Graphics4Science 2026: Graphics for Cross-Scale Reliable Scientific Instruments

Minghao Guo
Massachusetts Institute of Technology (MIT)
Cambridge, USA
guomh2014@gmail.com

Mina Konaković Lukovic
Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts Institute of Technology (MIT)
Cambridge, USA
minakl@mit.edu

Qixing Huang
The University of Texas at Austin
Austin, USA
huangqx@utexas.edu

Yin Yang
University of Utah
Utah, USA
yangzzzy@gmail.com

Chenfanfu Jiang
University of California Los Angeles
LA, USA
Adobe Research
LA, USA
chenfanfu.jiang@gmail.com

Wojciech Matusik
Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts Institute of Technology (MIT)
Cambridge, USA
wojciech@csail.mit.edu

Peter Yichen Chen
The University of British Columbia
Vancouver, Canada
pyc@csail.mit.edu

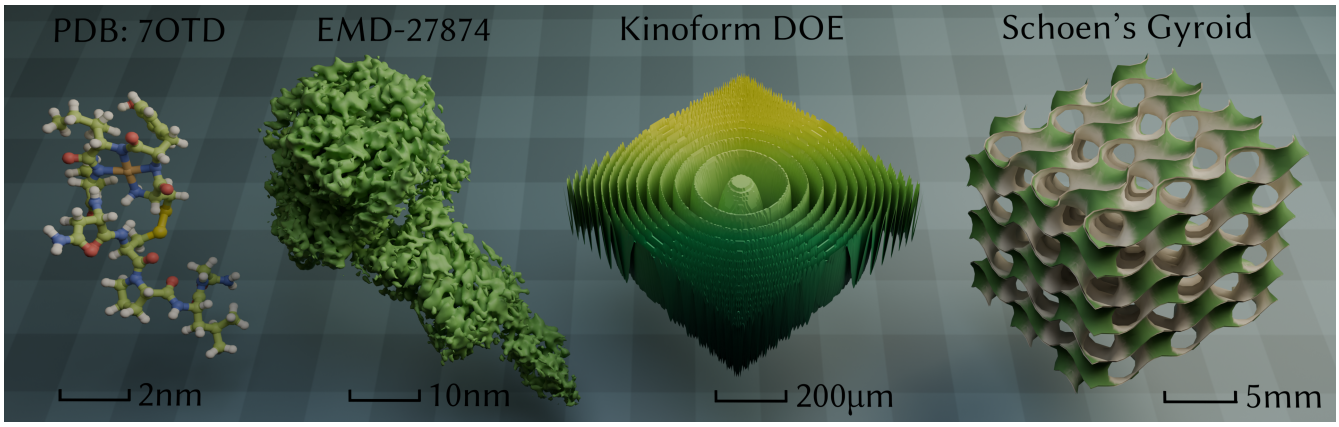

Figure 1: Graphics × Science is broadly applicable to cross-scale scientific problems, linking graphics and scientific computing from molecular structure (e.g. Oxytocin NMR solution structure [Berman et al. 2000]) and volumetric reconstruction (e.g. cryo-EM density maps of peptides [Lawson et al. 2016]) to computational optical element design (e.g. kinoform/diffractive optics [Yang et al. 2024]) and geometry-driven architected materials (e.g. Schoen's gyroid [Schoen 1970]). Graphics × Science 2026 pairs invited keynote deep dives with contributed lightning talks to distill emerging advances into reliable, reusable scientific instruments and workflows.

Keywords

graphics for science, scientific computing, computational imaging, simulation, geometry processing, generative models

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Abstract

Computer graphics is increasingly central to modern scientific discovery, providing not only visualization but also physically grounded modeling, simulation, inverse problem formulations, and interactive systems for hypothesis generation. Building on the *Graphics4Science* course at SIGGRAPH 2025 [Chen et al. 2025a], the 2026 edition shifts to a workshop-style format with fewer broadcast talks, more technical dives, and more in-depth discussion. The program features four keynotes spanning computational imaging, scientific reconstruction for structural biology, generative modeling for molecular structures, and reduced-order modeling for physical

simulation, complemented by two curated lightning-talk sessions that highlight the most recent advances from the broader community.

