

Robert R. McLeod

Richard and Joy Dorf Endowed Professor of
Electrical, Computer and Energy Engineering
and Materials Science and Engineering Program

Contact Information

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Education

1995	University of Colorado <i>Doctorate of Philosophy in Electrical Engineering</i>	Boulder, CO
1989	University of California <i>Masters of Science in Engineering Applied Science</i>	Davis, CA
1984	Montana State University <i>Bachelors of Science summa cum laude, Honors Program</i>	Bozeman, MT
1985	<i>Masters of Science in Electrical Engineering</i>	

Professional Experience

2017-2021	University of Colorado <i>Director, Materials Science and Engineering Program</i>	Boulder, CO
2015-2017	<i>Department Chair</i>	
2015-	<i>Full Professor</i>	
2014-	<i>Richard and Joy Dorf Endowed Professor</i>	
2013-2015	<i>Materials Science Program Graduate Director</i>	
2012-2015	<i>ECEE Graduate Director</i>	
2010-2015	<i>Associate Professor</i>	
2006-2007	<i>Director, Colorado Center for Information Storage</i>	
2003-2010	<i>Assistant Professor</i>	
2001-2003	JDS Uniphase <i>Director, Photonic Subsystems</i>	San Jose, CA
1999-2001	<i>Senior Manager, Passive Components</i>	
1997-1999	Siros Technologies <i>Manager of Head/Media Group</i>	San Jose, CA
1996-1997	<i>Systems Engineer</i>	
1993 - 1996	Optoelectronic Data Systems <i>Vice President</i>	Boulder, CO

1986-1991 Lawrence Livermore National Lab Livermore, CA
Member of Technical Staff

Consulting Services specializing in design, analysis, IP generation and IP litigation for optoelectronics, optical materials, data storage and telecommunications

2017 Align Technologies
 2017 Thalmic Labs
 2017 Park, Vaughan, Fleming & Dowler
 2015 [RealD vs. MasterImage Inc](#)
 2011 Neurok Technologies
 2010 Townsend, Townsend and Crew
 2007 dBm Optics
 2006 Vescent Photonics
 2005 Science Applications International Corporation
 2004 Ball Aerospace
 2003 InPhase Technologies
 2003 StorageTek

Honors and Awards

2021 **Lab Venture Challenge Award and People's Choice Award**, Camila Uzcategui and John Hergert at the CU Venture Partners Lab Venture Challenge
 2020 **Chancellor's Research Innovation Award and People's Choice Award**, Camila Uzcategui and John Hergert at the CU Venture Partners Lab Venture Challenge
 2020 **Best Student Poster Award**, Archish Muralidharan at the CPIA Photonics Research in Colorado annual meeting
 2020 **Dick Aubin Distinguished Paper Award**, Archish Muralidharan at the RAPID + TCT conference
 2017 **Emil Wolf Outstanding Student Paper Award**, David Miller at the OSA Frontiers in Optics Conference, Washington DC
 2016 **Best Poster Award**, Jacob Friedlein at the Asilomar Bioelectronics Symposium
 2015 **Nature Materials Prize**, Jacob Friedlein at the BioEl2015 International Winter School on Bioelectronics
 2015 **Best Student Poster Award**, Callie Fiedler at the CPIA Photonics Research in Colorado annual meeting
 2015 **Outstanding Performance Award**, ECEE Department, UC Boulder
 2014 **Provost Faculty Achievement Award**, University of Colorado
 2014 **Richard and Joy Dorf Endowed Professorship**
 2014 **Holland Teaching Award** from the University of Colorado
 2014 **Best Paper Award**, Adam Urness at the SPIE Advanced Fabrication Technologies for Micro/Nano Optics and Photonics
 2013 **Intel Outstanding Researcher Award** in Optoelectronics
 2013 **Topical Editor**, Optics Letters, Optical Society of America
 2013 **Fellow**, CU Materials Science and Engineering program

- 2012 **Best Student Poster Award**, Chunfang Ye at the CPIA Photonics Research in Colorado annual meeting
- 2012 **Best Student Poster Award**, Callie Fiedler at the CPIA Photonics Research in Colorado annual meeting
- 2010 **NSF CAREER Award**, Electrical, Communications and Cyber Systems Division of the Engineering Directorate.
- 2010 **General Chair** IEEE/OSA/SPIE Optical Data Storage Conference
- 2010 **Best Student Poster Award**, Adam Urness at the CPIA Photonics Research in Colorado annual meeting
- 2010 **Best Student Poster Award**, Eric Moore at the CPIA Photonics Research in Colorado annual meeting
- 2009 **Dean's Performance Award**, College of Engineering and Applied Science
- 2009 **Provost Achievement Award**, University of Colorado
- 2008 **Best Student Paper Award**, Benjamin Kowalski at the International Symposium on Optical Memory and Optical Data Storage
- 2007 **Best Student Paper Award**, Amy Sullivan at the OSA topical meeting on Controlling Light with Light: Photorefractive Effects, Photosensitivity, Fiber Gratings, Photonic Materials and More
- 2007 **Best Student Poster Award**, Eric Moore at the CPIA Photonics Research in Colorado annual meeting
- 2007 **Faculty Fellowship**, CU College of Engineering and Applied Science
- 2004 **Best Student Poster Award**, Amy C. Sullivan at the CPIA Photonics Research in Colorado annual meeting
- 2004 **Junior Faculty Development Award**, CU Boulder Council on Research and Creative Work
- 2002 **Award for Excellence**, JDS Uniphase
- 1992 **Defense Science and Engineering Fellow**
- 1982 **Phi Kappa Phi**

Publications

Google Scholar [Profile](#)

Peer-Reviewed Journal Papers

1. Sean P. Keyser, Marianela Trujillo-Lemon, Andrew N. Sias, Benjamin D. Fairbanks, Robert R. McLeod, and Christopher N. Bowman, "High Refractive Index, Low Birefringence Holographic Materials via the Homopolymerization of 1,2-Dithiolanes," ACS Applied Materials & Interfaces, 10.1021/acsami.4c09324
2. Thariq Shanavas, Robert R. McLeod, Mark E. Siemens, and Juliet T. Gopinath, "Fast finite difference solver for optical microscopy in deep biological tissue," Optics Letters 49, pp. 4417-4420, 2024, <https://doi.org/10.1364/OL.522382>
3. Eckstein, Kevin N., Hergert, John E., Uzcategui, Asias C., Schoonraad, Sarah A., Bryant, Stephanie J., McLeod, Robert R., Ferguson, Virginia L., "Controlled Mechanical Property Gradients Within a Digital Light Processing

- Printed Hydrogel-Composite Osteochondral Scaffold,” *Ann Biomed Eng* (2024). <https://doi.org/10.1007/s10439-024-03516-x>
4. M. B. Riffe, M. D. Davidson, G. Seymour, A. P. Dhand, M. E. Cooke, H. M. Zlotnick, R. R. McLeod, J. A. Burdick, “Multi-Material Volumetric Additive Manufacturing of Hydrogels using Gelatin as a Sacrificial Network and 3D Suspension Bath” . *Adv. Mater.* 2024, 2309026.
<https://doi.org/10.1002/adma.202309026>
 5. R. R. McLeod, G. G. Maliaras, “Conducting Polymers Take Control of the Field,” *PNAS* **121**(4), e2320855121 Jan. 2024,
<https://doi.org/10.1073/pnas.2320855121>
 6. E. Bihar, E. J. Strand, C. A. Crichton, M. N. Renny, I. Bonter, T. Tran, M. Atreya, A. Gestos, J. Haseloff, R. R. McLeod, and G. L. Whiting, “Self-healable stretchable printed electronic cryogels for in-vivo plant monitoring,” *Nature Flexible Electron.*, vol. 7, no. 1, p. 48, Oct. 2023,
<https://10.1038/s41528-023-00280-1>
 7. J. Madrid-Wolff, J. Toombs, R. Rizzo, P. N. Bernal, D. Porcincula, R. Walton, B. Wang, F. Kotz-Helmer, Y. Yang, D. Kaplan, Y. S. Zhang, M. Zenobi-Wong, R. R. McLeod, B. Rapp, J. Schwartz, M. Shusteff, H. Talyor, R. Levato, and C. Moser, “A review of materials used in tomographic volumetric additive manufacturing,” *MRS Commun.*, Aug. 2023,
<https://doi.org/10.1557/s43579-023-00447-x>
 8. Elliot J. Strand, Mallory J. Palizzi, Catherine A. Crichton, Megan N. Renny, Eloise Bihar, Robert R. McLeod, Gregory L Whiting, “Multimodal Operation of Printed Electrochemical Transistors for Sensing in Controlled Environment Agriculture,” *Sensors and Actuators B: Chemical* **387**, p. 133763, 2023,
<https://doi.org/10.1016/j.snb.2023.133763>
 9. Y. Hu, M. Podgórski, S. Mavila, J. Sinha, B. Fairbanks, R. McLeod, C. Bowman, “Dynamic Polymer Binder with Light-regulated Molecular Weight via Addition-fragmentation Chain Transfer for Holographic Recording,” *Macromolecules* **56**, p. 2536–2541, 2023,
<https://doi.org/10.1021/acs.macromol.2c02334>
 10. Y. Yu, K. M. Fischenich, S. A. Schoonraad, S. Weatherford, A. C. Uzcategui, K. Eckstein, A. Muralidharan, V. Crespo-Cuevas, F. Rodriguez-Fontan, J. P. Killgore, G. Li, R. R. McLeod, N. H. Miller, V. L. Ferguson, S. J. Bryant, and K. A. Payne, “A 3D printed mimetic composite for the treatment of growth plate injuries in a rabbit model,” *Nature Regen. Med.* **7**, no. 1, p. 60, 2022,
<https://doi.org/10.1038/s41536-022-00256-1>
 11. Muralidharan, A., Crespo-Cuevas, V., Ferguson, V.L., McLeod, R.R., Bryant, S.J. “Effects of Kinetic Chain Length on the Degradation of Poly(β -amino ester)-Based Networks and Use in 3D Printing by Projection Microstereolithography,” *Biomacromolecules* **2022**, 23, 8, 3272–3285,
<https://doi.org/10.1021/acs.biomac.2c00362>
 12. Hergert, J.E., Uzcategui, A.C., Muralidharan, A., Crespo-Cuevas, V., Ferguson, V.L., McLeod, R.R., “Grayscale Digital Light Processing and Post-Treatment for the Fabrication of 3D-Printed Polymer Blends,” *Advanced Adv. Eng. Mater.* **2101543**, 2022, <https://doi.org/10.1002/adem.202101543>

