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# 30th ANNUAL OpTeC CONFERENCE

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*Highlighting Optical Science & Engineering*

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OCTOBER 10, 2024

Inspiration Hall, Norm Asbjornson Hall  
Montana State University, Bozeman, Montana  
*Enter through the south-facing door on the 2nd floor*

Conference Organizers:  
Dr. Joseph Shaw, OpTeC Director  
Michelle Leonti, Conference Coordinator



*We extend our heartfelt gratitude to our sponsors for their generous support!*

8:00 am **CHECK-IN and MORNING REFRESHMENTS**

8:20 am *Conference Opening Remarks*  
Joseph Shaw  
Optical Technology Center Director, Montana State University

Session 1

Chair: Lee Spangler, Ph.D.

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8:30 am *Development and implementation of the Optical Cataloger for automatic 2D crystallite identification*

**Tim Faltermeier**,<sup>1</sup> Samuel Wyss,<sup>1</sup> Bridger McGimpsey,<sup>1</sup> David Miller,<sup>2</sup> Thomas Ferrel,<sup>2</sup> Dinh Loc Duong,<sup>3</sup> Torrey McLaughlin,<sup>1</sup> Nicholas J. Borys,<sup>1</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>3</sup>Department of Physics and Astronomy, University of Maine, Orono, ME

8:50 am *A silicon bilayer wire-grid as a polarizing beam splitter*  
**Jordan L. Baker**, James C. Graham, Andrew Oliver, David L. Dickensheets, Wataru Nakagawa  
Electrical and Computer Engineering Department, Montana State University

9:10 am High numerical aperture optical cavities for quantum information science  
**Matt Jaffe**  
Department of Physics, Montana State University

9:30 am *Demonstration of a three-node wavelength division multiplexed hybrid quantum-classical network through multicore fiber*  
**Joshua Dugre**, Samuel Fritsch, Krishna Rupavatharam  
Spectrum Lab, Montana State University

9:50 am *Probing the role of plasmonic enhancement in quantum emission in single-layer WSe<sub>2</sub> nanoribbons on Au nanocones*  
**Joe Stage**,<sup>1</sup> Xufan Li,<sup>2</sup> Samuel Wyss,<sup>1</sup> Emanuil Yanev,<sup>3</sup> Shuang Wu,<sup>2</sup> P. James Schuck,<sup>3</sup> Avetik. R. Harutyunyan,<sup>2</sup> Nicholas J. Borys<sup>1</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Honda Research Institute USA, Inc, San Jose, CA  
<sup>3</sup>Department of Mechanical Engineering, Columbia University, New York City, NY

10:10 am **BREAK & REFRESHMENTS**

- 10:40 am *Levitated optomechanics in the free-particle limit*  
**Brian D'Urso**, Larson Pavey, Cody Jessup, and Yateendra Sihag  
 Department of Physics, Montana State University
- 11:00 am *DFUSIONET: daily spatial prediction of plant evapotranspiration using satellite imagery and infield observations for optimized irrigation management*  
**Farshina Nazrul Shimim**,<sup>1</sup> Shilan Felegari,<sup>2</sup> Brett Griesbaum,<sup>2</sup> Bradley Whitaker,<sup>1</sup> Paul Nugent<sup>2</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>College of Agriculture, Montana State University
- 11:20 am *Low-cost multispectral imager for river algae monitoring*  
**Shannon M. Hamp**, Riley D. Logan, Henry O. Hamp, Joseph A. Shaw  
 Electrical and Computer Engineering Department, Montana State University  
 Optical Technology Center, Montana State University
- 11:40 pm *UAV detection with wingbeat-modulation lidar*  
**Wyatt W. Weller**,<sup>1</sup> Trevor C. Vannoy,<sup>1</sup> Joseph A. Shaw<sup>2</sup> Bradley M. Whitaker<sup>1</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Electrical and Computer Engineering Department and Optical Technology Center, Montana State University
- 12:00 pm **Lunch (provided)**

