale Quantum and Classical Microscopy for Superconducting Quantum Systems”*

1.5 million/year; CoPI

### **Department of Energy-Basic Energy Science**

#### **Experimental Condensed Matter Physics**

*“Oxide Quantum Heterostructures”*

2.0 million/year; CoPI

## **Organization**

- **The Materials Colloquium, Materials Science and Technology Division, ORNL** [Founding Organizer]
- **Telluride Science & Innovation Center Workshop 2024** [Lead Organizer]  
*“Quantum Materials for Emergent Applications in Quantum Science”*
- **The American Ceramic Society-Electronic Materials and Applications 2023 Symposium** [Lead Organizer]  
*“Emerging Semiconductor and Quantum Materials and Interfaces”*
- **The Materials Research Society-Spring Meeting 2023** [Coorganizer]  
*“Symmetry-guided Rational design and control of transient and metastable quantum phenomena”*
- **The American Physical Society March Meeting 2022 Symposium** for the Division of Materials Physics [Lead Organizer]  
*“07.01.01 Topological materials: synthesis, characterization and modeling”*
- **The American Ceramic Society-Electronic Materials and Applications 2022 Symposium** [Lead Organizer]  
*“Emerging Semiconductor and Quantum Materials and Interfaces”*
- **Gordon and Betty Moore Foundation-Conference for Young Investigators in Quantum Materials 2021** [Co-Organizer]: postponed due to COVID-19
- **The American Ceramic Society-Electronic Materials and Applications 2021 Symposium** [Coorganizer]  
*“Emerging Semiconductor Materials and Interfaces”*
- **The American Physical Society March Meeting 2020 Sorting Committee**
- **The Materials Research Society-Spring Meeting 2020** [Lead Organizer]  
*“Synthesis and Control of Dirac and Topological Materials”*
- **The American Ceramic Society-Electronic Materials and Applications 2019 Symposium** [Coorganizer]  
*“Complex Oxide and Chalcogenide Semiconductors: Research and Applications”*

- **Oak Ridge National Laboratory's Quantum Materials Workshop** Two-day event with 30+ invited speakers [Coorganizer]
- **Oak Ridge National Laboratory's Energy Materials Seminar Series** [Lead Organizer]

## **Recent Peer Review Referee Activity**

*Science*

*Nature Materials*

*Physical Review Letters*

*Physical Review X*

*Physical Review B*

*Physical Review Materials*

*Physical Review Applied*

*Applied Physics Letters*

*APL Materials*

*Journal of Applied Physics*

*Journal of Vacuum Science and Technology*

*Materials Today*

*Journal of Physics D*

*Nature Communications*

*Science Advances*

*PNAS*

*Advanced Functional Materials*

*Nano Letters*

*Journal of the American Chemical Society*

*MRS Communications*

*Journal of Electronic Materials*

*2D Materials*

*Nature Scientific Reports*

*Nanoscale Advances*

*Nanoscale*