2024 AFOSR/ONR High-Speed/Hypersonics MURI Review
Drs. Amanda Chou & Eric Marineau | December 2-6, 2024 | Arlington, VA

Basic Research Innovation Collaboration Center (BRICC)
4100 N Fairfax Drive, Suite 450 | Arlington, VA 22203

Agenda Day 1 | December 2, 2024

Development of Validated Hypersonic Plasma Kinetics Models Including Atomic Excitation

Time	Topic	Speaker
8:00-8:30	**Check In/ Zoomgov log in**	
8:30-8:45	Welcome and Overview of Topic	Dr. Eric Marineau, ONR
8:45-9:00	Overview of MURI Team and Research	Dr. Iian Boyd, University of Colorado Boulder
9:00-9:40	Molecular Computations	Dr. George Schatz, Northwestern University
9:40-10:00	Molecular Experiments	Dr. Tim Minton, University of Colorado Boulder
10:00-10:30	Plasma Reactor Experiments & Modeling	Dr. Igor Adamovich, Ohio State University
10:30-10:45	BREAK	
10:45-11:15	Shock Tube Experiments	Dr. Ron Hanson, Stanford
11:15-11:45	Shock Tube & Expansion Tunnel Experiments	Dr. Matt McGilvray, Oxford
11:45-12:05	Reduced Order Kinetics Modeling	Dr. Robyn Macdonald, University of Colorado Boulder
12:05-1:15	LUNCH	
1:15-1:45	Flow Modeling	Dr. Iian Boyd, University of Colorado Boulder
1:45-2:00	Summary and Next Steps	Dr. Iian Boyd, Dr. Iian Boyd
2:00-2:25	Invited talk #1: Cross Beam Experiments	Dr. Arthur Suits, University of Missouri
2:25-2:50	Invited talk #2: Electron Kinetics	Dr. Tzvetelina Petrova, Naval Research Laboratory
2:50-3:00	BREAK	
3:00-3:25	Invited talk #3: AFRL	Capt. Ashwin Rao, Air Force Research Laboratory

Time	Topic	Speaker
3:25-3:50	Invited talk #4: Plasma Chemistry Experiments	Dr. Nick Shuman, Air Force Research Laboratory
3:50-4:25	Discussion	Open Discussion, All Participants
4:25-5:00	Discussion	Closed Session, Government / MURI
5:00	**MEETING ADJOURN FOR THE DAY**	

Agenda Day 2 | December 3, 2024		
A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonics Systems Grounded in Rigorous Model Reductions		
Time	**Topic**	**Speaker**
8:00-8:30	**Check In/ Zoomgov log in**	
8:30-8:35	Welcome and Opening Remarks	Dr. Amanda Chou, AFOSR
8:35-8:45	A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonic Systems Grounded in Rigorous Model Reduction	Dr. Charbel Farhat, Stanford
8:45-9:10	Methods for Generation of Aerodynamic Databases for Hypersonic Glide Vehicles	Dr. Graham Candler, UMN
9:10-9:35	Model Reduction with Implicit Feature Tracking to Accelerate Simulation of Hypersonic Flow	Dr. Matthew Zahr, Notre Dame
9:35-10:00	Nonlinear Model Reduction Based on Modeling the Closure Error in the Latent Space and Application to Hypersonic Flows	Dr. Charbel Farhat, Stanford
10:00-10:25	Model-Based Control of a Hypersonic Glide Vehicle	Dr. Maziar Hemati, UMN
10:25-10:45	**BREAK**	
10:45-11:10	Bayesian Framework with Projection-Based Model Order Reduction for Efficient Global Optimization	Dr. Christian Porrello, Stanford
11:10-11:35	Sensitivity-Based Model Refinement for Trajectory Optimization of Hypersonic Vehicle	Dr. Matthias Heinkenschloss, Rice
11:35-12:00	Efficient MDAO of Hypersonic Boost-Glide Vehicles Using Multi-Fidelity Surrogate Models and Trajectory-Informed Acquisition Functions	Dr. Juan Alonso, Stanford
12:00-12:15	Single-Body vs. Multi-Body Modeling of a Hypersonic Dynamical System and Impact on Trajectory Prediction	Dr. Charbel Farhat, Stanford
12:15-1:15	**LUNCH**	

Time	Topic	Speaker
1:15-2:00	Challenges and Opportunities in the Deployment of Operational Hypersonic Vehicles	Dr. Mark Lewis, Purdue
2:00-2:45	Projection-Based Model Reduction for Aerodynamics: Nonlinear Approximation, Error Estimation, and Adaptation	Dr. Masayuki Yano, University of Toronto
2:45-3:05	**BREAK**	
3:05-3:50	Multi-Fidelity Linear Regression for Scientific Machine Learning from Scarce Data	Dr. Elizabeth Qian, Georgia Tech
3:50-4:00	Summary and Next Steps	Dr. Charbel Farhat, Stanford
4:00	**MEETING ADJOURN FOR THE DAY**	

