

Christopher M. Limbach

Title: Research Assistant Professor, Department of Aerospace Engineering

Institution: Texas A&M University

Office Address: 602D H.R. Bright Building

Office Tel: (970) 491-4710

Office Email: climbach@tamu.edu

Education:

- 2015 Ph.D. Princeton University, Mechanical and Aerospace Engineering
- 2009 B.S. University of Arizona, Engineering Physics (Summa Cum Laude)
- 2009 B.S. University of Arizona, Astronomy (Summa Cum Laude)

Appointments

- Jan 9, 2017 - Present Research Assistant Professor, Aerospace Engineering
Texas A&M University, College Station, TX
- 2015-2016 Research Scientist, Mechanical Engineering
Center for Laser Sensing, Powerhouse Energy Institute
Colorado State University, Fort Collins, CO

Research Interests:

- Plasma and laser applications to aerospace propulsion:
 - ▶ Laser ignition of gas phase and multiphase flows
 - ▶ Plasma enhanced mixing, combustion initiation and sustainment
 - ▶ Supersonic flow control and plasma-aerodynamics
 - ▶ Adjoint optimization and design with plasma flow-control approaches and devices
 - ▶ Laser ablation propulsion
- Laser diagnostics of high speed flows and plasmas:
 - ▶ Non-intrusive diagnostics for high enthalpy test facilities
 - ▶ Dissociation and ionization fraction measurement with Rayleigh and Thomson scattering
 - ▶ Laser-based atmospheric diagnostics, LIDAR

Awards and Honors:

- National Defense Science and Engineering Graduate Fellowship ASEE, 2012 - 2014
- Princeton Plasma Science and Technology Fellowship Princeton, 2010 - 2011
- National Merit Scholarship Award NMSC, 2005 - 2009
- Galileo Circle Scholarship Award Univ. Arizona, 2007

Professional Memberships:

- American Society of Aeronautics & Astronautics (AIAA), Member
- American Physical Society, Member

Professional Service:

- AIAA Aviation 2014 Session Chair 2014

Invited and Guest Lectures:

- Plasma Diagnostics Invited Talk at AIAA SciTech:
“Thomson Scattering Techniques for High and Low Pressure Plasmas” 2017
- Plasma Diagnostics Invited Talk at AIAA SciTech:
“Rayleigh and Raman Scattering Techniques and Application to Plasmas” 2017
- MAE 521: Optics and Lasers Class, Guest Lecture - “Light Scattering Diagnostics” 2014

- 66th Gas Electronics Conference Talk: “A Molecular Filtered Light Scattering Diagnostic for Atmospheric Pressure Laser Sparks” 2013

Teaching Experience & Honors:

- McGraw Graduate Teaching Fellowship Fall 2013
- Crocco Teaching Prize (for MAE 412) Fall 2012
- Assistant in Instruction: MAE 412 - Microprocessors, Measurement and Control Fall 2011/2012
- Assistant in Instruction: MAE 342 - Space System Design Spring 2012

Consulting:

2015 - MetroLaser Inc., Laguna Hills, CA.

Patents:

#20,160,109,349 Portable Particle Spectrometer. Issued April 21, 2016. Volckens, J., Anderson, K., Leith, D., Ndonga, M.T., Yalin, A., Limbach, C.M.

Publications:

A. Refereed Journal Articles

1. C.M. Limbach and R.B. Miles, “Two-Color Thomson/Rayleigh Scattering Diagnostic of Electron/Neutral Number Density,” Applied Physics D. (under review).
2. A.J. Friss, C.M. Limbach and A.P. Yalin, "Cavity-Enhanced Rotational Raman Scattering in Gases Using a 20 mW Near-Infrared Fiber Laser," Optics Letters. 41, 3193-3196 (2016).
3. C. Dumitrache, C.M. Limbach and A.P. Yalin, “Threshold Characteristics of Ultraviolet and Near Infrared Nanosecond Laser Induced Plasmas,” Physics of Plasmas, Vol. 23, No. 9 (2016).
4. C.M. Limbach and R.B. Miles, “Rayleigh Scattering Measurements of Heating and Gas Perturbations Accompanying Femtosecond Laser Tagging,” AIAA Journal. Vol. 55, No. 1 (2017) pp. 112-120 Article in Advance. DOI: 10.2514/1.J054772
5. R.B. Miles, J.B. Michael, C.M. Limbach, S.D. McGuire, T.L. Chng, M.R. Edwards, N.J. DeLuca, M.N. Shneider and A. Dogariu. “New Diagnostic Methods for Laser Plasma- and Microwave-Enhanced Combustion,” Philosophical transactions. Series A, Mathematical, physical, and engineering sciences, Vol. 373, No. 2048 (2015).
6. C.M. Limbach, L. Martinelli and R.B. Miles. “Adjoint Optimization of Sources in Steady, Supersonic Flow: Energy Addition,” AIAA Journal, Vol. 51, No. 10 (2013).
7. R. Miles, P. Howard, C.M. Limbach, S. Zaidi, S. Lucato, B. Cox, D. Marshall, A.M. Espinosa, D. Driemeyer, “A Shape Morphing Ceramic Composite for Variable Geometry Scramjet Inlets,” Journal of the American Ceramic Society, Vol. 94, No. S1 – supplement to Vol. 94, No. 5. Pages S35 – S41. (June 2011).
8. E. Ulrich, C.M. Limbach, S. Manne, “Imaging Microflows and Nanopore Structures Using Hydrodynamic Force Microscopy,” Applied Physics Letters 93, 243103 (2008).