13. Hu, Yunfeng; Mavila, Sudheendran; Podgórski, Maciej; Kowalski, Jamie; Mcleod, Robert; Bowman, Christopher, “Manipulating the relative rates of reaction and diffusion in a holographic photopolymer based on thiol-ene chemistry,” *Macromolecules* **2022**, 55, 5, 1822–1833, <https://doi.org/10.1021/acs.macromol.1c02528>
14. Rackson, C., Toombs, J., De Beer M., Cook, C., Shusteff M., Taylor, H., McLeod R.R., “Latent Image Volumetric Manufacturing,” *Optics Letters* **47**, 1279-1282, 2022 <https://doi.org/10.1364/OL.449220>
15. Strand, E. J., Bihar E., Gleason, S. M., Han, S., Schreiber, S. W., Renny, M. N., Malliaras, G. G., McLeod, R. R., Whiting, G. L., “Printed Organic Electrochemical Transistors for Detecting Nutrients in Whole Plant Sap,” *Advanced Electronic Materials* **2021**, 2100853, 2021, <https://doi.org/10.1002/aelm.202100853>
16. Rackson, Charles M., Champley, Kyle M., Toombs, Joseph T., Fong, Erika J., Bansal, Vishal, Taylor, Hayden K., Shusteff, Maxim, McLeod, Robert R., “Object-space optimization of tomographic reconstructions for additive manufacturing,” *Additive Manufacturing* **48**, Part A, 102367, 2021. <https://doi.org/10.1016/j.addma.2021.102367>
17. Schoonraad, S. A., Fischenich, K. M., Eckstein, K., Crespo-Cuevas, V., Savard, L. M., Muralidharan, A., Tomaschke, A. A., Uzcategui, A. C., Randolph, M. A., McLeod, R. R., Ferguson, V. L., Bryant, S. J. “Biomimetic and Mechanically Supportive 3D Printed Scaffolds for Cartilage and Osteochondral Tissue Engineering using Photopolymers and Digital Light Processing,” *Biofabrication* **13**, 044106, 2021, DOI: 10.1088/1758-5090/ac23ab
18. Muralidharan, A., McLeod, R.R. Bryant, S.J., “Hydrolytically degradable Poly (β -amino ester) resins with tunable degradation for 3D printing by projection micro-stereolithography”, *Adv. Funct. Mater.* **2021**, 2106509, 2021 <https://doi.org/10.1002/adfm.202106509>
19. Carberry, B. J., Hergert, J. E., Yavitt, F. M., Hernandez, J. J., Speckl, K. F., Bowman, C. N., McLeod, R. and Anseth, K., “3D printing of sacrificial thioester elastomers using digital light processing for templating 3D organoid structures in soft biomatrices,” *Biofabrication* **13**, 044104, 2021. <https://doi.org/10.1088/1758-5090/ac1c98>
20. Chen, S.-T., Renny, M. N., Tomé, L. C., Olmedo-Martínez, J. L., Udabe, E., Jenkins, E. P. W., Mecerreyes, D., Malliaras, G. G., McLeod, R. R., Proctor, C. M., “Reducing Passive Drug Diffusion from Electrophoretic Drug Delivery Devices through Co-Ion Engineering,” *Adv. Sci.* **2021**, 2003995. <https://doi.org/10.1002/advs.202003995>
21. Uzcategui, A.C., Higgins, C.I., Hergert, J.E., Tomaschke, A.E., Crespo-Cuevas, V., Ferguson, V.L., Bryant, S.J., McLeod, R.R. and Killgore, J.P., “Microscale Photopatterning of Through - Thickness Modulus in a Monolithic and Functionally Graded 3D Printed Part,” *Small Sci.*, 1: 2000017, 2021 <https://doi.org/10.1002/smsc.202000017>

22. McLeod, R.R., "Numerical Technique for Study of Noise Grating Dynamics in Holographic Photopolymers," *Polymers* 2020, 2744, 2020.
<https://doi.org/10.3390/polym12112744>
23. Hu, Y., Kowalski, B.A., Mavila, S., Podgórski, M., Sinha, J., Sullivan, A.C., McLeod, R.R., Bowman, C.N., "Holographic Photopolymer Material with High Dynamic Range (Δn) via Thiol–Ene Click Chemistry," *ACS Applied Materials & Interfaces* **12** (39), 44103-44109, 2020.
<https://doi.org/10.1021/acsami.0c08872>
24. Cook, C. C., Fong, E. J., Schwartz, J. J., Porcincula, D. H., Kaczmarek, A. C., Oakdale, J. S., Moran, B. D., Champley, K. M., Rackson, C. M., Muralidharan, A., McLeod, R. R., Shusteff, M., "Highly Tunable Thiol - Ene Photoresins for Volumetric Additive Manufacturing." *Adv. Mater.* **2020**, 2003376, 2020. <https://doi.org/10.1002/adma.202003376>
25. D. B. Miller, A. Jones, R.R. McLeod, "Contrast analysis in two-beam laser interference lithography," *Applied Optics* **59** (18), 5399-5407, 2020
26. C.I. Higgins, J. Killgore, F.W. DelRio, S. Bryant, R. R. McLeod, "Photo-tunable hydrogel mechanical heterogeneity informed by predictive transport kinetics model," *Soft Matter* **2020**, 4131-4141, 2020. PMID: [PMC7489306](https://pubmed.ncbi.nlm.nih.gov/37489306/), DOI: [10.1039/d0sm00052c](https://doi.org/10.1039/d0sm00052c)
27. M. D. Alim, K. K. Childress, N. J. Baugh, A. M. Martinez, A. Davenport, B. D. Fairbanks, M. K. McBride, B. T. Worrell, J. W. Stansbury, R. R. McLeod, C. N. Bowman, "A photopolymerizable thermoplastic with tunable mechanical performance," *Materials Horizons* **7**, 835-842, 2020.
28. D. B. Miller, M.D. Alim, R. R. McLeod, "Reflection suppression via elastomeric films," *Optics Letters* **44**, 6021-6024, 2019
29. A. Muralidharan, A. C. Uzcategui, R. R. McLeod, S. J. Bryant, "Stereolithographic 3D Printing for Deterministic Control over Integration in Dual - Material Composites," *Advanced Materials Technologies* **4**, 1900592, 2019.
30. M. D. Alim, S. Mavila, D. B. Miller, S. Huang, M. Podgórski, L.M. Cox, A. C. Sullivan, R. R. McLeod, C. N. Bowman, "Realizing High Refractive Index Thiol-X Materials: A General and Scalable Synthetic Approach," *ACS Materials Letters* **2019**, 582-588, 2019.
31. D. B. Miller, A. M. Jones, R. R. McLeod, "Super-resolved critical dimensions in far-field I-line photolithography," *Journal of Micro/Nanolithography, MEMS and MOEMs* **18**, 013505, 2019.
32. J. H. Hergert, D. J. Glugla, A.C. Sullivan, M. D. Alim, R. R. McLeod, "High efficiency Fresnel Lens design and fabrication in a two-stage photopolymer." *Optics Letters* **44**(7), 1540-1543, 2019.
33. J. T. Friedlein, R. R. McLeod, J. Rivnay, "Device Physics of Organic Electrochemical Transistors," *Organic Electronics* **63**, pp. 398-414, 2018.
34. A. C. Uzcategui, A. Muralidharan, V. L. Ferguson, S. J. Bryant, and R. R. McLeod, "Understanding and Improving Mechanical Properties in 3D printed Parts Using a Dual-Cure Acrylate-Based Resin for Stereolithography," *Advanced Engineering Materials* **2018**, 1800876, 2018.

