

Ciprian Dumitrache

Colorado State University (CSU)
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Education

- 01/15/2013 - 12/16/2017 **Doctor of Philosophy**
Institution: Colorado State University
Location: Fort Collins, CO, USA
Research area: Laser Diagnostics for Combustion and Plasma
- 08/21/2011 - 12/18/2012 **Master of Science**
Institution: Georgia Institute of Technology
Location: Atlanta, GA, USA
Research area: Combustion Instabilities in Liquid Rocket Engines
- 10/01/2006 - 07/16/2010 **Bachelor of Science**
Institution: University "Politehnica" Bucharest
Location: Bucharest, Romania
Field: Aerospace Engineering

Research Interests

- Aerospace Propulsion Systems
- Plasma Kinetics and Plasma Modeling
- Advanced Optical Diagnostics
- Experimental and Computational Fluid Mechanics

Professional Experience

- 08/16/2022 – Present **Colorado State University**
Fort Collins, CO, USA
Assistant Professor (Tenure-Track)
- Teaching courses within the Department of Mechanical Engineering
 - Develop High-Speed Aerodynamics and Aerospace Propulsion Laboratory
 - Conduct research on topics such as: plasma-assisted combustion (ignition, flame holding & stabilization), femtosecond laser diagnostics, computational fluid dynamics, hypersonics, etc.
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- 06/16/2022 – 08/16/2022 **Colorado State University**
Fort Collins, CO, USA
Adjunct Professor
- Collaborate with Dr. Azer Yalin to build the High-Speed Aerodynamics and Aerospace Propulsion Laboratory
 - Explore and pursue research grants to support my research program
 - Develop course material for MECH 344 – Heat and Mass Transfer (to be taught in Fall '22)
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- 01/01/2020 – 05/12/2022 **National Institute for Lasers, Plasma and Radiation Physics (INFLPR),**
Magurele, Romania
Research Scientist CSIII
- Worked on experimental study of multi-point (multi-pulse) laser ignition of engines.
 - Performed numerical modeling of laser plasma hydrodynamic instabilities.

- Conducted optical emission measurements in an RF-plasma source used for SARS-COV-2 decontamination.

01/01/2018 – 12/31/2019 **Laboratoire EM2C (CNRS UPR288) at École CentraleSupélec,**
Paris, France
Postdoctoral Fellow

- Worked on numerical modeling of nanosecond discharges used for plasma-assisted combustion.
- Performed femtosecond spectroscopy for atomic nitrogen in NRP discharges used for nitridation.
- Conducted spectroscopy measurements using VUV synchrotron radiation at Synchrotron SOLEIL.

08/25/2017 – 12/31/2017 **Center for Laser Sensing and Diagnostics (CLSD) at Colorado State University,** Fort Collins, CO, USA
Postdoctoral Fellow

- Developed a 2+1 O₂ **Resonantly Enhanced Multi-Photon Ionization (REMPI)** scheme for laser ignition
- Set-up **Two-photon Absorption Laser-Induced Fluorescence (TALIF)** diagnostic for measuring ultra-low densities ($\sim 10^{10}$ cm⁻³) of Xenon for Hall-effect thrusters
- Performed **Optical Emission Spectroscopy (OES)** measurements for laser sparks.

01/01/2013 - 12/31/2017 **Center for Laser Sensing and Diagnostics (CLSD) at Colorado State University,** Fort Collins, CO, USA
Graduate Research Assistant

- Developed a novel laser ignition technique using a non-resonant dual-pulse (UV+NIR) pre-ionization scheme.
- Performed numerical modeling of laser sparks and plasma kinetics.
- Developed a high-speed schlieren interferometry technique for studying supersonic flows induced by laser sparks.
- Conducted Laser Ignition experiments inside a Rapid Compression Machine

08/21/2011 - 12/31/2013 **“Ben T. Zinn” Aerospace Combustion Laboratory at Georgia Institute of Technology,** Atlanta, GA, USA
Graduate Research Assistant

- Developed an active control code for combustion instabilities for liquid rocket engines.
- Performed flame characterization using laser-induced fluorescence.

Honors & Awards

12/20/2020 **Early Career Scientists Award**
Awarded by Ad Astra (Association of Romanian scientists)

The award recognizes a young research scientist (less than 7 years from PhD graduation) for demonstrated excellence in research in the field of engineering science & technology with affiliation at a Romanian institution.