1 Motivation

Graphics4Science is a fast-evolving research direction at the intersection of computer graphics and domain sciences. Across scales and disciplines, scientific workflows increasingly rely on core capabilities long developed in graphics: expressive geometric representations, forward models for image formation and physical dynamics, and interactive tools that allow humans to steer complex computations.

Recent advances have expanded what is feasible in practice, including visual exploration of large biological volumes [Mohammed et al. 2017], physics-based imaging pipelines that jointly optimize optical design and reconstruction [Sun et al. 2021; Wang et al. 2022], and computational methods that infer latent structure from sparse or noisy measurements [Zhong et al. 2021].

As graphics-based methods increasingly move from retrospective analysis toward guiding experiments and engineering decisions, a shared requirement across application areas is *reliability*. In this workshop, *reliable scientific instruments* refers to methods and systems that remain useful under realistic scientific constraints, including limited or noisy measurements, distribution shift across instruments and conditions, and the need to communicate uncertainty to downstream users.

Reliability includes physical and geometric validity, numerical stability under reasonable perturbations, calibrated uncertainty estimates, and clearly stated assumptions and failure modes. It also encompasses practical considerations such as reproducible pipelines, transparent reporting, and interfaces that allow scientists to interrogate and stress-test results rather than treating models as black boxes.

Against this backdrop, Graphics × Science 2026 aims to move beyond a catalog of applications and toward an actionable technical agenda for graphics-enabled science. A unifying theme across the workshop is *translation*: connecting computational methods to scientific constraints, evaluating progress when ground truth is limited, and packaging techniques into practical tools that domain experts can trust and iterate on.

Why now. Graphics-based methods are increasingly embedded directly in scientific and engineering workflows, where they influence interpretation, experimental design, and downstream decisions. As the stakes of these decisions continue to rise, there is a timely need to consolidate technical insights, compare assumptions, and advance graphics-driven approaches that emphasize physical grounding, numerical stability, and explicit treatment of uncertainty across domains.

Building on last year's success. The SIGGRAPH 2025 Graphics4Science course framed this space broadly across visualization, imaging, geometry, simulation, and computational design [Chen et al. 2025a], and gained strong engagement from the community. The 2026 workshop builds on this momentum by moving from a course format to a workshop format, enabling deeper technical discussion, increased interaction, and more active participation from both senior researchers and emerging contributors.

Table 1: Preliminary schedule (total duration: 3.5 hours).

Time	Activity	Lead
0:00–0:15	Opening	Organizers
0:15–0:40	Keynote 1	Wolfgang Heidrich
0:40–1:15	Lightning Talks I	Selected presenters
1:15–1:40	Keynote 2	Karsten Kreis
1:40–2:15	Lightning Talks II	Selected presenters
2:15–2:40	Keynote 3	Peter Y. Chen
2:40–3:30	Panel and open discussion	All speakers + organizers

2 Workshop Structure

A core goal of Graphics × Science 2026 is to reflect how the field is currently evolving, rather than only presenting established results. To support this goal, the workshop allocates substantial program time to contributed lightning talks selected through an open call, with explicit encouragement for submissions from students and junior researchers. This design builds on our experience organizing lightning talks in the previous year [Levin et al. 2025].

The workshop is structured as an interaction-first program that alternates invited technical talks with contributed content and discussion. It begins with a brief framing segment introducing the Graphics4Science initiative [Chen et al. 2025a], the workshop objectives, and the lightning-talk format.