35. V. Venkatraman, J. Friedlein, I. McCulloch, R. R. McLeod, J. Rivnay, "Subthreshold operation of organic electrochemical transistors for bio-amplification," *Advanced Science* **5**, 1800453, 2018.
36. D. J. Glugla, M. B. Chosy, M. D. Alim, K. K. Childress, A. C. Sullivan, R. R. McLeod, "Multiple patterning of holographic photopolymers for increased refractive index contrast," *Optics Letters* **43**, pp. 1866-1869, 2018.
37. D. J. Glugla, M. B. Chosy, M. D. Alim, A. C. Sullivan, R. R. McLeod, "Transport-of-Intensity-Based Phase Imaging to Quantify the Refractive Index Response of 3D Direct-Write Lithography," *Optics Express* **26**, pp. 1851-1869, 2018.
38. M. D. Alim, D. J. Glugla, S. Mavila, C. Wang, P. D. Nystrom, A. C. Sullivan, R. R. McLeod, C. N. Bowman, "High dynamic range (Δn) two-stage photopolymers via enhanced solubility of a high refractive index acrylate writing monomer," *ACS Applied Materials & Interfaces* **10**, pp. 1217-1224, 2018.
39. Elizabeth A Aisenbrey, Andrew Tomaschke, Eric Kleinjan, Archish Muralidharan, Cecilia Pascual-Garrido, Robert R McLeod, Virginia L. Ferguson, Stephanie J Bryant, "A Stereolithography-based 3D printed Hybrid Scaffold for In Situ Cartilage Defect Repair," *Macromol. Biosci.* 2017, 1700267, 2017
40. Mary Donahue, Adam Williamson, Xenofon Strakosas, Jacob Friedlein, Robert McLeod, Helena Gleskova, George G. Malliaras, "High Performance Vertical Organic Electrochemical Transistors," *Advanced Materials* 2017, 1705031, 2017
41. J. T. Friedlein, J. Rivnay, D. H. Dunlap, I McCulloch, S. E. Shaheen, R. R. McLeod, George G. Malliaras, "Influence of disorder on transfer characteristics of organic electrochemical transistors," *Applied Physics Letters* **111**, 023301 (2017)
42. C. I. Fiedler, E. A. Aisenbrey, J.A. Wahlquist, C. M. Heveran, V. L. Ferguson, S. J. Bryant, and R. R. McLeod, "Enhanced mechanical properties of photo-clickable thiol-ene PEG hydrogels through repeated photopolymerization of in-swollen macromere," *Soft Matter* **12**, 9095 – 9104, 2016
43. D. J. Glugla, M. Alim, K. Byars, D. P. Nair, C. N. Bowman, K.K. Maute, R. R. McLeod, "Rigid Origami via Optical Programming and Deferred Self-Folding of a Two-Stage Photopolymer," *ACS Applied Materials & Interfaces*, *ACS Applied Materials & Interfaces* **8**, 29658-29667, 2016
44. Z. D. Marks, D. Glugla, J. T. Friedlein, S. M. Shaheen, R. R. McLeod, M. Y. Kahook and D. P. Nair, "Switchable diffractive optics using patterned PEDOT/PSS based electrochromic thin-films," *Organic Electronics* **37**, 271-279, 2016
45. J. T. Friedlein, M. J. Donahue, S. E. Shaheen, G. G. Malliaras, and R. R. McLeod, "Microsecond Response in Organic Electrochemical Transistors: Exceeding the Intrinsic Speed Limit," *Advanced Materials* **28**, 8398–8404, 2016.

46. B. A. Kowalski, R. R. McLeod, "Design concepts for diffusive holographic photopolymers," *J. Polymer Science Part B: Polymer Physics* **54**, 1021-1035, 2016
47. M. I. Bodine, R. R. McLeod, "Superresolved swept wavelength interferometry using frequency estimation methods," *Optics Letters* **41**, 159-162, 2016
48. J. T. Friedlein, S. E. Shaheen, G. G. Malliaras, R. R. McLeod, "Optical measurements revealing non-uniform hole mobility in organic electrochemical transistors," *Advanced Electronic Materials* **2015**, pp. 1500189 (9 pages), 2015.
49. A. Aguirre-Soto, A. T. Hwang, D. Glugla, J. W. Wydra, R. R. McLeod, C. N. Bowman, J. W. Stansbury, "Coupled UV-Vis/FT-NIR Spectroscopy for Kinetic Analysis of Multiple Reaction Steps during polymerizations," *Macromolecules* **48**, pp. 6781-6790, 2015.
50. Darren L. Forman, Robert R. McLeod, Parag K. Shah, Jeffrey W. Stansbury, "Evaporation of low volatility components in polymeric dental resins," *Dental Materials* **31**, pp. 1090-1099, 2015.
51. A.C. Urness, K. Anderson, W. L. Wilson and R. R. McLeod, "Arbitrary 2D GRIN lens fabrication in diffusive photopolymers," *Optics Express* **23**, pp. 264–273, 2015.
52. H. Peng, C. Wang, W. Xi, B. A Kowalski, T. Gong, X. Xie, W. Wang, D. P. Nair, R. R. McLeod, C. N. Bowman, "Facile Image Patterning via Sequential Thiol-Michael/Thiol-Yne Click Reactions," *Chemistry of Materials* **26**, pp. 6819–6826, 2014.
53. R. R. McLeod and K. H. Wagner, "Vector Fourier Optics of Anisotropic Materials," *Advances in Optics and Photonics* **6**, pp. 368-412 ,2014.
54. S. Shajee, L. Y. Pao, and R. R. McLeod, "Optimizing the Layout of Heaters for Distributed Active De-icing of Wind Turbine Blades," *Wind Engineering* **38**, pp. 587-600, 2014.
55. B. A. Kowalski, A. C. Urness, M-E. Baylor, M. C. Cole, W. L. Wilson, R. R. McLeod, "Quantitative modeling of the reaction/diffusion kinetics of two-component diffusive photopolymers," *Optics Materials Express* **4**, pp. 1668-1682, 2014.
56. H. Peng, D. P. Nair, B. A. Kowalski, W. Xi, T. Gong, C. Wang, M. Cole, N. B. Cramer, X. Xie, R. R. McLeod, and C. N. Bowman, "High performance graded rainbow holograms via two-stage sequential orthogonal thiol-click chemistry," *Macromolecules* **47**, no. 7, pp. 2306–2315, 2014.
57. D. L. Forman, M C. Cole and R. R. McLeod, "Radical diffusion limits to photoinhibited superresolution lithography," *Phys. Chem. Chem. Phys.* **15** (36), 14862 – 14867, 2013.
58. A. Linnenberger, M. I. Bodine, C. Fiedler, J. J. Roberts, S. C. Skaalure, S. J. Bryant M. Cole, R. R. McLeod, "Three Dimensional Live Cell Lithography," *Optics Express* **21**, 10269-10277, 2013. **Selected for co-publication in the Virtual Journal for Biomedical Optics, vol 8 (2013).**
59. M.R. Gleeson, Y. Tomita, S. Gallego, and R. McLeod, "Advances in Novel Optical Materials and Devices," *Physics Research International* **2013**, Article ID 430947, 2 pages, 2013.