B. Conference Proceedings

1. C.M. Limbach, C. Dumitrache, and A.P. Yalin. "Laser Light Scattering from Equilibrium, High Temperature Gases: Limitations on Rayleigh Scattering Thermometry," 47th AIAA Plasmadynamics and Lasers Conference, AIAA Aviation, (AIAA 2016-3381).
2. C.M. Limbach, R. Robinson, D. Adams, M. Wilbanks and A.P. Yalin. “Toward A Microscopic Study of Laser Interactions with Single Levitated Liquid Droplets in an Electrodynamic Balance,” 47th AIAA Plasmadynamics and Lasers Conference, AIAA Aviation, (AIAA 2016-3382).

3. J. George, C.M. Limbach, T.P. Jenkins, and R.B. Miles. "Measurement of Dissociation Fraction and Temperature using Laser Rayleigh Scattering Methods," 32nd AIAA Aerodynamic Measurement Technology and Ground Testing Conference, AIAA Aviation, (AIAA 2016-3114).
4. C. Dumitrache, C.M. Limbach and A.P. Yalin. "Laser Thermal Ignition Using a Dual-Pulse Approach," 54th AIAA Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2016-0460).
5. A.J. Friss, C.M. Limbach and A.P. Yalin. "Development of a Cavity Enhanced Thomson and Raman Scattering Diagnostic," 54th AIAA Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2016-1698).
6. A. Starikovskiy, C.M. Limbach, and R.B. Miles. "Trajectory Control of Small Rotating Projectiles by Laser Sparks," 54th AIAA Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2016-0459).
7. C.M. Limbach and R.B. Miles. "Characterization of Dissociation and Gas Heating in Femtosecond Laser Plasma with Planar Rayleigh Scattering and Rayleigh Scattering Polarimetry," 53rd AIAA Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2015-0932).
8. M.R. Edwards, C.M. Limbach, R.B. Miles and A. Tropina. "Limitations on High-Spatial Resolution Measurements of Turbulence Using Femtosecond Laser Tagging," 53rd AIAA Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2015-1219).
9. C.M. Limbach and R.B. Miles. "Adjoint Optimization of the Spatial Profile of Steady Energy Deposition for Supersonic Drag Reduction," 45th AIAA Fluid Dynamics Conference, AIAA Aviation, (AIAA 2015-2466).
10. C.M. Limbach, R.B. Miles. "Rayleigh and Thomson scattering diagnostics of laser air sparks: a testbed for tailoring laser plasmas," 45th Plasmadynamics and Lasers Conference, AIAA Aviation, (AIAA 2014-2538).
11. C.M. Limbach, R.B. Miles. "Simultaneous Temperature, Density and Velocity Measurements in Laser-Generated Plasmas by Rayleigh and Filtered Rayleigh Scattering," 52nd Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2014-0143).
12. C.M. Limbach, R.B. Miles. "Steering in Supersonic Flow via Laser Breakdown: Measurements for a Tethered Cylinder-Cone," 51st Aerospace Sciences Meeting, (AIAA 2013-0318).
13. C.M. Limbach, M.N. Shneider and R.B. Miles. "Hypersonic Vehicle MHD Power Extraction Concept Utilizing Mach Stem Thermal Ionization," 42nd AIAA Plasmadynamics and Lasers Conference in conjunction with the 18th International Conference on MHD Energy Conversion (ICMHD), (AIAA-2011-3595).
14. C.M. Limbach, S. Zaidi, P. Howard, R.B. Miles (Princeton University); S. dos Santos e Lucato, (Teledyne Scientific Company). "Test of a Morphing Hypersonic Inlet with Ceramic Matrix Composite Surface in a Mach 8 Tunnel," 49th AIAA Aerospace Sciences Meeting, 2011. (oral presentation).

C. Published Abstracts

1. C. Dumitrache, C.M. Limbach, A.P. Yalin, "A study of flame dynamics induced by a dual-pulse laser ignition technique," IEEE International Conference on Plasma Science (ICOPS), Atlantic City, NJ, 2017.
2. A.J. Friss, C.M. Limbach and A.P. Yalin, "Development of cavity enhanced Raman and Thomson scattering diagnostics," IEEE International Conference on Plasma Science (ICOPS), Banff, AB, Canada, 2016.

3. C. Dumitrache, C.M. Limbach and A.P. Yalin, "Properties of ultraviolet and near-infrared laser induced air plasmas and their application for spark ignition," IEEE International Conference on Plasma Science (ICOPS), Banff, AB, Canada, 2016.
4. A. Starikovskiy, C.M. Limbach and R.B. Miles, "Trajectory control of small rotating projectiles by laser sparks," 68th Annual Gaseous Electronics Conference/9th International Conference on Reactive Plasmas/33rd Symposium on Plasma Processing. Honolulu, Hawaii, 2015.
5. C.M. Limbach and R.B. Miles, "Light scattering measurements of energy partitioning in laser air sparks," IEEE 41st International Conference on Plasma Sciences (ICOPS) held with IEEE International Conference on High-Power Particle Beams (BEAMS), Washington, DC, 2014.
6. C.M. Limbach, R.B. Miles, "Simultaneous filtered and unfiltered light scattering measurements in laser generated air sparks," 66th Annual Gaseous Electronics Conference. Princeton, NJ, 2013.

D. Ph.D. Thesis

Christopher M. Limbach, "Characterization of nanosecond, femtosecond and dual pulse laser energy deposition in air for flow control and diagnostic applications," Ph.D. Thesis, Department of Mechanical and Aerospace Engineering. Princeton University, Nov. 2015.