Four invited speakers will then deliver technically detailed, tutorial-style talks, each paired with dedicated discussion time. These talks draw on representative advances in differentiable imaging and optics [Sun et al. 2021; Wang et al. 2022], reconstruction from scientific measurements [Zhong et al. 2021], molecular structure modeling [Geffner et al. 2025], and reduced-order modeling for fast physical simulation [Chang et al. 2023; Chen et al. [n. d.]].

Two lightning-talk blocks are interleaved between the invited talks and curated to maximize diversity across topics and institutions. Each block is followed by moderated Q&A that connects related results, surfaces points of agreement or disagreement, and clarifies open challenges.

The workshop concludes with a panel-style discussion involving invited speakers and selected lightning-talk presenters. This final session focuses on synthesizing technical takeaways into concrete directions for the Graphics4Science community, including evaluation practices, benchmark needs, and opportunities for shared tools and infrastructure.

3 Schedule Overview

Table 1 outlines a preliminary 3.5-hour schedule. All times are approximate and may be adjusted based on final speaker availability and SIGGRAPH scheduling constraints.

4 Target Audience

This workshop targets researchers and practitioners in computer graphics, scientific computing, machine learning, and applied domains who are interested in building reliable computational pipelines for scientific discovery. We expect relevance for attendees working on visualization, inverse problems and computational imaging, geometry processing for scientific data, physics-based simulation and

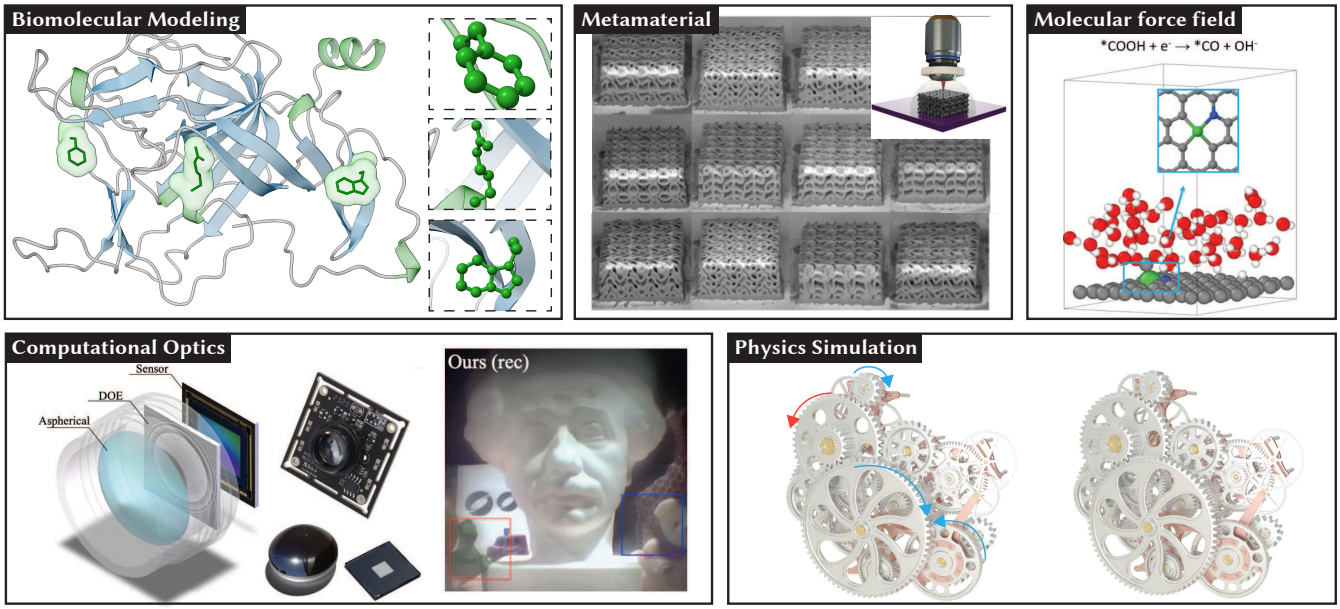

Figure 2: Cross-scale Graphics × Science exemplars (selected from publications by the invited speakers and workshop organizers): biomolecular modeling [Chen et al. 2025b]; metamaterial [Perroni-Scharf et al. 2025]; molecular force field [Wang et al. 2025]; computational optics [Yang et al. 2024]; physics simulation [Lan et al. 2022].

differentiable solvers, and generative modeling in scientific settings. The lightning-talk format is specifically designed to welcome participation from students and junior researchers and to create space for timely community updates alongside invited perspectives.