- 1:10 pm *A comparison of sCMOS and CMOS detectors in broadband pump probe microscopy*  
**Kendall Benton**,<sup>1</sup> Emma Orcutt,<sup>2</sup> Skyler Hollinbeck,<sup>2</sup> Erik Grumstrup<sup>1</sup>  
<sup>1</sup>Materials Science and Department of Chemistry & Biochemistry, Montana State University  
<sup>2</sup>Department of Chemistry & Biochemistry, Montana State University
- 1:30 pm *Development and evaluation of a long-range FMCW lidar and digital holographic imager*  
**Zachery Lakin**, Cole Hammond, Krishna Rupavatharam, Wm. Randall Babbitt  
<sup>1</sup>Spectrum Lab, Montana State University
- 1:50 pm *Design and initial results of a diode-laser-based direct-detection doppler lidar*  
**Luke Colberg**, Dylan J. Maxwell, Kevin S. Repasky  
 Electrical and Computer Engineering Department, Montana State University
- 2:10 pm *Er,Yb:Glass transmitter designed for high volume manufacturing*  
 Caroline Cummins, Andrew Guevara, Shirley McNeil<sup>1</sup>, Laine McNeil, Murphy Polsak, Keaten Barbula, **Connor Dack**, Larson Brandstetter, Brett Swimley, Kora Lozano, Brent Schroeder, Lance Lusby, Halle Priddy, Casimir Melton, Roger Beers, Jamie Barbula, Jon McGuire  
 Lumibird Photonics, USA

- 2:30 pm      *Coherent long-range lidar for autonomous trucking at Aurora*  
**Zeb Barber**, Sen Lin, Andy Michaels, Jim Curry  
Aurora Innovation, Inc.
- 2:50 pm      *Summary of the Headwaters Tech Hub*  
**Tim VanReken**  
Headwaters Tech Hub
- 3:10 pm      **BREAK & REFRESHMENTS (NAH 165)**
- Session 4      **Montana Photonics Jobs Outlook**      (move to NAH 165)      Chair: Jason Yager
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- 3:40 pm      *Montana's Workforce – Trends and Implications for the Optics Sector*  
**Jennifer Owen**  
Director  
Montana State Workforce Innovation Board
- 4:00 pm      *Workforce Development: Recent government actions and pending initiatives*  
**Jennifer O'Bryan**  
Government Affairs Director  
SPIE
- 4:20 pm      *10 Hot Montana Photonics Jobs*  
**Christina Henderson**  
Director  
Montana High Tech Business Alliance
- 4:40 pm      *No VACOM – No smartphone: Vacuum Technology for Hitech applications and careers*  
**Marcel Kleßen**  
General Manager  
VACOM Montana Inc.
- 5:00 pm      *An Introduction to Photonic Integrated Modules, the Integrated Photonics Ecosystem (IPE) project, and hiring needs*  
**Stefan Heinemann**  
Managing Director  
PHIX, USA
- 5:20 pm      *Telling your story – Recruiting, Selection, and Skill*  
**Annamarie Brasseur**, Recruiter  
**David Yaralian**, LiDAR Data Analyst Senior Team Lead  
Bridger Photonics

*Exhibitors*

<b>AdvR, Inc.</b>	<b>Montana Photonics &amp; Quantum Alliance (MPQA)</b>	<b>Shadow Ridge Analytics (The Eido Tech Project)</b>
<b>Agile Focus Designs</b>	<b>Omega Optical Holdings, LLC</b>	<b>Shimadzu Scientific Instruments</b>
<b>Altos Photonics, Inc.</b>	<b>OptoSigma Corporation</b>	<b>SmarAct, Inc.</b>
<b>Lumibird, Inc.</b>	<b>Out of the Box Manufacturing</b>	<b>SPIE</b>
<b>Marcotech2</b>	<b>PHIX, USA</b>	<b>Teledyne FLIR Laser Crystals and Components</b>
<b>MKS Instruments</b>	<b>Quartus Engineering</b>	<b>UpNano</b>
<b>Montana Microfabrication Facility</b>		

