Atulya U. **Kumar**

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Summary

First year PhD student majoring in Physics with research focus in developing laser diagnostics for plasma and neutral gas flow applications. I graduated with Master of Science degree in aerospace engineering from Texas A&M University with research focus in laser induced breakdown spectroscopy for plasma and ignition applications.

Education

University of Luxembourg

Esch-sur-Alzette, Luxembourg

Doctor of Philosophy in Physics - Advisor : Dr. Alexandros Gerakis — *Jun. 2022 - Current*

- Research focus on 1D boundary layer characterization of neutral gas flow for aerodynamic testing using Coherent Rayleigh Brillouin Scattering technique (CRBS)
- PhD student – Luxembourg Institute of Science and Technology (LIST)- MRT department

Texas A&M University, Main Campus

College Station, Texas

Master of Science (Thesis). in Aerospace Engineering - GPA - 3.52/4.00 - Advisor : Dr. Christopher Limbach — *Jun. 2019 - Jan. 2022*

- Pursuing Master of Science degree with research focus on Optics Diagnostics and Laser Induced Plasmas
- Graduate Research Assistant – Laser Diagnostics and Plasma Devices Laboratory

Amrita School of Engineering

Bangalore, India

B.Tech. in Mechanical engineering - GPA - 8.36/10.00 — *Jul. 2012 - May. 2016*

- Recipient of scholarship for merit from Fall 2012 to Spring 2016
- Major/Minor Concentrations – Mechanical Engineering
- Graduated with Distinction

Research/Work Experience

Luxembourg Institute of Science and Technology.

Esch-sur-Alzette, Luxembourg.

PhD student. — *Jun. 2022 - Current*

- Currently working on developing a laser diagnostic technique that can characterize the boundary layer created over an airfoil in a neutral gas flow using coherent Rayleigh-Brillouin scattering.

Texas A&M Engineering.

College Station, Texas.

Graduate Research assistant. — *Jun. 2019 - Jan 2022*

- Worked on studying H diffusion (H-alpha line), in order to understand the kinetics and visualize the flame kernel development of a single micro-droplet when subjected to a laser induced breakdown directly on it or somewhere in its vicinity. This is conducted using an electrodynamic balance to isolate a single fuel droplet in space. This has relevant applications to laser ignition and mixing.
- Worked on understanding the interaction of laser-generated plasmas with micro-particles and micro-droplets with applications to diagnostics, remote sensing and aerosol LIBS . For this purpose, an electrodynamic balance is employed, allowing electrical levitation of single metal particles. High speed microscopy, stereo-shadowgraphy, spectroscopy and advanced laser diagnostics are then applied towards quantitative understanding of the interaction with high spatio-temporal resolution.

Super-wave Technology Pvt Ltd, Indian Institute of Science.

Bangalore, India.

Project Engineer. — *Jun. 2016 - Feb. 2019*

- Investigated the side on, reflected and transmitted pressures of a shock tube end wall for different test gases.
- Modelled a shock formation problem in a miniature shock tube using OpenFoam with the 'ddtFoam' solver in order to visualize and estimate side-on, end-wall pressures and temperature in a closed tube.
- Simulated a conjugate heat transfer scenario for electronic equipment and characterized the thermal performance of a 600W DC-DC convertor and associated sub-systems in a 100^{o} C environment using the Ansys Heat Transfer module.
- Designed and developed a thermal management system for electronics operating in a high temperature environment.
- Developed a Proton Exchange Membrane (PEM) electrolyser
- Developed a flap type check valve which has a micro-second scale actuation time.

Altair Engineering Pvt Ltd.

Bangalore, India.

Student Intern. — *Jan. 2016 - Jun. 2016*

- Developed a module for the Noise Harshness and Vibrations Director for the Hyperworks software which characterizes contribution of power-train associated loads to every sub-system of the vehicle and quantifies it based on a unit excitation. This was modelled using a transfer path analysis.

Larsen and Toubro Technology Development Center. *Mumbai, India.*

Student Intern. *Apr. 2015 - May. 2015*

- Conducted a characterization study for different elastomeric materials for an elastomeric ejection system.

Publications

Conference Papers

- **Kumar, A.**, Leonov, B. S., Wu, Y., and Limbach, C., "Spatio-temporal studies on laser induced plasma interactions with micro-particles using stereo-imaging.", AIAA SciTech Forum 2021. DOI link
- **Kumar, A.**, Stefan Karatodorov, Gabriel F. Alfaro and Alexandros Gerakis., "Towards multi-point thermodynamic flow characterization using single shot coherent Rayleigh Brillouin scattering.", AIAA SciTech Forum 2023.

Honors & Awards

2021	**AIAA Walter Lempert Best student paper award,** AIAA Scitech 2021	*College Station,Texas*
2017	**Technology Excellence award ,** Indian Technology Congress.	*Indian Institute of Science.*
2012-2016	**Scholarship for Merit,** Semester honors	*Amrita School of Engineering*

Technical Skills

Diagnostics	Laser-Induced Breakdown Spectroscopy (LIBS), Thompson Scattering, Filtered Rayleigh Scattering (FRS), Coherent Rayeligh Brillou Scattering (CRBS), High-speed imaging, OH Chemiluminescence
Programming	MATLAB, Wolfram Mathematica, OpenFoam, LaTeX
Equipment	High power laser systems, Shock Tunnels, Expansion Tunnels, Intensified CCD cameras, Intensified Relay Optics, Machining facilitie (general shop floor equipment like lathes, mills, drill presses,etc).
Subjects	Aerothermochemistry, Low Temperature Plasmas, Plasma/Plasma-particle Interaction, Combustion and Ignition, Gas Dynamics, Spectroscopy and Optics
Software Applications	SOLIDWORKS, Inventor, Ansys (structural, heat transfer and fluent modules), Microsoft Office
Languages	English(fluent)

Professional Affiliations & Memberships

OPTICA, Student Member	*2022 - 2023*
American Institute of Aeronautics and Astronautics (AIAA), Student Member	*2020 - 2023*
American Physical Society (APS), Graduate Student Member	*2020 - 2023*
Society of Automotive Engineers, Student Member	*2013 - 2016*

References

1 **Dr. Alexandros Gerakis (Asst. Prof.), University of Luxembourg**, email: alexandros.gerakis@list.lu

1 **Dr. Christopher Limbach (Asst. Prof.), Texas A&M University**, email: climbach@tamu.edu

3 **Dr. Gopalan Jagadeesh (Prof.), Indian Institute of Science**, email: jaggie@iisc.ac.in