What we have achieved in 2023

Presented by Ji-Xin Cheng, 12/15/2023
Novel ‘few mode’ innovation reboots and expands OCT

Professor Caroline Boudreau is casting new light from her photonic lantern for optical coherence tomography.

AT Politecnico Montréal, Caroline Boudreau has developed a new technique for obtaining high resolution, high speed images of structural information. OCT, based on low coherence interferometry, has turned this area into an incandescent photonics industry. Boudreau’s team has developed a technique for obtaining high resolution, high speed images of structural information. OCT, based on low coherence interferometry, has turned this area into an incandescent photonics industry.

Boudreau said her team has developed a technique that provides a new way to sample and manipulate into “atomic”-level information and to use it in a technique with large-scale organization to allow rapid visualization outside the lab.

In this issue:
- p. 48: LED-Laden Chip
- p. 46: GPP-Related garnet
- p. 17: Programmable microfluidics
- p. 39: Silicon Photonics
- p. 12: Hybrid Optical

Linking light and sound creates safer noninvasive brain investigations

Boston University’s Professor Chen Yang is refining photacoustic neural stimulation to improve understanding of disorders of the nervous system.

Yang, a neuroscientist at the University of Illinois, has developed a technique to combine light and sound in a way that allows for noninvasive brain stimulation. This approach is being used to study the effects of light and sound on neural activity, with the goal of developing new treatments for neurological disorders.

In her talk, Yang will discuss the potential of photacoustic neural stimulation for treating disorders such as Parkinson’s disease, multiple sclerosis, and Alzheimer’s disease.
Dear Ji-Xin Cheng:

Thank you for the opportunity to review your application Dynamic-000000094 "Bond-selective Intensity Diffraction Tomography" in response to our Request for Applications: Dynamic Imaging.

We are pleased to inform you that your application has been selected for recommendation for funding for an amount of $1,360,955 from the Chan Zuckerberg Donor Advised Fund (DAF), through the Silicon Valley Community Foundation (SVCF). SVCF will be reaching out to you in the following 4-6 weeks. Should you have any questions about this process, please contact Meagan Mnich (mmnich@chanzuckerberg.com). See below for additional information we need from you, including a formal acknowledgment of this funding notification.
Having Fun at Fuller’s Pub, July 2023
Cheng-Yang Group
Ping-Pong Game

7/12/2023
Chemical Imaging
Gordon Research Conference
July 30 - August 4, 2023
Stonehill College, Easton, MA, United States
Chairs: Ji-Xin Cheng and Ning Fang
Vice Chairs: Lane Baker and Livia Eberlin

12/17/2023
We generated 7 PhD & 2 MS in 2023!

- Yuying Tan (BME)
- Sebastian Jusuf (BME)
- Yueming Li (ME)
- Nan Zhang (MSE)
- Ran Chen (CHEM)
- Jing Zhang (BME)
- Haonan Zong (ECE)
  - Mark (MS BME)
  - Jiyang (MS BME)
New members joining our team

- Jianpeng Ao (postdoc)
- Dashan Dong (postdoc)
- Stephanie Huang (Research program manager)
- Biwen Gao (Chemistry)
- Rylie Bolarinho (Chemistry)
21 papers published or accepted in 2023

- Hongjian He, Jiaze Yin, Mingsheng Li, Xinyan Teng, Meng Zhang, Yueming Li, Zhiyi Du, Bing Xu, Ji-Xin Cheng, Mapping enzyme activity in live cells and in vivo by real-time mid-infrared photothermal imaging of nitrile chameleons, *Nature Methods*, in press


• Jian Zhao, Lulu Jiang, Alex Matlock, Yihong Xu, Jiabei Zhu, Hongbo Zhu, Lei Tian, Benjamin Wolozin, Ji-Xin Cheng, Mid-infrared Chemical Imaging of Intracellular Tau Fibrils using Fluorescence-guided Computational Photothermal Microscopy *Light: Science and Applications*, 2023, 12: 147

• Jiaze Yin, Meng Zhang, Yuying Tan, Zhongyue Guo, Hongjian He, Lu Lan, Ji-Xin Cheng, Video-rate mid-infrared photothermal imaging by single pulse photothermal detection per pixel, *Science Advances*, 2023, 9: eadge8814

• Mingwei Tang, Yubing Han, Danchen Jia, Qing Yang, Ji-Xin Cheng, Far-field super-resolution chemical microscopy, *Light: Science and Applications*, review article, 2023, 12: 137
• Haonan Lin, Ji-Xin Cheng, Computational coherent Raman scattering imaging: breaking physical barriers by fusion of advanced instrumentation and data science, elight, review article, 2023, 3:6
• Danchen Jia, Yi Zhang, Qianwan Yang, Yujia Xue, Yuying Tan, Lei Tian, Ji-Xin Cheng, 3D Chemical Imaging by Fluorescence-detected Mid-Infrared Photothermal Fourier Light Field Microscopy, Chemical and Biomedical Imaging, 2023, https://doi.org/10.1021/cbmi.3c00022
• Yuhao Yuan, Guangju Zhang, Yuqi Chen, Hongli Ni, Mingsheng Li, Michael Sturek, Ji-Xin Cheng*, A high-sensitivity high-resolution intravascular photoacoustic catheter through mode cleaning in a graded-index fiber, Photoacoustics, 2023, 29:100451
## Grants received in 2023

<table>
<thead>
<tr>
<th>Source</th>
<th>Title</th>
<th>Amount</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH R01 AI141439-05A1</td>
<td>“Rapid AST through Metabolic Imaging at Single Cell Level”, Cheng PI</td>
<td>$2,484,714</td>
<td>07/07/2023</td>
<td>06/30/2027</td>
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<td>Chan Zuckerberg Initiative</td>
<td>“Bond-selective Intensity Diffraction Tomography” Cheng PI</td>
<td>$1,360,955</td>
<td>3/1/2023 to</td>
<td>8/31/2025</td>
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<tr>
<td>NIH R21 Brain Initiative</td>
<td>“Massively Parallel Optoacoustic Retinal Stimulation at Micrometer-Resolution”, Yang PI</td>
<td>$660,000</td>
<td>07/01/2023</td>
<td>06/30/2026</td>
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<tr>
<td>Axorus</td>
<td>“Injectable materials for optoacoustic retinal stimulation”, Yang PI</td>
<td>$300,000</td>
<td>9/1/2023 to</td>
<td>8/31/2024</td>
</tr>
</tbody>
</table>
An outlook into 2024

• Yang: promotion to full professor
• Cheng: Biophotonics Technology Innovator, speech at SPIE meeting, Jan 2024
• Nature Methods: Focused Issue on Vibrational Imaging
• New R01 grant: super-sensitive SRS
• New students, research program manager
• New PhDs, New Assistant Professors
• ...