60. Adam C. Urness, Eric D. Moore, Keith K. Kamysiak, Michael C. Cole, Robert R. McLeod, "Liquid Deposition Photolithography for sub-micron resolution three-dimensional index structuring with large throughput," *Light: Science and Applications* **2**, e56, 2013.
61. Martha-Elizabeth Baylor, Benjamin W. Cerjan, Charlotte R. Pfiefer, Robert W. Boyne, Charles L. Couch, Neil B. Cramer, Christopher N. Bowman, Robert R. McLeod, "Monolithic integration of optical waveguide and fluidic channel structures in a Thiol-ene/Methacrylate photopolymer," *Optical Materials Express* **2**, 1548-1555, 2012.
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63. D. P. Nair, N. B. Cramer, J. C. Gaipa, M. K. McBride, R. R. McLeod, R. Shandas, C.N. Bowman, "Two-Stage Reactive Polymer Network Forming Systems," *Advanced Functional Materials* **2012**, 1-9, 2012.
64. T.F. Scott, C. Kloxin, D. Forman, R. R. McLeod, C. Bowman, "Principles of voxel refinement in optical direct write lithography," *J. Mater. Chem* **21**, 14150-14155, 2011.
65. E. D. Moore, R. R. McLeod, "Phase-sensitive swept-source interferometry for absolute ranging with application to measurements of group refractive index and thickness," *Optics Express* **19**, 8117-8126, 2011. Selected for co-publication in the *Virtual Journal for Biomedical Optics* **3**, 2011.
66. M. R. Gleeson, S. Liu, R. R. McLeod, J. T. Sheridan, "Nonlocal Photo-Polymerization Kinetics Including Multiple Termination Mechanisms and Dark Reactions: Part II. Experimental Validation," *JOSA B* **26**, 1746-1754, 2009.
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69. R. R. McLeod, "Impact of phase aberrations caused by multilayer optical data storage in weakly inhomogeneous media," *JOSA B* **26**, 308-317, 2009.
70. C. Ye, R. R. McLeod, "GRIN lens and lens array fabrication with diffusion-driven photopolymer," *Optics Letters* **33**, 2575-2577, 2008.
71. E. D. Moore, R. R. McLeod, "Correction of sampling errors due to laser tuning rate fluctuations in swept-wavelength interferometry," *Optics Express* **16**, 13139-13149, 2008. **Selected for co-publication in the Virtual Journal for Biomedical Optics, vol 3 (2008)**
72. R. R. McLeod, A. J. Daiber, T. Honda, M. E. McDonald, T. L. Robertson, T. Slagle, S. L. Sochava, and L. Hesselink, "Three-dimensional optical disk data storage via the localized alteration of a hologram," *Applied Optics* **47**, 2696-2707, 2008.
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3. R. R. McLeod, A. C. Sullivan, D. J. Glugla, M. D. Alim, "Self-actuated origami via optically patterned photopolymer gels," XXVI International Materials Research Congress, Cancun, Aug 21, 2017.
4. R. R. McLeod, "Multiple patterning lithography far beyond the diffraction limit," 2016 Lithography Workshop, Kamuela, HI.
5. R. R. McLeod, "Control of photopolymer properties through structured illumination," Photopolymerization: Past, Present and Future, Estes Park 2016
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56. M.R. Ayres, R.R. McLeod, "Volumetric Phase Metrology for Optical Data Storage," *Optical Data Storage Topical Meeting 2006*, 132- 134, Montreal, CA, April 2006.

57. C. D. Anderson, R. R. McLeod, M. W. Grabowski, A. C. Sullivan, "Photopolymer Waveguide to Fiber Coupling via 3D Direct-Write Lithography," in *Integrated Photonics Research and Applications/Nanophotonics 2006 Technical Digest*, 3 pages (Optical Society of America, Washington, DC, 2006), ITuD4
58. M. W. Grabowski, A. C. Sullivan, R. R. McLeod, "3D Direct-Write Waveguides in Diffusion Photopolymers," in *Integrated Photonics Research and Applications/Nanophotonics 2006 Technical Digest*, 3 pages (Optical Society of America, Washington, DC, 2006), ITuD5
59. R. R. McLeod, A. J. Daiber, M. E. McDonald, S. L. Sochava, T. Honda, T. L. Robertson, T. Slagle, and L. Hesselink, "Holographic Storage without Holography: Optical Data Storage by Localized Alteration of a Format Hologram," in *International Symposium on Optical Memory and Optical Data Storage*, OSA Technical Digest Series (Optical Society of America, 2005), paper MB1.
60. S. Kim, L. Gao, and K. H. Wagner, R. T. Weverka, and R. McLeod, "Acousto-Optic Tunable Filter Using Phased-Array Transducer with Linearized RF to Optical Frequency Mapping," *Proc. SPIE* **5953**, 59530M, 2005.
61. R. R. McLeod, A. J. Daiber, M. E. McDonald, S. L. Sochava, T. L. Robertson, T. Slagle, and L. Hesselink, "Micro-Holographic Multi-Layer Optical Disk Data Storage," in *International Symposium on Optical Memory and Optical Data Storage*, OSA Technical Digest Series (Optical Society of America, 2005), paper MB3.
62. R. R. McLeod, S. K. Walter, "Acousto-optic parallel read/write head for optical disk data storage," *International Symposium on Optical Memory and Optical Data Storage*, Paper WB3, Honolulu, HI, July 2005.
63. L. Gao, K. H. Wagner, R. McLeod, "Dispersion-Managed Light Bullets and Their Interactions," *OSA Nonlinear Guided Waves and Their Applications Technical Digest*, Dresden, Germany, Sept 2005.
64. A. C. Sullivan, M. W. Grabowski, R. R. McLeod, "Tomographic Reconstruction of 3D Index Structures in Photopolymer," *Integrated Photonics Research and Applications Technical Digest*, San Diego, CA, April 2005.
65. L. Gao, R. McLeod, and K. Wagner, "Dispersion-Managed (3+1)-D Optical Solitons for Ultrafast Switching and Wavelength Conversion," *Proc. SPIE* **5556**, 57, 2004.
66. Lu Gao, Robert McLeod, Kelvin H. Wagner, "Ultrafast all-optical wavelength conversion based on (3+1)-D optical soliton dragging interaction", *Proc. SPIE* Vol. 5556, p. 57-67, *Photonic Devices and Algorithms for Computing VI*, Denver, CO, August 2004
67. Robert R. McLeod, Amy C. Sullivan, Matthew Grabowski, "Direct-write waveguides in volume photopolymers," *Integrated Photonics Research and Applications*, Paper JWB24, San Francisco, CA, June 2004.
68. Robert R. McLeod, Amy C. Sullivan, Matthew W. Grabowski, Timothy F. Scott, "Hybrid integrated optics in volume holographic photopolymer", *Proc. SPIE* **5521**, 55, 2004.

69. T. Honda, A.C. Liu, J. Valera, J. Colvin, R. R. McLeod, K. Sawyer, "Diffraction-compensated free-space wavelength add/drop module with thin-film filters," in *Optical Fiber Communications Conference*, A. Sawchuk, ed., Vol. 70 of OSA Trends in Optics and Photonics, 323- 324 (Optical Society of America, 2002), paper WS5
70. X. Li, F. Dimov, W. Phillips, L. Hesselink, and R. McLeod, "Parallel Associative Search by Use of a Volume Holographic Memory", *Proceedings of 29th Applied Imagery Pattern Recognition Workshop*, pp.78-83, Washington, DC, October 2000.
71. J. Gamo-Aranda, R. R. McLeod, P. R. Horche, K. H. Wagner, "Rapid reconfiguration in an acousto-optic crossbar interconnection network," *Proc. SPIE* **3805**, 11, 1999.
72. J. Gamo, P. R. Horche, R. McLeod, K. Wagner, "Dynamic switching of an acousto-optic photonic crossbar," *Proceedings of Advances in Acousto-Optics AAO'99*, 27-28, Firenze, Italy, June 1999.
73. S. Blair and K. Wagner and R. McLeod, "(2+1)-D spatio-temporal solitary-wave dragging," *OSA topical meeting on Nonlinear Optics: Materials, Fundamentals, and Applications*, 482-484, Maui HI, July 1996.
74. R. McLeod, K. Wagner, and S. Blair, "Robust light bullet dragging logic," *1995 OSA topical meeting on Optical Computing*, Salt Lake City UT, March 1995.
75. R. McLeod, K. Wagner, and S. Blair, "Collisions of stable spatio-temporal solitons," *1995 OSA topical meeting on nonlinear optical guided waves*, Dana Point, CA, February 1995.
76. S. Blair, K. Wagner, and R. McLeod, "Orthogonally polarized soliton interactions for all optical logic," *1995 OSA topical meeting on nonlinear optical guided waves*, Dana Point, CA, February 1995.
77. Robert McLeod, Steve Blair, and Kelvin Wagner, "Asymmetric light bullet dragging logic," *Optical Computing 1994*, Edinburgh Scotland, August 1994.
78. K. -Y. Wu, R. McLeod, S. Kwiatkowski, R. T. Weverka, K. Wagner, and A. Mickelson, "Integrated AO space-division optical crossbar," in *Conference on Optical Fiber Communication*, Vol. 4 of 1994 OSA Technical Digest Series (Optical Society of America, 1994), paper WL9.
79. K. Wagner, R. McLeod, "Spatial soliton dragging gates and light bullets," in *Optical Computing*, Vol. 7 of 1993 OSA Technical Digest Series (Optical Society of America, Washington, D.C., 1993), pp. 305-307.
80. R. McLeod, R.T. Weverka, K.Y. Wu, K. Wagner, A. Mickelson, R. Roth, "Acoustooptic Crossbar Photonic Switch," *OSA Topical Mtg. on Photonics in Switching*, Palm Springs CA, March 1993.
81. R. R. McLeod, R. J. Hawkins, "Using the Finite Difference Time Domain Method as a Design Tool," *Integrated Photonics Research, OSA Technical Digest Series Vol. 10*, 38-39, paper MB17, New Orleans, LA, April 1992.
82. R. J. Hawkins, R. R. McLeod, J.S. Kallman, R.P. Ratowsky, M.D. Feit, J. A. Fleck, Jr., "New Directions in Photonics Simulations: Lanczos Recursion and Finite-Difference Time-Domain," *Seventh IMACS International Conference on Computer Methods for Partial Differential Equations*, New Brunswick, New Jersey, June 1992.