6:00 pm Evening Welcoming Remarks  
Joseph Shaw, OpTeC Director  
Alison Harmon, Vice President for Research & Economic Development  
Jason Yager, Executive Director, Montana Photonics Quantum Alliance

*Research Posters*

- Spectral Processing for Algae Monitoring and Mapping (SPAMM): Imaging techniques for tracking riverine algal blooms*  
**Riley D. Logan**,<sup>1,2</sup> Shannon M. Hamp,<sup>1,2</sup> Rafael Feijo-Lima,<sup>3</sup> H. Maurice Valett,<sup>4</sup> Joseph A. Shaw<sup>1,2</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Optical Technology Center, Montana State University  
<sup>3</sup>Department of Ecosystem and Conservation Sciences, University of Montana, Missoula, MT  
<sup>4</sup>Division of Biological Sciences, University of Montana, Missoula, MT
- Design and calibration of an all-sky polarization imager for smoke plume characterization*  
**Matthew McClelland**,<sup>1</sup> Erica Venkatesulu,<sup>1,2</sup> Joseph A. Shaw<sup>1,2</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Optical Technology Center, Montana State University
- Testing and correcting compact thermal camera response with changing air temperature*  
**Brandon Mickelson**,<sup>1,2</sup> Matthew McClelland,<sup>3</sup> Riley D. Logan,<sup>3,4</sup> Joseph A. Shaw<sup>3,4</sup>  
<sup>1</sup>Engineering and Physics, Swarthmore College, Swarthmore, PA  
<sup>2</sup>Research Experience for Undergraduates program, Electrical and Computer Engineering Department, Montana State University  
<sup>3</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>4</sup>Optical Technology Center, Montana State University
- Ultra-low-cost river algae imager and calibration system*  
**Ella Neimeyer**,<sup>1,2</sup> **Cayce Russo**,<sup>2,3</sup> Shannon M. Hamp,<sup>4,5</sup> Henry O. Hamp,<sup>4,5</sup> Riley D. Logan,<sup>4,5</sup> Joseph A. Shaw<sup>4,5</sup>  
<sup>1</sup>Environmental Engineering Department, University of Vermont  
<sup>2</sup>Research Experience for Undergraduates (REU), Electrical and Computer Engineering Department, Montana State University  
<sup>3</sup>Electrical and Computer Engineering Department, Mississippi State University  
<sup>4</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>5</sup>Optical Technology Center, Montana State University