5 Keynote Speaker Biographies

Wolfgang Heidrich [*Professor, KAUST*, Confirmed]
Wolfgang Heidrich is a Professor of Computer Science and Electrical and Computer Engineering at King Abdullah University of Science and Technology (KAUST), where he also served as the Director of the Visual Computing Center from 2014 to 2021. He joined KAUST in 2014, after 13 years as a faculty member at the University of British Columbia. He received his PhD from the University of Erlangen, and then worked as a Research Associate in the Computer Graphics Group of the Max-Planck-Institute for Computer Science in Saarbrucken, Germany. His research interests lie at the intersection of imaging, optics, computer vision, computer graphics, and inverse problems. His more recent interest is in computational imaging, focusing on hardware-software co-design of the next generation of imaging systems, with applications such as High-Dynamic Range imaging, compact computational cameras, and hyperspectral cameras. He is a Fellow of the National Academy of Inventors, IEEE, Optica, AAIA, and Eurographics, and the recipient of a Humboldt Research Award and ACM SIGGRAPH Computer Graphics Achievement Award.

Karsten Kreis [*Principal Research Scientist, NVIDIA*, Confirmed]
Karsten Kreis is a Principal Research Scientist at NVIDIA Research, where he works in the Fundamental Generative AI Research team on both the foundations of generative modeling and applications across scientific and creative domains. Recently, his work has emphasized generative learning for molecular modeling, and he has been leading efforts in generative modeling for protein design. Before NVIDIA, he worked on deep generative learning at D-Wave Systems and co-founded Variational AI, a startup applying generative models to drug discovery. He completed an M.Sc. in quantum information theory at the Max Planck Institute for the Science of Light and a Ph.D. in computational and statistical physics at the Max Planck Institute for Polymer Research.

6 Organizer Biographies

Below is a list of the workshop organizers. We have previously organized a total of 23 workshops and courses at graphics, vision, and robotics conferences, including SIGGRAPH North America, SIGGRAPH Asia, CVPR, ICCV, ECCV, ICRA, and many more (Sec. 7).

Minghao Guo [*PhD Student, MIT*]
Minghao Guo is a fifth-year Ph.D. student in the Computational Design & Fabrication Group at MIT CSAIL, advised by Prof. Wojciech Matusik. He received his M.Phil. from The Chinese University of Hong Kong and his bachelor's degree from Tsinghua University. His research sits at the intersection of computer graphics, generative modeling, and scientific discovery. He builds generative design systems that translate scientific and engineering intent into designs that are physically valid, manufacturable, and functionally correct. He publishes in venues including SIGGRAPH, SIGGRAPH Asia, ICLR, NeurIPS, ICML, and scientific journals. He is a recipient of the MathWorks Fellowship and the Meshy AI Fellowship, and a finalist for the Roblox Fellowship.

Mina Konaković Luković [*Assistant Professor, MIT*]
Mina Konaković Luković is an assistant professor at MIT EECS. Her research focuses on computer graphics, computational fabrication, 3D geometry processing and machine learning, including

architectural geometry and design of smart materials. She was a Schmidt Science Postdoctoral Fellow at MIT CSAIL working in the Computational Fabrication Group mentored by Prof. Wojciech Matusik. She completed her PhD in Computer Science at the Swiss Federal Institute of Technology Lausanne (EPFL), advised by Prof. Dr. Mark Pauly. Parts of her PhD research were supported by the Swiss National Centre of Competence in Research (NCCR) Digital Fabrication. She received her MS and BS both from the University of Belgrade, Faculty of Mathematics.