83. R. J. Hawkins and R. McLeod, "Finite-difference time-domain simulations of linear integrated photonic devices," *IEEE Antennas Propagation Society International Symposium Digest*, vol. 1, 261., New York, July 1992,
84. R. McLeod, R.J. Hawkins, J.S. Kallman, "Simulation of planar integrated photonics devices with the LLNL time-domain finite-difference code suite," *Integrated Photonic Research/Gradient Index Optic System (IPR/GIOS) Workshop*, Monterey, CA, April 1991.
85. Barth, Marvin; Pennock, Steve; Ziolkowski, Richard; McLeod, R., "Modeling pulse driven antenna systems with finite differences," *6th Annual Review of Progress in Applied Computational Electromagnetics*, Monterey, CA, March 1990.
86. B. K. Cabral, G. W. Laguna, R. R. McLeod, S. L. Ray, S. T. Pennock, R. L. Berger, and M. F. Bland, "Interactive pre and post-processing tools for finite-difference time-domain codes," *IEEE Antennas and Propagation Society International Symposium*, 1098-1099, San Jose, CA, June 1989.
87. J.F. DeFord, G.D. Craig, R. McLeod, "The AMOS (Azimuthal Mode Simulator) Code," *Proceedings of the 1989 IEEE Particle Accelerator Conference*, 1181-1183, Chicago, IL, March 1989.
88. S. T. Pennock, R. R. McLeod, and H. G. Hudson, "Finite-difference time-domain modeling of electromagnetic radiation from an electron beam," *5th Annual Review of Progress in Applied Computational Electromagnetics*, volume 1, 360-372, Monterey, CA, March 1989.
89. R. R. McLeod, S. T. Pennock, and M. J. Barth, "Time domain analysis of waveguide fed antennas," in *Proceedings of the 1989 URSI Radio Science Meeting.*, p. 269, June 1989.
90. McLeod, R. R.; Berger, R. L.; Bacon, L. D. "Time domain modeling of electromagnetic coupling," *4th National Conference on High Power Microwave (HPM) Technology for Defense Applications*, Monterey, CA, May 1988.
91. McLeod, R. R.; Hudson, H. G.; King, R. J., "Magnitude and phase calibration of microwave sensors," *National Radio Science Meeting*, Boulder, CO, January 1986.
92. B.R. McLeod, R.R. McLeod, "Experimental Measurements on a large-scale Helmholtz Coil – Broken Bone Model," *5th Annual BRAGS*, Boston, Massachusetts, October 1985

Peer-Reviewed Conference Proceedings (in review)

Seminars and Tutorials

1. R. R. McLeod, "Structuring Material with Light: Photolithography Beyond Moore's Law," Montana State University College of Engineering Seminar, Bozeman, MT, Feb 2011.
2. R. R. McLeod, "Structuring Material with Light: Photolithography Beyond Moore's Law," Optical, Electronic and Quantum Systems Seminar, Boulder CO, Feb 2011.
3. R. R. McLeod, "3D optical manipulation of photopolymers," ICAM Summer School, Brisbane Australia, June 2010

4. R. R. McLeod, "3D single-mode, hybrid integrated optics in solid photopolymers," Fraunhofer Institute, Würzburg Germany, June 2010
5. R. R. McLeod, Susanna Orlic, "Microholographic recording", *Optical Data Storage Topical Meeting 2010*, Boulder, CO, May 2010
6. R. R. McLeod, Susanna Orlic, "Microholographic recording", *Optical Data Storage Topical Meeting 2009*, Lake Buena Vista, FL, May 2009
7. R. R. McLeod, "Two color lithography beyond the diffraction limit," CU IEEE Student Chapter, Boulder CO, May 2009
8. R. R. McLeod, C. Anderson, E. Moore, M. W. Grabowski, A. C. Sullivan, "Hybrid Integrated Photonics," on-site seminar, Lockheed Martin, Louisville, CO, May 2006.
9. R. R. McLeod, E. Moore, A. C. Sullivan, M. Grabowski, C. Anderson, "Hybrid Integrated Photonics in 3D Photopolymers: Integrating nanophotonics into complex systems," NIST Nanoscience and Applications Conference, Boulder, CO October 2005.
10. R. R. McLeod, "Hybrid Integrated Photonics in 3D Photopolymer," on-site seminar, Lawrence Livermore National Laboratory, Livermore, CA August 2005.
11. R. R. McLeod, "Hybrid Integrated Photonics in 3D Photopolymer," on-site seminar, Intel Corporation, San Jose, CA August 2005.
12. R. R. McLeod, "Hybrid Integrated Photonics," on-site seminar, JDS Uniphase, San Jose, CA, June 2004.
13. R. R. McLeod, "Hybrid Integrated Photonics Development at CU," on-site seminar, Coherent Technologies, Louisville, CO, October 2003.
14. "CDMA Search of holographic digital data storage," on-site seminar, StorageTek, Louisville, CO, October 2003.
15. R. R. McLeod, "Optical Data Storage and Communications Devices in 3D Photopolymers," Optical Sciences and Engineering Program Seminar, Boulder, CO, September 2003.
16. R. R. McLeod, "Next Generation Telecom Components", Stanford Center for Novel Opto-Electronic Materials Annual Meeting, Stanford, CA, September 2000.

Unclassified Government Reports

1. R. J. Hawkins, R.R. McLeod, J.S. Kallman, R.P. Ratowsky, M.D. Feit, J.A. Fleck Jr. "New directions in photonics simulation: Lanczos recursion and finite-difference time-domain," 1992.
2. R. R. McLeod, "Temporal scattering and reflection software users manual, version 2.3" Report UCRL-MA--104861-Ver.2-3, Lawrence Livermore National Laboratories, Livermore, CA, 1992.
3. J.F. Deford, G. D. Craig, R.R. McLeod, "The AMOS (Azimuthal MOde Simulator) wakefield code," Report UCRL-102731;CONF-900163—4, 1990.
4. R. R. McLeod, "Temporal scattering and reflection software, Users Manual," Report UCID-21637, Lawrence Livermore National Laboratories, Livermore, CA, 1989.

5. B.K. Cabral, G.W. Laguna, R.R. McLeod, S.L. Ray, S. T. Pennock, R.L. Berger, M.F. Bland, "Interactive pre- and post-processing tools for finite-difference time-domain codes," Report UCRL-100237; CONF-890660—11, 1989.
6. R.R. McLeod, R.L. Berger, L.D. Bacon, "Time domain modeling of electromagnetic coupling," Report UCRL-97831;CONF-8805132-14, 1989.
7. R.J. King, H.G. Hudson, R.R. McLeod, "EM laboratories for linear coupling," Report UCID-20954, 8 pages, Lawrence Livermore National Lab, Livermore, CA, 1987.
8. R.R. McLeod, H.G. Hudson, H.S. Cabayan, R.J. King, "Experiments in high power microwave susceptibility simulation issues," Report UCID-20851, 16 pages, Lawrence Livermore National Lab, Livermore, CA, 1986.
9. R.R. McLeod, H.G. Hudson, R.J. King, "Magnitude and phase calibration of microwave sensors," Report UCRL-95475;CONF-860198-1, 1986.