5. *Widefield imaging integrated RCM*  
**Nathaniel J. Smith**,<sup>1</sup> Justin Wigle,<sup>1</sup> Milind Rajadhyaksha,<sup>2</sup> William Fox,<sup>2</sup>  
David Dickensheets<sup>1</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Department of Medicine, Memorial Sloan Kettering Cancer Center, Caliber, ID
6. *Investigation of strain-localized excitons in nanobubbles of single-layer WS<sub>2</sub> on a gold surface*  
**Mohammad Soroush**,<sup>1</sup> Matthew Strasbourg,<sup>4</sup> Kiyoung Jo,<sup>3</sup> Emanuil Yanev,<sup>4</sup> P. James Schuck,<sup>4</sup> Deep  
Jariwala,<sup>3</sup> David Dickensheet,<sup>1</sup> Nicholas J. Borys<sup>2</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Department of Physics, Montana State University  
<sup>3</sup>Department of Electrical and Systems Engineering, University of Pennsylvania, Philadelphia, PA  
<sup>4</sup>Department of Mechanical Engineering, Columbia University, New York, NY
7. *Design and simulation of passive nanostructure polarization filters operating in the short-wave and  
mid-wave infrared*  
**Dylan J. Maxwell**, James C. Graham, Jordan L. Baker, Wataru Nakagawa, Joseph A. Shaw  
Electrical and Computer Engineering Department, Montana State University
8. *Polarimetric frequency-modulated continuous-wave lidar with dual frequency-shifted transmit and  
local oscillator*  
**Ector A. Diego**, Krishna Rupavatharam, Wm. Randall Babbitt  
Spectrum Lab, Montana State University
9. *Development of an OTDR system utilizing FMCW homodyne technique to measure skew in MCF*  
**James Broderick**, Katerina Shabalin, Joshua Dugre, Zachery Lakin, Matthew Goodman, Krishna  
Rupavatharam  
Spectrum Lab, Montana State University
10. *Development of a fiber oven for motoring temperature effects on QKD in MCF*  
**Katerina Shabalin**, Joshua Dugre, Krishna Rupavatharam  
Spectrum Lab, Montana State University
11. *Enhancing beam stability in FSO communication systems under simulated atmospheric turbulence*  
**Charlie Dixon**, Caleb Rohn, Krishna Rupavatharam  
Spectrum Lab, Montana State University
12. *Proposed phase stabilization system for long range digital holographic imaging*  
**Cole Hammond**, Zachery Lakin, Krishna Rupavatharam, Wm. Randall Babbitt  
Spectrum Lab, Montana State University
13. *Fabricating a fiber-based polarization entangled photon source for quantum network research*  
**Caleb Humber**, Nathan Kuehl, Krishna Rupavatharam  
Spectrum Lab, Montana State University
14. *Non-degenerate spontaneous parametric down conversion at NIR and IR wavelengths using  
periodically poled waveguides*  
**Eric J Pritchard**, B. Slezak, Krishna Rupavatharam  
Spectrum Lab, Montana State University
15. *Range-selective FMCW digital holography for imaging through scattering environments*  
**Corey Pearson**, Matthew Goodman, Krishna Rupavatharam, Wm. Randall Babbitt  
Spectrum Lab, Montana State University

16. *Summary of optical metrology projects under the high school summer internship program*  
**Christopher Balas**, Krishna Rupavatharam  
Spectrum Lab, Montana State University
17. *Exploration of micro-optics fabrication using 3D printing*  
**Samuel Fritsch**, Krishna Rupavatharam  
Spectrum Lab, Montana State University
18. *Development and evaluation of FSO communication technologies with adaptive Feedback, OAM encoding, and quantum key distribution*  
**Caleb Rohn**, Krishna Rupavatharam  
Spectrum Lab, Montana State University
19. *Smart hyperspectral camera for fuel characterization*  
**Nathaniel Sweeney**,<sup>1</sup> Zackary Backman,<sup>1</sup> Dirk Kaiser,<sup>1</sup> Nicholas Margavio,<sup>2</sup> Dr. Ross Snider<sup>1</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Electrical Engineering, University of Tennessee, Chattanooga, TN
20. *Advancing soil pH detection and prediction: Integrating open-source remote sensing data with Landsat-9 and multi-temporal analysis*  
**Shilan Felehgari**, Paul Nugent  
Precision Agriculture Lab, College of Agriculture, Montana State University
21. *Post-fire landscape recovery prediction using deep learning*  
**Mahmad Isaq Karankot**, Bradley M. Whitaker  
Electrical and Computer Engineering Department, Montana State University
22. *Inducing single-photon emitter formation in torn and strained 2D single-layer transition metal dichalcogenides*  
**J. Pierce Fix**,<sup>1,2</sup> Joe Stage,<sup>1</sup> Nicholas J. Borys<sup>1</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Materials Science Program, Montana State University
23. *Probing charge density waves with Raman spectroscopy*  
**Patrick White**<sup>1</sup>, Dinh Loc Duong,<sup>2</sup> Jorge E. Guerrero-Ramírez,<sup>1</sup> Nick J. Borys,<sup>1</sup> John J. Neumeier<sup>1</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Department of Physics, University of Maine, Orono, ME
24. *Polarization-dependent absorption in monolayer MoxW1-xS2 alloys*  
**Frank Schooner**,<sup>1</sup> Kavika Faagau,<sup>2</sup> J. Pierce Fix,<sup>1,3</sup> Joseph Stage,<sup>1</sup> Nicholas Borys<sup>1</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Department of Physics, Whitworth University, Spokane, WA  
<sup>3</sup>Material Science Program, Montana State University
25. *Advancements in the autonomous production of 2D van der Waals materials*  
**Forrest Gile**,<sup>1</sup> Nolan Geyer-Poncin,<sup>1</sup> Josh Oliver,<sup>1</sup> Daniel Vazquez,<sup>1</sup> Josh Goss,<sup>2</sup> Torrey McLoughlin,<sup>1</sup> Hugh Churchill,<sup>2</sup> Nicholas Borys  
MonArk Quantum Foundry  
<sup>1</sup>Montana State University  
<sup>2</sup>University of Arkansas