03/06/2020 **Best Paper Award**
Awarded by American Institute of Aeronautics and Astronautics (AIAA)

The award recognizes the best paper presented at the AIAA Aviation 2019 & Scitech 2020 in the “Plasmadynamics and Lasers” section. Paper: ” C. Butte, C. Dumitrache, A Yalin, “Dual-pulse Laser Ignition Using Oxygen REMPI Preionization”, AIAA 2019-3117.

05/01/2016 **PhD Teaching Fellowship**
Awarded by the Department of Mechanical Engineering at Colorado State University

The fellowship supports only one PhD student interested in a mentored teaching experience in preparation for pursuing academic faculty position.

11/09/2015 **CSU Ventures-Drivers of Innovation Award**
Awarded by CSU Ventures at Colorado State University

The Drivers of Innovation Awards highlight the leading edge of the most innovative research originating from CSU.

06/08/2015 **Gordon C. Oates Air Breathing Propulsion Award**
Awarded by the American Institute of Aeronautics and Astronautics (AIAA)
Award recognizes a graduate student doing excellent research in the Air & Space Sciences.

06/10/2011 **Fulbright Junior Award**
Awarded by the Romanian-U.S. Fulbright Commission (US Department of State)
A 2-semester grant offered by the Fulbright Program to an international student covering tuition and living expense to attend graduate school in the US.

Teaching Experience

01/2019 – 06/2019 **Teaching Assistant**
Department of Energy, École CentraleSupélec
EN1120: Heat Transfer (in English)

09/2018 – 12/2018 **Teaching Assistant (Laboratory Work)**
Department of Energy, École CentraleSupélec
Laboratory: Emission Spectroscopy in Oxygen and Argon Lamps (in French)

05/2016- 09/2016 **Course Instructor**
Department of Mechanical Engineering, Colorado State University
MECH 342: Mechanics and Thermodynamics of Flow Process (Fluid Mechanics)

01/2014 – 05/2014 **Graduate Teaching Assistant**
Department of Mechanical Engineering, Colorado State University
MECH 301 : Mechanical Design III (Teaching Ansys Fluent laboratory)

Supervising & Mentoring Experience

MSc Thesis Supervisor

- Catalin Constantin (10/01/2019 - 07/01/2021) – University of Bucharest

Co-Advisor for CSU's Research Practicum Program (MECH 498)

- Carter Butte (08/01/2017 - 12/31/2017)
- Andrew Eickelberg (08/01/2017-12/31/2017)

Co-Advisor for CSU's NSF-REU Program

- Rachel VanOsdol (05/01/2016 - 08/31/2016)

Academic Service

Peer-reviewer: Journal of Quantitative Spectroscopy and Radiative Transfer
Plasma Sources Science and Technology
Journal of Physics D: Applied Physics
Plasma
Measurement Science & Technology

06/22/2015 **Session Chair**
AIAA Aviation 2015, Dallas, TX, 46th Plasmadynamics and Lasers Conference
Session: PDL-06, Plasma Diagnostics I

LIST OF PUBLICATIONS

A. PAPERS PUBLISHED IN PEER-REVIEW JOURNALS

10. **C. Dumitrache**, A. Gallant N. de Oliveira, C. Laux, G. Stancu, "Quantitative fs-TALIF in High-Pressure NRP Discharges: Calibration using VUV Absorption Spectroscopy", *Plasma Sources Science & Technology*, 31 015004 (2022)
9. **C. Dumitrache**, C. Butte, A. Yalin, "Resonant dual-pulse laser ignition technique based on oxygen REMPI pre-ionization", *Scientific Reports* **10**, art. 19916 (2020).
8. **C. Dumitrache** and A. Yalin, "Gas dynamic regimes observed in dual-pulse laser ignition," *Int. J. Heat Mass Transf.* 161, 120302 (2020).
7. **C. Dumitrache** and A. Yalin, "Gas dynamics and vorticity generation in laser-induced breakdown of air," *Opt. Express* **28**(4) 5835-5850 (2020).
6. **C. Dumitrache**, A. Gallant, N. Minesi, S. Stepanyan, G. Stancu, C. Laux, "Hydrodynamic regimes induced by nanosecond pulsed discharges in air: mechanism of vorticity generation," *Journal of Appl. Phys. D.* **52**(36), art. 364001 (2019).
5. **C. Dumitrache**, R. VanOsdol, C. Limbach, A. Yalin, "Control of Early Flame Kernel Growth by Multi-Wavelength Laser Pulses for Enhanced Ignition," *Scientific Reports* **7**, art. 10239 (2017).
4. **C. Dumitrache**, M. Baumgardner, A. Boissiere, A. Maria, J. Roucis, A. Marchese, A. Yalin "A study of laser induced ignition of methane-air mixtures inside a Rapid Compression Machine," *Proc. Combust. Inst.* **36**(3), 3431-3439 (2017).
3. **C. Dumitrache**, C. Limbach, A. Yalin, "Threshold Characteristics of Ultraviolet and Near Infrared Nanosecond Laser Induced Plasmas," *Phys. Plasmas* (1994-present) **23**(9), art. 093515 (2016).
2. A. Yalin, N. Wilvert, **C. Dumitrache**, S. Joshi, M. Shneider, "Laser Plasma Formation Assisted by Ultraviolet Pre-ionization," *Phys. Plasma* **21**(10), art. 103511 (2014).
1. **C. Dumitrache**, J. Rath, A. Yalin, "High Power Spark Delivery System Using Hollow Core Kagome Lattice Fibers," *Materials* **7**(8), 5700-5710 (2014)