Qixing Huang [*Associate Professor, UT Austin*]
Qixing Huang is an associate professor of Computer Science at the University of Texas at Austin. He obtained his PhD in Computer Science from Stanford University. He was a research assistant professor at Toyota Technological Institute at Chicago before joining UT Austin. His research spans the fields of computer vision, computer graphics, and machine learning, and publishes extensively in venues such as SIGGRAPH, CVPR, ICCV, ECCV, NeuriPS, ICML, ICLR and etc. His recent focus is on developing 3D generative models that enforce geometric, physical, and topological priors and learn from both 3D and 2D that address issues of limited 3D data and generalization. He also received the best paper award at the Symposium on Geometry Processing 2013, the best dataset award at the Symposium on Geometry Processing 2018, and the most cited paper award of Computer-Aided Geometric Design in 2010 and 2011, IJCAI Career Spotlight, and an NSF Career award.

Yin Yang [*Associate Professor, University of Utah*]
Yin Yang is an associate professor with Kahlert School of Computing, University of Utah. He co-directs Utah Graphics Lab with Prof. Cem Yuksel. He is also affiliated with Utah Robotic Center. Before joining University of Utah, he was a faculty member at University of New Mexico and Clemson University. He received his Ph.D. from University of Texas at Dallas (with David Daniel fellowship). He is a recipient of the NSF CRII award (2015) and CAREER award (2019). His research aims to develop efficient and customized computing methods for challenging problems in Graphics, Simulation, Deep Learning, Vision, Robotics, and many other applied areas.

Chenfanfu Jiang [*Professor, UCLA*]
Chenfanfu Jiang is a Professor of Mathematics and the Director of the Artificial Intelligence and Visual Computing (AIVC) Lab at UCLA. He has developed widely used physics-based simulation methods, including APIC, MLS-MPM, and IPC. His research was supported by the NSF, DOE, Toyota, Amazon, Style3D, SideFX, Sony, Adobe, Snap, and NVIDIA. He has received UCLA's Ph.D. Dissertation Award, an NSF CAREER Award, faculty awards from Amazon, Style3D, and Sony, as well as best paper awards and honorable mentions at venues including SIGGRAPH, SCA, MIG, ICRA, and IROS. He earned his Ph.D. in Computer Science from UCLA in 2015, co-advised by Demetri Terzopoulos and Joseph Teran, and was an Assistant Professor of Computer and Information Science at the University of Pennsylvania from 2017 to 2021.

Wojciech Matusik [*Professor, MIT*]
Wojciech Matusik is a Professor of EECS at MIT CSAIL, where he leads the Computational Design and Fabrication Group and is a member of the Computer Graphics Group. Before coming to MIT, he worked at Mitsubishi Electric Research Laboratories, Adobe Systems, and Disney Research Zurich. He studied computer graphics at MIT and received his PhD in 2003. He also received a BS in EECS from the University of California at Berkeley in 1997 and MS in EECS from MIT in 2001. His research interests are in computer graphics, computational design and fabrication, computer vision, robotics, and HCI. In 2004, he was named one of the world's top 100 young innovators by MIT's Technology Review Magazine. In 2009, he received the Significant New Researcher Award from ACM SIGGRAPH. In 2012, he received the DARPA Young Faculty Award and he was named a Sloan Research Fellow.

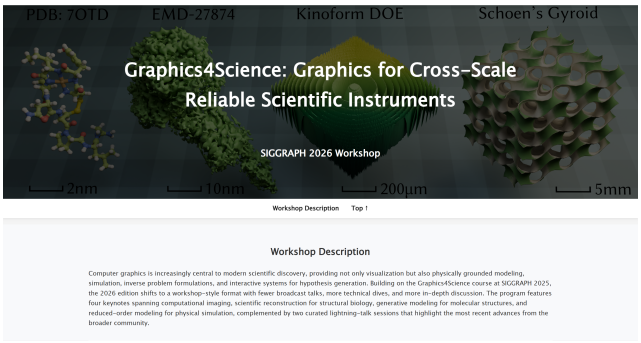

Figure 3: An overview of our workshop website.