Research Grants and Contracts (University of Colorado only)

Research Equipment and Facilities Grants Awarded, (all as PI except where noted)

1. CU Provost and College of Engineering, "Office space and lab renovation", Total: \$21,408, Award Date May 2013.
2. National Science Foundation, "EAGER: Shared Materials Plotter for Organic Robotics," Total: \$30,000, Award Date Aug 2012
3. College of Engineering, "Expansion of Nanolithography Laboratories," Total: \$12,000, Award Date: June 2011.
4. CU Provost and College of Engineering, "Augmentation of Shared Nano-Scale Characterization Facility for Advanced Materials and Biological Systems," Total: \$80,000, Award Date: November, 2006, *Co-PI with Rafael Piestun*
5. CU Provost and College of Engineering, "Recirculated Chilled Water for Lasers in ECE and Optics Research and Teaching," \$260,000, Award Date: November 2006
6. Engineering Excellence Fund, "Undergraduate Optics Lab Computer and Remote Instrumentation," Total \$25,750, February 2006
7. CU College of Engineering: "Photopolymer Testing and Packaging," Total: \$15,000, Award date: March 2005.
8. ILX Lightwave University Donation Program: "Optical Circuits Lab Instrumentation," Total \$10,000, Award date: August 2005.
9. InPhase Technologies: "Optical data storage equipment donation", Total: \$53,000, Award date: January 2005
10. JDS Uniphase: "Integrated Optics Research Facility," Total: \$871,612, Award date: August 2003.

Research Grants and Contracts Awarded (all as PI except where noted)

1. NIH Diversity Supplement, 290K\$, PI
2. CU Venture Partners Chancellor's Research Innovation Award, "Vitro3D - Biomimetic 3D Printed Scaffolds for Drug Discovery," PI, \$50K, Jan 2020 – Dec 2022

3. CU AB Nexus Program, “Biophysical Cues Governing Growth Plate Organization: A Computational & Experimental Approach,” Co-I, 125K\$, Dec 2020 – Dec 2021
4. NIH NINDS R01 NS118188, “Optimization of a Minimally-Invasive Bidirectional Optogenetic Peripheral Nerve Interface with Single Axon Read-in & Read-out Specificity”, \$624K, Co-I, Sept 2020-Aug 2025.
5. NSF 1935594, “SitS NSF-UKRI: Phytoelectronic Soil Sensing,” \$800K, PI, Jan 2020 – Dec 2022
6. CU Research and Innovation Office, “Touchless stereolithography of 3D heterogeneous tissues within sealed microfabricated platforms to enable *in vitro* biomedical research,” 50K\$, PI, July 2019 – Dec 2020
7. Quantum Explorations in Science & Technology, “Ultrastable spatial light modulators for quantum state assembly with neutral atoms and entanglement-assisted clocks,” \$50,000, co-PI. Jan 2019 – Dec 2019
8. Lawrence Livermore National Lab, “Advanced Photopolymer Materials Engineering for Multiscale Additive Fabrication,” \$200,000, Dec 2018 – Nov 2021
9. Facebook Reality Labs, “High Performance Holographic Photopolymers,” \$1,555,000, Nov 2018 – Dec 2020
10. DoEd P200A180070 “Graduate Program in Soft Materials,” \$895,500, Oct 2018 – Sept 2021
11. NSF 1826454, “GOALI: Projection Stereolithography of Gradient Viscoelastic Polymer Nanocomposites,” \$399,199, Oct 2018 – Sept 2021
12. NIH, “Mechanically Stiff Hydrogels for Osteochondral Tissue Engineering,” \$462,486, co-PI, July 2016 – June 2019
13. NIH SPARC 1 OT2 OD023852-01, “Development of a Bidirectional Optogenetic Minimally Invasive Peripheral Nerve Interface with single axon read-in & read-out specificity,” \$120,699 (McLeod portion), co-PI, Oct 2017 – Sept 2019
14. NSF “MRI: Acquisition of a 4D High-Resolution X-Ray Micro-Computed Tomography System for the Rocky Mountain Region,” \$801,508, co-PI, Sept 2017 – Aug. 2018
15. Sandia National Labs, “Super-resolution Near UV Projection Lithography,” \$117,000, PI, Oct. 2017 – Sept 2019
16. NSF 1721055, “STTR Phase 1: On-demand optical printing of high-performance personalized eyeglass lenses,” \$100,000, PI, July 2017 – June 2018.
17. CU Innovative Seed Grant Program, “Liquid Crystal Polymer masks: A new optical element,” \$50,000, July 2016 – June 2017
18. Photopolymerizations Center, “Improving 3D Photocured Systems,” \$35,000, Jan 2016 – Dec 2018
19. Colorado Advanced Industries Accelerator Program, “High Throughput Additive Manufacturing,” \$100,000, Feb 2016 – Jan 2018
20. National Science Foundation, “Precision Organic Electrochemical Transistors for Single-Cell Electrophysiology,” \$389,985, June 2015 – May 2018
21. Konica Minolta, “Modeling of Holographic Photopolymers,” \$80,000, co-PI with Christopher Bowman, Aug 14 – July 15

22. National Science Foundation, “MRSEC: Soft Materials Research Center,” \$12,000,000, McLeod portion \$772,000. Nov 2014 – Oct 2020. *Co-investigator*.
23. National Science Foundation, “GOALI: Two-photon optical origami of intraocular lenses,” \$75,000, Aug 2014 – July 2015.
24. NIH SBIR, “Three Dimensional Living Neural Networks,” Grant # 1R43MH102946-01, \$116,357, Duration: July 2014 – June 2016
25. CU Innovative Seed Grant Program (Steve George, PI), “High Resolution Lithography using Molecular Layer Deposition with Photoremovable Protecting Groups,” \$50,000, Duration: July 2013 – June 2014.
26. National Science Foundation, “STTR Phase 1: Multistatic Spectral Interferometry for Precision Profilometry,” \$37,192, Jan 2013 – June 2013.
27. National Science Foundation, “GOALI: Holographic Passive Solar Concentration and Lighting,” \$375,000, Aug 2013 – July 2016.
28. Oracle Corporation, “Super Resolution Optical Storage,” \$200,000. 2012-2015
29. National Science Foundation, “EFRI-ODISSEI: Photo-Origami,” Total \$2,000,000, McLeod portion: \$465,116, Duration Aug 2012 – July 2016
30. National Science Foundation, “TECP: 3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides,” Total: \$38,375, Duration Aug 2012 – Jan 2013
31. Department of Education Graduate Assistance in Areas of National Need, “Graduate Program in Functional Materials,” \$666,330, Duration Aug 2012 – Aug 2015, award number P200A120063.
32. National Science Foundation, “GOALI supplement: 3D Optoelectronic Devices Fabricated via 2-Color Photo-Inhibition/Initiation Lithography,” \$75,000, Duration July 2012 – June 2013
33. CU Innovative Seed Grant Program, “Micro-fabrication of Living Systems,” \$44,000, Duration: July 2011 – June 2012.
34. National Institutes of Health, “R01: Natural History of Vulnerable Coronary Plaques,” subcontract to the Massachusetts General Hospital, total \$231,257, Duration: Feb 2011 – Jan 2014
35. National Science Foundation, “SBIR/STTR and ERC Collaboration: 3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides,” Total \$69,968, Duration: July 2010 – July 2012
36. National Science Foundation, “SBIR Phase I: Structural properties of carbon nanotube polymer composites,” Phase I Total: \$50,000, Duration: July 2010 – June 2011
37. Center for Research and Education in Wind, “Feasibility Study of Control of Novel Active Coating Materials for Preventing Icing on Wind Turbine Blades,” \$40,000, Duration: June 2010 – May 2011, *Co-PI with Lucy Pao*
38. National Science Foundation, “CAREER: 3D optoelectronic devices fabricated via 2-color photo-inhibition/initiation lithography,” \$400,000, Duration: Feb 2010 – Jan 2015. REU Supplement of \$6,000. Duration: May 2011 – April 2012.
39. Intel Corporation, “Plastic PHY Interconnect Technology Phase II,” Total: \$462,281, Duration: Nov 2009 – Oct 2012