B. PROCEEDINGS OF INTERNATIONAL CONFERENCES

(Presentations at International Meetings published in extended version)

18. **C. Dumitrache**, A. Gallant, G. Stancu, and C. Laux, "Ground-State Atomic Nitrogen Measurements using fs-TALIF in High-Pressure NRP Discharges," 58th AIAA Aerospace Sciences Meeting, 6-10 January 2020, Orlando, FL, USA; AIAA 2020-1745.
17. C. Butte, P. Lokini, **C. Dumitrache**, and A. Yalin, "Single and Dual-Pulse Laser Ignition of Methane-Air and Hydrogen-Air Mixtures," 58th AIAA Aerospace Sciences Meeting, 6-10 January 2020, Orlando, FL, USA; AIAA 2020-1893.
16. C. Butte, **C. Dumitrache**, and A. Yalin, "Dual-Pulse Laser Ignition Using Oxygen REMPI Preionization," 50th AIAA Plasmadynamics and Lasers Conference, 17-21 June 2019, Dallas, TX, USA; AIAA 2019-3117.

15. **C. Dumitrache**, A. Gallant, G. Stancu, and C. Laux, "Measurements of ground state atomic nitrogen in high-pressure NRP discharges using fs-TALIF," 24th International Symposium on Plasma Chemistry, Naples, Italy, June 9-14, 2019.
14. A. Gallant, **C. Dumitrache**, G. Stancu, and C. Laux, "Long-lived emission in the afterglow of Nitrogen NRP discharges: a tool for hydrodynamics and kinetics studies," 24th International Symposium on Plasma Chemistry, Naples, Italy, June 9-14, 2019.
13. **C. Dumitrache**, A. Gallant, G. Stancu, and C. Laux, "Femtosecond Two-Photon Absorption Laser Induced Fluorescence (fs-TALIF) Imaging of Atomic Nitrogen in Nanosecond Repetitive Discharges," 57th AIAA Aerospace Sciences Meeting, 7-11 January 2019, San Diego, CA, USA; AIAA 2019-1507.
12. C. Butte, **C. Dumitrache**, and A. Yalin, "Properties of dual-pulse laser plasmas and ignition characteristics in propane-air and methane-air mixtures," 57th AIAA Aerospace Sciences Meeting, 7-11 January 2019, San Diego, CA, USA; AIAA 2019-0464.
11. **C. Dumitrache**, C. Butte, A. Eickelberg, and A. Yalin, "On the Use of REMPI Pre-Ionization for Laser Plasma Formation," 56th AIAA Aerospace Sciences Meeting, Kissimmee, 8-12 January 2018, Kissimmee, FL, USA; AIAA 2018-1431.
10. **C. Dumitrache** and A. Yalin, "Numerical Modeling of the Hydrodynamics Induced by Dual-Pulse Plasma," 56th AIAA Aerospace Sciences Meeting, 8-12 January 2018, Kissimmee, FL, USA; AIAA 2018-0689
9. **C. Dumitrache**, R. VanOsdol, C. Limbach, and A. Yalin, "Laser Ignition of Propane-Air Mixtures Using a Dual-Pulse Technique," 55th AIAA Aerospace Sciences Meeting, Grapevine, 9-13 January 2017, Grapevine, TX, USA; AIAA 2017-1976.
8. C. Limbach, **C. Dumitrache**, and A. Yalin, "Laser Light Scattering from Equilibrium, High Temperature Gases: Limitations on Rayleigh Scattering Thermometry," 47th AIAA Plasmadynamics and Lasers Conference, 13-16 June 2016, Washington, D.C., USA; AIAA 2016-3381.
7. **C. Dumitrache**, C. Limbach, and A. Yalin, "Laser Thermal Ignition Using a Dual-Pulse Approach," 54th AIAA Aerospace Sciences Meeting, 4-8 January 2016, San Diego, CA, USA; AIAA 2016-0460.
6. **C. Dumitrache**, C. Rose, and A. Yalin, "Towards Laser Ignition by Rapid Heating of Water Vapor," 46th AIAA Plasmadynamics and Lasers Conference, 22-26 June 2015, Dallas, TX, USA; AIAA 2015-2660.
5. **C. Dumitrache** and A. Yalin, "Laser-Induced Heating Using a Non-Resonant Dual-Pulse Approach with Application to Laser Ignition," 46th AIAA Plasmadynamics and Lasers Conference, 22-26 June 2015, Dallas, TX, USA; AIAA 2015-2658.
4. **C. Dumitrache**, M. Baumgardner, A. Boissiere, A. Marchese, A. Maria, and J. Roucis, "Laser Ignition of Methane-Air Mixtures with a Rapid Compression Machine," 53rd AIAA Aerospace Sciences Meeting, 5-9 January 2015, Kissimmee, FL, USA; AIAA 2015-1831.
3. **C. Dumitrache**, A. Yalin, and M. Shneider, "Laser Generated Plasma Using a Dual Pulse Approach with Application to Laser Ignition," 45th AIAA Plasmadynamics and Lasers Conference, 16-20 June 2014, Atlanta, GA, USA; AIAA 2014-2071.
2. **C. Dumitrache**, J. Rath, A. Yalin, and Gupta, "Development of a Photonic Crystal Fiber Delivery System for Laser Ignition in Engines," 45th AIAA Plasmadynamics and Lasers Conference, 16-20 June 2014, Atlanta, GA, USA; AIAA 2014-2074