Peter Yichen Chen [*Assistant Professor, UBC*]
Peter Yichen Chen is an assistant professor at the University of British Columbia, where he directs the UBC PhysAI Lab. He was a postdoc at MIT CSAIL and earned his CS PhD from Columbia University. Earlier, he was a Sherwood Prize-winning math undergrad at UCLA. His research advances 3D content creation for artists, design/fabrication/control for engineers, and material discovery for scientists. His interdisciplinary work spans computer graphics, machine learning, scientific computing, mechanics, and robotics.

7 Plan to solicit participation

The organizers aim to engage a broad and diverse audience by promoting the workshop across multiple channels. Information will be shared through an official website, with regular updates disseminated via social media platforms. We anticipate strong interest from communities working on areas such as animation, simulation, rendering, geometric modeling, and fabrication.

Underrepresented groups. A particular emphasis will be placed on encouraging students, early-career researchers, and individuals from underrepresented groups to participate. This includes, but is not limited to, women, members of underrepresented racial and ethnic groups, and participants from varied geographical backgrounds. To support this goal, the organizers will coordinate with affinity and advocacy groups, e.g., WIGGRAPH.

Once the proposal is accepted, a call for papers will be issued and broadly distributed through the aforementioned channels. Outreach will extend to relevant conferences, academic networks, and professional forums, ensuring the solicitation of high-quality contributions and fostering inclusive engagement with the workshop. The workshop website is available at https://graphics4science.github.io/2026/, and a screenshot of the website can be seen in Figure 3.

We anticipate approximately 100 in-person participants for our proposed workshop (not including additional online attendees should live streaming be supported). This estimate is informed

by the organizers' prior experience in hosting related workshops and courses at major conferences:

- SIGGRAPH 2025, Workshop on Reduced-Order Modeling for Physical Simulation: from the Classical to the Neural, Co-organizer (Peter Yichen Chen)
- SIGGRAPH 2025, Course on Graphics4Science: Computer Graphics for Scientific Impacts, Co-organizer (Minghao Guo)
- SIGGRAPH 2025, Workshop on Graphics Computing and World Models Industry Workshop, Speaker (Yin Yang)
- SIGGRAPH 2024, Course on Warp: Differentiable Spatial Computing for Python, Co-organizer (Peter Yichen Chen)
- SIGGRAPH Asia 2024, Course on Parallel Iterative Solvers for Real-time Elastic Deformations, Co-organizer & Speaker (Yin Yang)
- SIGGRAPH 2019, Course on Computational Fabrication, Instructor (Wojciech Matusik)
- SIGGRAPH 2019, Course on Hybrid Lagrangian–Eulerian Simulation Methods, Co-organizer (Chenfanfu Jiang)
- SIGGRAPH 2016, Course on the Material Point Method for Physics Based Simulation, Co-organizer (Chenfanfu Jiang)
- SIGGRAPH Asia 2016, Workshop on Virtual Reality meets Physical Reality, Co-organizer (Chenfanfu Jiang)
- SIGGRAPH 2005, Course on Realistic Materials in Computer Graphics, Instructor (Wojciech Matusik)
- CVPR 2026, Workshop on Geometry Generation for Scientific Computing, Co-organizer (Peter Yichen Chen)
- CVPR 2026, Workshop on 3D Scene Understanding for Vision, Graphics, and Robotics, Co-organizer (Chenfanfu Jiang)
- CVPR 2025, Workshop on Vision Meet Physics, Co-organizer (Chenfanfu Jiang)
- CVPR 2025, Workshop: Ind3D: Enforcing Inductive Bias in 3D Generation from Geometric, Physical, Topological, and Functional Perspectives, Lead Organizer (Qixing Huang)
- CVPR 2019, Workshop on Vision Meets Cognition, Co-organizer (Chenfanfu Jiang)
- CVPR 2018, Workshop on Vision Meets Cognition, Co-organizer (Chenfanfu Jiang)
- CVPR 2017, Workshop on Vision Meets Cognition, Co-organizer (Chenfanfu Jiang)
- ICCV 2025, Workshop: Wild3D: 3D Modeling, Reconstruction, and Generation in the Wild, Co-organizer (Qixing Huang)
- ICCV 2021, Workshop on SEAI: Simulation Technology for Embodied AI, Speaker (Yin Yang)
- ICCV 2021, Workshop on Simulation Technology for Embodied AI, Co-organizer (Chenfanfu Jiang)
- ECCV 2024, Workshop: Wild3D: 3D Modeling, Reconstruction, and Generation in the Wild, Co-organizer (Qixing Huang)
- GII 2023, Workshop on Cloud Rendering, Simulation, and Animation, Speaker (Yin Yang)
- Cogsci 2016, Workshop on Physical and Social Scene Understanding, Co-organizer (Chenfanfu Jiang)
- ICRA 2026, Workshop on Synthetic Data for Robot Learning, Co-organizer (Peter Yichen Chen)

