2021 Newsletter — Scientific Computing and Flow Physics Laboratory

SCFPL this Year

PhD Students: Eunhye An, Erin Burrell, Griffin Cearley, Sonya Dick, Codie Fiedler-Kawaguchi (co-advised by Xun Huan), Baudouin Fonkwa, Minki Kim, Nick Lucido (advised by S. Ceccio), Kevin Ma, Sam Pellone, Michael Wadas, William White, Hai Zhu (advised by S. Veerapaneni)

MS Students: Maryknoll Dsouza, Mizuho Takayama, Sijian Tan

UG Students: Jiashu Han, Eric Hersey, Michaela Landman, Yuenong Ling

Post-docs: Loc Khieu, Ziyang Huang

Admin: Diane Brouwer

PI: Eric Johnsen

Research Highlights

- **Multiphase flows.** Using theory and high-resolution simulations, we are investigating energy transfer during bubble growth and collapse in the context of cavitation damage. We are also studying high-speed droplet dynamics in the context of hypersonics. Additionally, we are developing numerical methods that maintain sharp gas/liquid interfaces.

- **High-energy-density physics.** We are using theory and simulations to investigate shock strengthening in laser compression experiments, shock-driven interfacial instabilities, and vortex dipoles. We are also studying mechanical impulse produced by x-ray-illuminated materials and thermal transport in laser-irradiated materials and devising approaches to measure viscosity of materials under high states of compression.

- **Turbulence.** We are investigating mixing at turbulent/less-turbulent interfaces in a variety of geometrical configurations.

- **Scientific Computing.** We are developing Discontinuous Galerkin methods for high-fidelity simulations of the compressible Navier-Stokes equations, including for gas/liquid flows, on arbitrary meshes, as well as for the multicomponent radiation hydrodynamics equations.


We also started a new project on computational studies of hot spot modeling supported by LLE.

We take this opportunity to acknowledge the invaluable contributions from our research collaborators this past year: C. Franck (Wisconsin), D. Henann (Brown), T. Colonius (Caltech), P. Bardet (George Washington U.), K. Ando (Keio U.), E. Vlaisavljevich (Virginia Tech), J. Wicks (Johns Hopkins U.), C. Di Stefano, A. Rasmus (LANL), J. Eggert, M. Millot, L. Berzak Hopkins, P. Porazik, C. Knisely, B. Perfect (LLNL), C. Barbier, E. Dominguez-Montiveros (ORNL), S. Ceccio, X. Huan, C. Kuranz, R. P. Drake, K. Maki, J. Sukovich, Z. Xu (U-M). We are also grateful to our sponsors for their support: ONR, LLNL, LANL, ORNL, LLE, and MICDE, as well as ALCF, OLCF, DOD Supercomputing, and XSEDE for computing resources.
Group Happenings

We hope that you are all in good health. The challenges associated with the pandemic have persisted and like everyone we are still adjusting as we look to balance in-person and virtual activities. It was exciting to participate in in-person conferences (APS DPP and DFD meetings) and see friends and colleagues, even if this might be short lived. On campus, it has been great to actually see each other on a regular basis. At the same time, we have learned to be productive with virtual meetings and remote work.

This year, we were excited to welcome new group members:

- PhD students Baudouin Fonkwa and William White (since Fall 2021).
- Undergraduate researchers Jiashu Han and Michaela Landman (since Fall 2021).
- Post-doctoral scholar Ziyang Huang (since June 2021).

Several group members moved on to new positions this year:

- Sam Pellone started a postdoc at Los Alamos National Laboratory.
- Hai Zhu (Applied Math, primarily advised by Shravan Veerapaneni) defended his PhD this year and started a postdoc in Applied Math at Michigan.
- Loc Khieu started a position at Lordstown Motor Corp.
- Yuenong Ling completed his BS and started his PhD at MIT.

Eric started a term as Associate Chair for Undergraduate Education in Mechanical Engineering as part of which he oversees the ME undergraduate program.

Congratulations!

Several group members received awards this year—congratulations to:

- Codie Fiedler Kawaguchi, 2021 NSF Graduate Research Fellowship.
- Erin Burrell, 2021 MICDE Graduate Fellowship.
- Minki Kim, 2021 KSEA-KUSCO Graduate Scholarship (Korean-American Scientists and Engineers Association and Korean-US Science Cooperation Center) and 2021 U-M Towner Prize for Distinguished Academic Achievement.
- Michael Wadas, 2021 Best Poster Award at the NIF/JLF User Group Meeting and 2021 Scientific Communication Award at the U-M Engineering Research Symposium.

Alumni News

One silver lining of the pandemic has been the opportunity to engage with our group alumni more regularly through virtual events such as thesis defenses and seminars. Over Summer 2021, it was a pleasure to host a virtual seminar series with presentations by Marc Henry de Frahan (NREL), Aditya Nair (U. Nevada Reno), Siddhesh Shinde (Aptiv), and Chengyun Hua (ORNL). It was fun to hear about the great things they’ve done since leaving the group, both professionally and personally. To Marc, Aditya, Siddhesh, and Chengyun: Thanks for participating! We hope to keep these activities going as we move forward.
In other alumni news:

- Mauro Rodriguez started this Fall as Assistant Professor in Engineering at Brown University.
- After completing her M.D., Lauren Mancia started her Residency in Orthopaedics at U. Rochester.
- Colleen Crouch started this Fall as Assistant Professor in Mechanical, Aerospace and Biomedical Engineering at the University of Tennessee Knoxville.
- Maryam Akram defended her PhD (Aero, Summer 2021) and started a position at Ford Motor Company.
- Fanchen He defended her PhD (Applied Math, Summer 2021) and started a position at Comsol.
- Anil Yildirim defended his PhD (Aero, Summer 2021), won a 2021 Best Student Paper Award in Multidisciplinary Design Optimization at the AIAA Aviation Forum and the Air Breathing Propulsion TC Gordon C. Oates Air Breathing Propulsion Graduate Award.

We may have missed some of our group alumni’s achievements—please let us know if this is the case and do stay in touch!

Selected artwork from this year’s SCFPL papers
(Philip Johnson, Michael Wadas, Kazuya Murakami, Sam Pellone, Lauren Mancia).

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