1. **C. Dumitrache**, N. Wilvert, M. Shneider, and A. Yalin, "Laser Plasma Formation Using Dual Pulse Pre-ionization," 44th AIAA Plasmadynamics and Lasers Conference, 24-27 June 2013, San Diego, CA, USA; AIAA 2013-2636.

C. COMMUNICATIONS AT INTERNATIONAL CONFERENCES

(Technical Digests, manuscripts up to 3 pages)

7. **C. Dumitrache**, A. P. Yalin, "Vorticity Dynamics in Laser-induced Plasma," 19th International Conference on Plasma Physics and Application - CPPA 2021, August 31-September 3, 2021, Magurele, Bucharest, Romania; oral presentation O11.
6. A. P. Yalin, Carter Butte, and **C. Dumitrache**, "Comparison of Non-Resonant and Resonant Preionization for Dual-Pulse Laser Plasma Ignition in Air", APS Annual Gaseous Electronics Meeting Abstracts, JT4.002, October 5-9 2020, Virtual Meeting.
5. **C. Dumitrache**, A. Gallant, G. Stancu, and C. Laux, "Study of Hydrodynamic effects induced by Nanosecond Repetitively Pulsed (NRP) Discharges," XXXIV ICPIG & ICRP-10, July 14-19, 2019, Sapporo, Hokkaido, Japan.
4. **C. Dumitrache**, C. M. Limbach and A. P. Yalin, "A Study of Flame Dynamics Induced by A Dual-Pulse Laser Ignition Technique," 2017 IEEE International Conference on Plasma Science (ICOPS), Atlantic City, NJ, 2017, pp. 1-1.
3. C. M. Limbach, **C. Dumitrache** and A. P. Yalin, "Shock Wave Generation by Ultraviolet Nanosecond Laser Pulses at Reduced Pressure," 2017 IEEE International Conference on Plasma Science (ICOPS), Atlantic City, NJ, 2017, pp. 1-1.
2. **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," 2016 IEEE International Conference on Plasma Science (ICOPS), Banff, AB, 2016, pp. 1-1.
1. **C. Dumitrache**, A. Boissiere, M. E. Baumgardner, A. J. Marchese, A. P. Yalin, A. Maria, and J. Roucis, "Laser Ignition of Methane-Air Mixtures: An investigation of the Lean Limit and Minimum Ignition Energy," in Laser Ignition Conference, OSA Technical Digest (online) (Optical Society of America, 2015), paper W3A.4.

D. PATENTS

1. S. Simpson, O. Johns, C. E. Rose, A. Yalin, **C. Dumitrache**
"PHOTONIC-CRYSTAL-FIBER-DELIVERED LASER-TRIGGERED HIGH-VOLTAGE GAS SWITCH", United States Patent and Trademark Office, Patent No.: US 10,687,412 B1. Publication Date: 07/16/2020.