8 Sketch Submissions

A core objective of this workshop is to surface emerging work and support community building across career stages, connecting junior researchers, senior researchers, and industry practitioners. To this end, we will organize a sketch submission track focused on work-in-progress, emerging technical ideas, and forward-looking perspectives aligned with the workshop theme.

We will welcome short submissions that report recent technical progress, articulate focused problem statements, describe reusable infrastructure, or present careful empirical findings of interest to the community. Accepted sketches will be presented through posters and short lightning talks, with particular emphasis on participation by students and early-career researchers.

Lightning talks will be organized into thematic blocks, each followed by a moderated discussion that connects related contributions, highlights shared technical themes, and identifies open questions. This format lowers barriers to participation while encouraging substantive feedback, cross-pollination of ideas, and engagement across different career stages and research backgrounds.

Following the workshop guidelines, we will implement the following timeline for workshop sketch submissions (anywhere on earth):

- Workshop Sketch Submission Deadline: April 7, 2026
- Workshop Sketch Reviews Due / Discussion Opens: April 28, 2026
- Workshop Sketch Decision Notification: May 5, 2026
- Workshop Date: July 20 or 21, 2026

9 Community Building

The workshop explicitly aims to connect graphics researchers with domain scientists and to support junior researchers through mentorship and visibility. To achieve this, the program is structured to encourage direct interaction across disciplines and career stages.

Junior researchers and students will be given dedicated opportunities to present their work through lightning talks and posters, enabling them to share early-stage ideas and receive feedback from senior researchers and industry participants. These sessions are designed to surface emerging work and facilitate practical mentorship through discussion rather than formal pairing.

Beyond the formal program, we will organize an informal post-workshop gathering to support continued interaction among attendees, speakers, and industry participants. The organizing team has extensive experience organizing high-attendance SIGGRAPH community events, including the Canada Party, and will apply this experience to create a focused, welcoming environment that encourages sustained professional connections.

10 Sponsorship

Confirmed industry and academic sponsors include Xtalpi, FoundryBio, and the University of British Columbia (UBC), with a total pledged sponsorship amount of $10,000 USD.

Sponsorship funds will be used to support a *Best Paper Award*, recognizing outstanding contributions from the sketch submissions and encouraging high-quality participation from junior researchers and students.

Additional sponsorship support will be allocated to offset invited speaker expenses and to provide travel or participation scholarships for students and early-career researchers. These efforts directly support the workshop's goals of broadening participation, strengthening community engagement, and ensuring an inclusive, high-impact technical program.

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