26. *Dynamic control of excitons in single-layer WSe<sub>2</sub> with surface acoustic waves*  
**Sheikh Parvez**,<sup>1,2</sup> J. Pierce Fix,<sup>1,2</sup> Joe Stage,<sup>1</sup> Samuel Berweger,<sup>3</sup> Nicholas J. Borys,<sup>1,2</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Materials Science Program, Montana State University  
<sup>3</sup>National Institute of Standards and Technology, Boulder, CO
27. *Strain-induced single photon emitters in transition-metal dichalcogenide nanoribbons*  
**Samuel Wyss**,<sup>1</sup> Xufan Li,<sup>2</sup> Matthew Strasbourg,<sup>3</sup> Joseph Stage,<sup>1</sup> Emanuil Yanev,<sup>3</sup> Shuang Wu,<sup>2</sup> Avetik R. Harutyunyan,<sup>2</sup> Nicholas J. Borys,<sup>1</sup> P. James Schuck,<sup>3</sup>  
<sup>1</sup>Department of Physics, Montana State University  
<sup>2</sup>Honda Research Institute USA Inc, San José, CA  
<sup>3</sup>Department of Mechanical Engineering, Columbia University, New York City, NY
28. *Levitated optomechanics in the free particle limit*  
**Larson Pavey, Sophia Balderrama**, Brian D'urso  
Department of Physics, Montana State University
29. *Enhancing magnetogravitational trap through composite pole piece manufacturing, magnetic field optimization, and improved position calibration*  
**Tahereh Naderishahab**, Brian D'Urso  
Department of Physics, Montana State University
30. *Spectroscopic insights into zinc porphyrin: elucidating the effect of structural heterogeneity on excited-state dynamics in solution and solid Phase H-Aggregates*  
**Emma K. Orcutt**,<sup>1</sup> Alexander J. King,<sup>1</sup> Erik M. Grumstrup,<sup>1</sup> Ifigeneia Tsironi,<sup>2</sup> Jean-Hubert Olivier,<sup>2</sup>  
<sup>1</sup>Department of Chemistry and Biochemistry, Montana State University  
<sup>2</sup>Department of Chemistry and Chemical Biology, University of New Mexico, Albuquerque, NM
31. *Lithium volatilization and phase changes during aluminum-doped cubic Li<sub>6.25</sub>La<sub>3</sub>Zr<sub>2</sub>O<sub>12</sub> (c-LLZO) processing*  
**Steven Montoya**,<sup>1</sup> Shah A. H. Shanto,<sup>2</sup> Robert Walker,<sup>1,2</sup>  
<sup>1</sup>Department of Chemistry and Biochemistry, Montana State University  
<sup>2</sup>Montana Materials Science PhD Program, Montana State University
32. *Optimization of simplex Stokes constellations*  
A. Brisson,<sup>1</sup> I. Roudas,<sup>1</sup> E. Fink<sup>2</sup> (**A. Biswas**,<sup>1</sup>)  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Department of Mathematical Sciences, Montana State University
33. *Modal dispersion performance of mode vector modulation*  
A. Brisson,<sup>1</sup> **A. Biswas**,<sup>1</sup> E. Fink,<sup>2</sup> I. Roudas<sup>1</sup>  
<sup>1</sup>Electrical and Computer Engineering Department, Montana State University  
<sup>2</sup>Department of Mathematical Sciences, Montana State University