40. Air Force Office of Scientific Research MURI, "Polymeric Optical Sensor Meshes and Composite Meta-Materials," \$745,500, Duration: Sept 2009 – Aug 2014
41. CU Innovative Seed Grant Program (Lucy Pao, PI), "High - Speed Precision Motion Control for Near - Field Optical Microscopy and Lithography," \$43,500, Duration: Sept 2008 – May 2011.
42. National Science Foundation, "3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides," Phase II Total: \$250,000, matched with \$20,000 gift from prime contractor. REU Supplement of 6000\$. Duration: July 2008 – Aug 2010
43. National Science Foundation, "3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides," Phase IB Total: \$25,000, matched with \$50,000 gift from prime contractor. Duration: January 2008 – June 2008
44. National Science Foundation, "Hybrid integrated optoelectronic systems," Phase II Total: \$250,000, matched with \$38,217 of CU funds. REU Supplement of 6000\$. Duration: January 2008 – Dec 2009.
45. CU Innovative Seed Grant Program, "Diffraction Unlimited Photolithography," \$49,926, Duration: July 2007 – July 2008.
46. CU Tech Transfer Office, "Tape casting of high performance polymer optical imaging arrays," \$24,964, Duration: June 2007 – November 2007.
47. National Science Foundation, "Hybrid integrated optoelectronic systems," Phase IB Total: \$25,000, Duration: January 2007 – June 2007.
48. National Science Foundation, "3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides," Phase I Total: \$89,921. Duration: January 2007 – December 2007
49. National Science Foundation, "Hybrid RF/Optical ICs for High-Bandwidth Spread-Spectrum Communications," Total: \$499,996, Co-PIs Z. Popovic and D. Anderson, McLeod portion: \$432,808, REU Supplement of \$6,000. Duration: January 2007 – December 2010.
50. Intel Corporation, "Plastic PHY Interconnect Technology," Total: \$231,000, Duration: August 2006 – July 2009
51. dBm Optics, "Design of system and development of algorithms for interferometric measurement of chromatic dispersion and polarization mode dispersion," Total: \$25,000, May 2006 – December 2007
52. National Science Foundation, "Hybrid integrated optoelectronic systems," Phase I Total: \$50,000, Duration: January 2006 – December 2006.
53. Science Applications International Corporation, "Parallel Polymer Waveguide Array Development," Total: \$50,000, Duration: July 2005 – December 2006.
54. Engineering Excellence Fund, "Optical Circuits Lab Instrumentation," Total: \$15,000, Duration: July 2005 – July 2007
55. CU Council on Research and Creative Work, "Imaging via Flexible Polymer Fiber Arrays," Total: \$7,000, Duration: May 2005 – May 2006
56. US Army Medical Research and Materiel Command, "Innovative portable human computer interface system for performance monitoring prediction and eye movement robotic control," Phase I Total: \$39,899, Duration: January 2005 – October 2005

57. CU Council on Research and Creative Work, “Hybrid Integrated Photonics,” Total: \$5,000, Duration: July 2004 – July 2005
58. Colorado Center for Information Storage, “Parallel Track and Layer Read/Write Head for Optical Disks,” Total: \$64,963, Duration: July 2004 – July 2005
59. StorageTek, Inc, “CDMA Search of Holographic Databases,” Total: \$40,867, Duration: January 2004 – January 2005
60. Philip Anthony Charitable Trust, “Hybrid Integrated Photonics,” Total: \$50,000, Duration: January 2004 – January 2005

Graduate student advising

Graduated students

1. Benjamin Kowalski, Doctor of Philosophy in Electrical Engineering 2014, *Quantitative Modeling of the reaction/diffusion kinetics of two-chemistry photopolymers*
2. Darren Forman, Doctor of Philosophy in Electrical Engineering 2014, *Photoinhibition superresolution lithography*
3. Anna Linnenberger, Doctor of Philosophy in Electrical Engineering 2014, *Live cell lithography and non-invasive mapping of neural networks*, now with Meadowlark Optics
4. Adam Urness, Doctor of Philosophy in Electrical Engineering 2012, *Liquid Deposition Photolithography for Efficient Three Dimensional Structuring*, now with Akonia Holographics
5. Chunfang Ye, Doctor of Philosophy in Electrical Engineering 2012, *Three-dimensional Gradient Index Optics Fabricated in Diffusive Photopolymers*
6. Eric D. Moore, Doctor of Philosophy in Electrical Engineering, *Advances in Swept-Wavelength Interferometry for Precision Measurements*, University of Colorado, May 2011. Co-Founder of Chiaro Technologies.
7. Pat Wagner, M.S. in Electrical Engineering
8. Amy C. Sullivan, Doctor of Philosophy in Physics, *Tomographic Characterization of Volume Photopolymers for Integrated Optics*, University of Colorado, May 2008.
9. Mark R. Ayres, Doctor of Philosophy in Electrical Engineering, *Signal Modulation for Holographic Memories*, University of Colorado, Dec 2007. Now Founder of Akonia Holographics, Longmont Colorado.
10. Charles D. Anderson, Master of Science in Electrical Engineering, *Photopolymer waveguide to fiber coupling via 3D direct-write lithography*, University of Colorado, August 2006. Now at Research Electro-optics, Boulder.
11. Sarah K. Walter, Master of Science in Electrical Engineering, *Parallel read/write system for optical data storage*, University of Colorado, May 2005. Technical Sales Manager at Encoder Products Company, Sagle, ID.

Postdoctoral scholars

1. Kimberly Urness, 2014 – 2015. Now at NIST, Boulder.
2. Adam Urness, 2012-2014. Now with Akonia Holographics
3. Eric Moore, 7/11-6/12. Now Founder of Chiaro Technologies, Boulder.

4. Martha-Elizabeth Baylor, 8/1/08 –6/30/10. Now an Assistant Professor of Physics, Carlton College.
5. Timothy Scott (co-advised with Dr. Christopher Bowman). 6/07 – 7/08, Topic: *Diffraction unlimited photolithography*. Now an Assistant Research Professor of Chemical Engineering, Michigan

Current graduate students

1. Martha Bodine, Ph.D. in Electrical Engineering
2. Callie Fiedler, Ph.D. in Electrical Engineering
3. Jake Friedlein, Ph.D. in Electrical Engineering
4. David Glugla, Ph.D. in Electrical Engineering
5. Marvin Alim, Ph.D. in Materials Science and Engineering
6. David Miller, Ph.D. in Electrical Engineering
7. Charles Rackson, Ph.D. in Electrical Engineering

Ph.D. student research rotations hosted (outcome)

1. Libby Heeb, Ph.D. Chemistry, Topic: *Thiol-ene polymers for volume phase lithography*, Fall 2004
2. Eric Moore, Ph.D. ECE, Topic: *3D parallel waveguide arrays in photopolymer*, Fall 2004. **(Two conference presentations including one Best Poster award)**
3. David Goldstein, Ph.D. Chemistry, Topic: *Measurement of Polymerization Kinetics of thiol-ene photopolymers* Spring 2005
4. Laura Haynes, Ph.D. Chemistry, Topic: *2D and 3D waveguide arrays in photopolymer*, Fall 2005
5. Kimberly Kester, Ph.D. Chemistry, Topic: *Termination kinetics for optimization of thiol-ene polymerization*, Fall 2005
6. Matthew Kirchner, Ph.D. Physics, Topic: *Parallel-write waveguide to fiber coupling in volume photopolymers*, Fall 2006 **(Three conference presentations including one Best Paper award).**
7. Kristen Vogelhuber, Ph.D. Chemistry, Topic: *Holographic metrology of epoxy-based volume photopolymers*, Spring 2007
8. Greg Berman, Ph.D. ECE, Topic: *Diffraction Unlimited Lithography*, Spring 2007
9. Michael Gleeson, Ph.D. EE University College Dublin, Topic: *Photopolymer waveguide integration with thin film filters*, Fall 2007. **(One conference presentation & JOSA publication)**
10. April Kloxin, Ph.D. Chemical and Biological Engineering, Topic: *3D patterning of hydrogel tissue scaffolds*, Fall 2007. **(Science publication: DOI: 10.1126/science.1169494)**
11. Seyitriza Tigrek, Ph. D. Mechanical Engineering, Topic: *Tape casting of photopolymer waveguide arrays*, Summer 2007
12. Adam Urness, Ph. D. ECE, Topic: *Microstereolithography of photopolymer index structures*, Fall 2007 – Summer 2008.
13. Matthew Titus, Ph.D. ECE Topic: *Tape casting of photopolymer waveguide arrays*, Fall 2007
14. Ginni Sharma, Ph.D. ECE, Topic: *Antiresonant optical waveguides in 3D photopolymer*, Spring/Summer 2008.

15. Eric Dudley, Ph.D. ECE, Topic: *Solid Immersion Optics for lithography*, Fall 2008.
16. Betsy Hall, Ph.D. ECE, Topic: *Optical Diffraction Tomography and Photopolymer Materials Optimization*, Fall 2008.
17. Qing Chao, Ph.D. ECE, Topic: *3D Polymer Hybrid Circuits*, Fall 2008.
18. Sebastian Köber, Ph.D in Physical Chemistry, University of Cologne, Topic: *Photorefractive Polymers*, Fall 2008-Spring 2009.
19. Kevin Zekis, Ph.D ECE, Topic: *Photo-initiation/photo-termination for 3D index polymer distributions in a host matrix*. Fall 2009.
20. Farhad Majdeteimouri, M.S. ECE, Topic: *Polymer waveguide Bragg grating sensor arrays*. Summer 2009
21. Kevin Gemp, Ph.D. ECE, Topic: *Analysis of novel photopolymerizable materials*
22. Darren Forman, Ph.D. ECE, Topic: *Swept-wavelength interferometry of 3D polymer waveguide arrays and Bragg gratings*. Spring 2010.
23. Dawei Liu, Ph.D. ECE, Topic: *Performance of polymer waveguide to single-mode fiber interconnects*, Spring 2011

Undergraduate research associates 2003-present: Mrnal Shukla (DLA), Devin Mayer, Wei-Chu Liao (DLA), Wei-Shen Liao (DLA), Ben Mauser, Matanya Horowitz, John Chen, Dominic Boiko, David Jorgensen (DLA), Filip Maksimovic, Takako Hirokawa, Robert Boyne (DLA), Niket Sheth (DLA), Drew Schiltz (REU), Gregory Scranton (REU), Seth Miers.