**Agenda Day 3	December 4, 2024**		
Particulate and Precipitation Effects on High-speed Flight Vehicles		
Time	**Topic**	**Speaker**
8:00-8:30	**Check In/ Zoomgov log in**	
8:30-8:40	Welcome and Overview of Topic	Dr. Eric Marineau, ONR
8:40-8:50	MURI Year-3 Overview	Dr. Tom Schwartzentruber, University of Minnesota
8:50-9:15	Experiments of High-Speed Particle Collisions with Surfaces	Dr. Chris Hogan, University of Minnesota
9:15-9:40	Modeling Particle Interactions with Highspeed Flow	Dr. Tom Schwartzentruber, University of Minnesota
9:40-10:05	CFD Framework and Modeling for Particle/Droplet Flow Interactions	Dr. Graham Candler, University of Minnesota
10:05-10:20	**BREAK**	
10:20-10:45	Verification and Validation Studies for Damage Modeling & Simulation	Drs. Suraj Ravindran & Ibrahim Guven, University of Minnesota
10:45-11:10	PISALE Code Development for Particle Impacts	Dr. Alice Koniges, University of Hawaii
11:10-11:35	Advanced Diagnostics and Imaging of Droplet Demise at High Weber Number	Dr. Nick Parziale, Stevens
11:35-12:00	Wind-tunnel and Small Gas-gun Experiments with Droplets and Particulates	Dr. Stuart Laurence, UMD
12:00-1:10	**LUNCH**	

Time	Topic	Speaker
1:10-1:35	Summary of Multiphase Flow Numerical Method Verification & Validation Exercises	Dr. Jason Rabinovich, Stevens Institute
1:35-2:00	Multiphase Flow Predictions for Droplet Breakup in Hypersonic Flow	Dr. Christoph Brehm, UMD
2:00-2:25	Peridynamics Approaches for Weather Encounters	Dr. Ibrahim Guvin, Virginia Commonwealth University
2:25-2:50	Microparticle Impact Experiments of POCO-graphite at Elevated Temperatures	Dr. Suraj Ravindran, University of Minnesota
2:50-3:05	**BREAK**	
3:05-3:05	Workshop Planning	Open Discussion, All Participants
3:05-4:15	Summary and Next Steps	Dr. Tom Schwartzentruber, University of Minnesota
4:15-5:00	Wrap Up Discussion	Open Discussion, All Participants
5:00	**MEETING ADJOURN FOR THE DAY**	

Agenda Day 4 | December 5, 2024		
Discovering & Modeling Turbulence and Chemistry Interactions in High-Speed Reactive Flows		
Time	**Topic**	**Speaker**
8:00-8:30	**Check In/ Zoomgov log in**	
8:30-8:45	Welcome and Overview of Topic	Dr. Eric Marineau, ONR
8:45-9:00	Overview of MURI project and Year 2 progress	Dr. Venkat Raman, University of Michigan
9:00-9:30	Fundamental Processes in High-speed Combustion	Dr. Venkat Raman, University of Michigan
9:30-10:00	Diagnostic Approaches for High-speed Reacting Flows	Dr. Tonghun Lee, University of Illinois at UC
10:00-10:30	Uncertainty Quantification for Learning and Inference in Reactive Flows	Dr. Roger Ghanem, University of Southern California
10:30-10:45	**BREAK**	
10:45-11:15	Balancing Accuracy and Computational Cost: A Multi-Fidelity Approach to Reduced-Order Chemical Modeling	Dr. Marco Panesi, University of Illinois at UC
11:15-11:45	Aerothermochemistry Effects in the Receptivity Process at High-Enthalpy Conditions	Dr. Carlo Scalo, Purdue University

11:45-12:15	Knowledge Gap in High-speed Combustion Chemistry and Its Application	Dr. Hai Wang, Stanford
12:15-12:30	General Discussion	Open Session All Participants
12:30-1:30	**LUNCH**	
1:30-2:00	Invited Talk	Dr. Sam Gruer, Penn State
2:00-2:30	Invited Talk	Dr. Kareem Ahmed, UCF
2:30-3:00	Invited Talk	Dr. Alexei Poludnenko, University of Connecticut
3:00-3:15	**BREAK**	
3:15-3:45	MURI Summary	Dr. Venkat Raman, University of Michigan
3:45-4:00	Wrap Up Discussion	Open Discussion, All Participants
4:00-5:00	Closed Discussion	Closed Discussion Government / MURI Team
5:00	**MEETING ADJOURN FOR THE DAY**	

Agenda Day 5 | December 6, 2024		
Combustion of Solid Fuels in High Enthalpy Flow		
Time	**Topic**	**Speaker**
8:00-8:30	**Check In/ Zoomgov log in**	
8:30-8:45	Welcome and Overview of Topic	Dr. Eric Marineau, ONR
8:45-9:00	Overview of MURI Team and Research	Dr. Greg Young, Virginia Tech
9:00-9:35	Molecule-based Models for Polymer Pyrolysis	Dr. Phil Westmoreland, N.C. State
9:35-10:10	Combustion of Polymer Fuel with Additives	Dr. Michael Zachariah, U.C. Riverside
10:10-10:20	**BREAK**	
10:20-11:05	Invited Talk #1	Dr. Linda Broadbelt, Northwestern University

11:05-11:40	HyChem+: Solid Polymer Decomposition Kinetics and Gas-phase Foundational Fuel Chemistry Modeling	Dr. Hai Wang, Stanford
11:40-12:15	Interfacial and Near Surface Processes during Solid Fuel Combustion from Sub- to Super- Atmospheric Pressures	Dr. Rich Yetter, Penn State
12:15-1:15	**LUNCH**	
1:15-2:00	Invited Talk #2	Dr. Alexander Laskin, Purdue
2:00-2:35	Solid Fuel Pyrolysis and Combustion Experiments	Dr. Greg Young, Virginia Tech
2:35-3:10	Opposed Flow Flame Characterization with Hybrid fs/ps CARS and Particle Diagnostics	Dr. James Michael, Auburn
3:10-3:20	**BREAK**	
3:20-3:55	Numerical Simulations of Solid Fuel Ramjet Combustion	Dr. Suresh Menon, Georgia Tech
3:55-4:40	Invited Talk #3	Dr. Nick Parziale, Stevens
4:40-5:00	Off-line Discussion	Discussion MURI / Government Team
5:00	**MEETING ADJOURNED**	