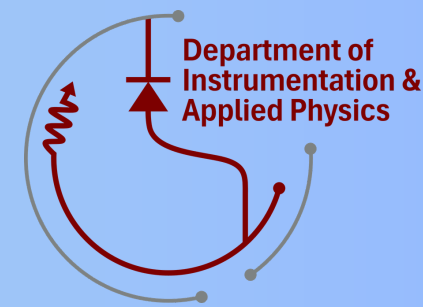




# Department of Instrumentation and Applied Physics Seminar Series



## Advancing Aerosol Measurements: From Composition and Volatility to Cost-effective Instrumentation

**Date:** 14th July 2026 **Time:** 10.30AM **Venue:** ONLINE



**Abstract:** Understanding the chemical composition and physicochemical properties of atmospheric aerosols is central to addressing challenges in air quality, human health, and climate change. However, long-term and spatially extensive in-situ measurements remain limited due to the high cost and operational complexity of traditional instruments such as aerosol mass spectrometers and gas chromatographs. This limitation is especially acute in developing regions, where pollution levels are high, but measurement infrastructure is sparse. With an objective to address this challenge, during my PhD, I worked on the development of ChemSpot, an online instrument that enables volatility-resolved, semi-continuous measurements of aerosol composition at a relatively lower cost than mass spectrometric systems. By integrating thermal desorption with gas-chromatographic detectors, ChemSpot provides information on aerosol carbon, oxygen, and sulfur content, suitable for routine monitoring. Building on this foundation, my current work at Caltech, in collaboration with Aerosol Dynamics Inc. (ADI) and the ASCENT network, focuses on evaluating Spider-Magic Particle Mobility Spectrometer (for submicron aerosol sizing), community condensation particle counters (cCPCs) and multi-bin optical particle counters (OPCs), and the development of a cost-effective aerosol sizing instrument.

Together, these efforts aim to create a scalable framework for affordable and reliable atmospheric measurements, enabling deployment across diverse environments. The resulting data can help improve source apportionment, assess exposure risks, and refine models of aerosol-cloud interactions. In the future, I envision integrating these tools with machine learning-based calibration and automated data analysis to build adaptive, low-maintenance air-quality monitoring networks, bridging the gap between advanced research capabilities and practical, policy-relevant observation systems.

## About the Speaker



**DR. PURUSHOTTAM KUMAR,**  
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Dr. Purushottam Kumar is currently a Postdoctoral Scholar in Chemical Engineering working with Prof. Richard Flagan, in the Division of Chemistry and Chemical Engineering at Caltech. He received his PhD in Fall 2024 from Virginia Tech. Before joining for his PhD, he received his bachelor's degree in chemical engineering from IIT Gandhinagar in 2017. He has also worked with groups from IIT Kanpur and the University of Texas (UT) Austin on Delhi Air pollution for two years before joining for his PhD studies. His research interests lie primarily in the design, development and troubleshooting of analytical instruments used for environmental research (especially aerosols and VOCs). His PhD research focused on the development of a new instrument for enabling routine chemical composition measurement of aerosols. His current work involves maintaining a routine measurement site (at Pico Rivera, California) and developing a cheaper aerosol sizing system.