

Plasmadynamics and Lasers

Papers Presented at the AIAA Aviation Forum 2023

San Diego, California, USA
12-16 June 2023

ISBN: 978-1-7138-7871-1

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwptkug'Xcmg{ 'F tkxg."Uwkug"422, Reston, VA 20191, USA.

TABLE OF CONTENTS

LASER, PLASMA, RADIATION, AND OPTICAL PHYSICS

Numerical Study of Radiative Heat Effects in Inductively Coupled Plasma Discharges	1
<i>Sanjeev Kumar, Sung Min Jo, Alessandro Munafò, Daniel J. Bodony, Marco Panesi</i>	
Refractive Index of Diatomic Species for Nonequilibrium Flows	15
<i>Juan J. Anaya, Albina Tropina, Richard Miles, Maninder Grover</i>	
Investigation of Gas Flow Within a Laser Amplifier Head for Optimal Cooling.....	30
<i>Edward Lowell, Oliver T. Schmidt, Frantisek Batysta, Thomas Spinka</i>	
A Numerical Investigation of the Micronozzle Geometry Effect on the Performance of Microwave Electrothermal Thrusters	41
<i>Juyeon Lee, Laxminarayan L. Raja</i>	
Magnetized High-Frequency Excited Plasmas for Rarefied Air Ionization in Air-Breathing Electric Propulsion.....	58
<i>Mammadbaghir Baghirzade, Laxminarayan L. Raja</i>	

PLASMA-ASSISTED COMBUSTION AND IGNITION

Simultaneous Laser Ignition and Laser-Induced Breakdown Spectroscopy of a Hydrocarbon Spray Flame.....	71
<i>Parneeth Lokini, Ciprian Dumitache, Bret C. Windom, Azer P. Yalin</i>	
Towards Plasma-Assisted Combustion Using a Continuous Optical Discharge	82
<i>Mozhdeh Hooshyar, Ciprian Dumitache</i>	

PLASMA FLOW CONTROL

Characteristics of Radiative Heating in Mars Entry Flight with Magnetohydrodynamic Flow Control.....	95
<i>Kotaro Tabuchi, Takayasu Fujino</i>	
Extended Control of Shock Wave Reflection by Long Q-DC Electrical Discharge.....	105
<i>Philip S. Andrews, Philip Lax, Sergey B. Leonov</i>	
Trichel-Like Pulses in Negative Corona Discharge Under a Supersonic Flow	117
<i>Guillaume Dufour, Konstantinos Kourtzanidis, François Rogier</i>	
Combined and Simultaneous Electro-Optical Diagnostics for Oscillatory Plasma Discharges.....	128
<i>Saskia Pasch, Tom Fridlender, Marc T. Hehner, Nicolas Benard, Jochen Kriegseis</i>	

PLASMA AND LASER DIAGNOSTICS I

A Quantum-Cascade-Laser-Absorption-Spectroscopy Diagnostic for Measuring Temperature and Nitric Oxide at 1 MHz in Shock-Heated Air	137
<i>Jonathan J. Gilvey, Christopher S. Goldenstein</i>	

Temperature and Velocity Measurement in a Shock Tube with Homodyne and Heterodyne Grating Spectroscopy	147
<i>Lukas Jakobs, Tobias Sander, Christian Mundt</i>	

Spatially Resolved Measurements of Krypton by Two-Photon Absorption Laser Induced Fluorescence (TALIF) in a Barium Oxide Hollow Cathode Plasma	158
<i>Seth Antozzi, Jacob Gottfried, John D. Williams, Azer P. Yalin</i>	

PLASMA AND LASER DIAGNOSTICS II

Ultraviolet (UV) Laser Implementation and Measurement Sensitivities in Filtered Rayleigh Scattering for Aerodynamic Flows	173
<i>Garrett Pitt, Todd Lowe</i>	

Burst-Mode Nitric Oxide PLIF for Visualization and Mode Spectral Analysis of Hypersonic Shear Layers	217
<i>Boris S. Leonov, Tyler S. Dean, Donovan E. McGruder, Rodney D. Bowersox, Christopher Limbach, Richard Miles</i>	

A 100 kHz TDLAS Diagnostic for Characterizing Non-Equilibrium CN Formed Behind Shock Waves in N ₂ -CH ₄ Mixtures	235
<i>Jennifer L. Vera, Vishnu Radhakrishna, Charles J. Schwartz, Christopher S. Goldenstein</i>	

GENERAL TOPICS IN AVIATION II VIRTUAL SESSION

Collision Severity Analysis of Quadrotors on Covered Linkways for Ground Risk Assessment in Urbanized Environments	246
<i>Mohd Hasrizam Che Man, Anush K. Sivakumar, Nathaniel Ng Jingwei, Kin Huat Low</i>	

Simulation of Laser Induced Breakdown and Heating of Oxygen Gas	260
<i>Kenneth A. Croft, George Ashe, Trevor M. Moeller</i>	

A Particle-Based Direct Numerical Simulation Model for Turbulence-Cloud-Aerosol Interactions	288
<i>Abdullah Al Muti Sharuddin, Foluso Ladeinde</i>	

Sanal Flow Choking And/or Sonic-Fluid-Throat Effect Reconfirms the Chapman-Jouguet Condition of Detonation Propagation and Ceases	298
<i>Vr Sanal Kumar, Raunak Sharma, Vinay Dekkala, Saatvik Sharma, Vigneshwaran Rajendran, Vigneshwaran Sankar, Dhruv Panchal, Yash Raj, Amit Kushwaha, Hindool Sharma, Rohan Sharma, Arwa Farhat Abbas, Vignesh Saravanan, Nichith C, Ajith S, Sulthan Ariff Rahman M, Rohan Sarswat, Prathit Kalra, Srajan Shrivastava, Tejas Sandeep Kapatkar, Prisha K. Asher, Bhavya Saxena, Tanishka Varma, Sagnik Saha, Sobia Raza, Tanisha Singh, Maansi Srivastava</i>	

Shock Standoff Distance in Viscous Hypersonic Flows Around a Blunt Body	318
<i>Himanshu Khatri, Liwei Zhang</i>	

Author Index