Pre-college research associates: John Chen (SURE program)

Teaching

Courses taught

1. ECEN 2250, *Circuits I*
Fall 08
2. ECEN 3400, *Electromagnetic Fields and Waves*
Fall 2005
3. **Developed:** ECEN 4606, *Undergraduate Optics Lab*
Spring 07, Fall 09, Fall 12, Spring 13
4. ECEN 4616/5616, *Optoelectronic System Design*
Fall 03, Spring 05, Fall 06, Fall 07, Spring 12
5. ECEN 5606, *Advanced Optics Lab*
Spring 04, Spring 14
6. ECEN 4606/5166, *Guided Wave Optics*
Spring 06, Spring 10
7. **Developed:** ECEN 6006, *Numerical Methods in Photonics*
Fall 04, Spring 07, Spring 09, Fall 11, Spring 15
8. **Redeveloped:** ECEN 1400, *Introduction to Analog and Digital Electronics*
Fall 12, Fall 13, Fall 14

Faculty Course Questionnaire Results (all out of 6.0)

Term	ECEN	Title	Students	Course	Instructor
2003	Fall	5616 OE System Design	14	5.4	5.9
2004	Spring	5606 Advanced Optics Lab	28	5.1	4.9
	Fall	6006 Numerical Methods	11	5.7	5.9
2005	Spring	5616 OE System Design	8	5.6	5.8
	Fall	3400 EM fields & waves	56	5.5	5.9
2006	Spring	4006	2	6	6
		5166 Guided wave optics	4	5.4	6
	Fall	5616 OE System Design	27	5.3	5.6
2007	Spring	4606 UG Optics Lab	22	5.4	5.8
		6006 Numerical Methods	8	5.1	5.6
	Fall	5616 OE System Design	17	5.7	5.7
2008	Spring	Faculty Fellowship			
	Fall	2250 Circuits/Electronics 1	97	4.6	5.1
2009	Spring	6006 Numerical Methods	12	5.7	5.9
	Fall	4606 UG Optics Lab	14	5.2	5.6
2010	Spring	5166 Guided wave optics	7	4.8	5.5
	Fall	Sabbatical			
2011	Spring	Sabbatical			
	Fall	6006 Numerical Methods	10	5.6	5.6
2012	Spring	4/5616 OE System Design	21	5.1	5.3
	Fall	1400 Intro to A&D Electron.	76	4.7	4.8
		4606 UG Optics Lab	16	4.6	5.6
2013	Spring	6006 Optics and Cellular Biol	4	6	6
	Fall	1400 Intro to A&D Electron.	84	5.2	5.3
		4606 UG Optics Lab	9	5.5	5.5
2014	Spring	5606 Advanced Optics Lab	<i>No individual faculty ratings</i>		
	Fall	1400 Intro to A&D Electron.	78	5.2	5.4
2015	Spring	6006 Numerical Methods	7	5	5.6

Undergrad weighted average 5.0 5.3

Graduate weighted average 5.4 5.7

Notes:

- Upper division undergrad course and instructor ratings are **0.7** and **0.9** standard deviations above the mean for tenure track professors in the College of Engineering
- Graduate course and instructor ratings are **0.7** and **0.9** standard deviations above the mean for tenure track professors in the College of Engineering
- ECEN 5606 in Spring 04 and Spring 14 was co-taught and no individual scores were collected. This course is not included in the weighted averages.

Professional Service

External

1. **Topical Editor**, Optics Letters, (2013-2019).
2. **Program Committee Member**, SPIE Advanced Fabrication Technologies for Micro/Nano Optics and Photonics Conference, (2010-present).
3. **Guest Editor**, “Advances in Optical Materials and Devices” in Physics Research International, (2011).
4. **Advisory Committee Chair**, IEEE/OSA/SPIE Optical Data Storage Conference, (2011).
5. **General Chair** IEEE/OSA/SPIE Optical Data Storage Conference, (2010).
6. **Program Committee Co-Chair** (with In-Ho Choi, LG Electronics), IEEE/OSA/SPIE Optical Data Storage Conference, (2009).
7. **Faculty Tenure Evaluation**, (name withheld) (2009).
8. **Technical Program Committee Member and Session Chair**, IEEE/OSA/SPIE Optical Data Storage Conference, (2005-2008).
9. **General Co-chair** (with Susanna Orlic, Technische Universitaet Berlin), SPIE Organic Holographic Materials and Applications Conference, (2007-2009).
10. **Technical Program Committee Member and Session Chair**, SPIE Organic Holographic Materials and Applications Conference, (2004-2008).
11. **Panel Member**, NSF Proposal Review, ECCS, (2005, 2009).
12. **Resource Volunteer** to science teachers in Colorado disadvantaged schools through the NSF/OSA/SPIE/MESA Hands On Optics program, (2005-2008).
13. **Board of Directors Member**, Colorado Photonics Industry Association, (2004-2010).
14. **General Chair**, SPIE/CPIA Photonics Research in Colorado Annual Meeting, (2004-2009).
15. **Technical Program Committee Member**, IEEE LEOS Workshop on Fiber Optic Passive Components, (2002).
16. **Reviewer** for: Nature, Applied Optics, Journal of Quantum Electronics, Optics Communications, Optics Letters, Optics Express, Journal of Applied Physics A & B, Journal of Communications, Journal of Polymer Science A, Computer Methods and Programs in Biomedicine, Materials, Advanced Optical Materials, ASME Journal of Mechanical Design, Applied Science, the DOE SBIR program, Research Corporation for Scientific Advancement

Internal

1. **Graduate Director and Executive Committee Member**, ECEE Department, (2012-present)
2. **Fellow, Executive Committee Member and Graduate Director**, Materials Science and Engineering Program (2012-present)
3. **Chair**, ad-hoc hiring committee for RASEI faculty hire. (2013).
4. **Member**, Search Committees for ECEE office administrator and accountant. (2013).
5. **Member**, Search Committee in Bioengineering, ECEE department (2012).
6. **Member**, Future Leaders Advisory Group (FLAG), College of Engineering (2011-).
7. **Member**, Office of Contracts and Grants oversight committee (2011-2013)

8. **Member**, Search Committee in Manufacturing, ME department (2012).
9. **Member**, Search Committee in Materials, MSE program (2012-2013)
10. **Member**, Search Committee for second college research administrator, (2009).
11. **Chair**, Optics prelim exam, (2009, 2011).
12. **Member**, Search Committee for three junior optics faculty, (2008-2009).
13. **Chair**, graduate recruiting for optics, 2008
14. **Member**, Search Committee for junior nano/optics faculty, (2007-2008).
15. **Member**, Search Committee for college grants administrator, (2007).
16. **Member**, Search Committee for two junior materials faculty, (2007-2008).
17. **Director**, Colorado Center for Information Storage, (2006-2007).
18. **Member**, Search Committee for senior optics faculty, (2006).
19. **Chair**, Campus-wide Optics Initiative Strategy Committee, (2006).
20. **Member**, College Nano Characterization Facility advisory board, (2006-2007).
21. **Member**, ECE Executive Committee, (2005-2007 and 2012-present)
22. **Member**, NSF I/UCRC Photopolymerization Center, (2004-present).
23. **Member**, Executive Committee for Hybrid Signal Electronics GAANN fellowship program, (2004-2008) and Functional Materials GAANN (2012-present)
24. **Faculty Reappointment Evaluation**, (name withheld) (2004).
25. **Co-chair** of Optics, Materials, Devices and Solid State prelim exam (2003, 2005)
26. **Member**, Optical Sciences and Engineering Program, (2003-2008).
27. **Member or Chair** of >50 graduate student committees in ECEE, Mech. E, Chem. E, and Physics, EE Dublin Ireland (2003-present).

Professional Memberships

1. **Optical Society of America** (OSA)
2. **Society of Photo-Optical Instrumentation Engineers** (SPIE)
3. **Materials Research Society** (MRS)
4. **Institute of Electrical and Electronics Engineers** (IEEE)