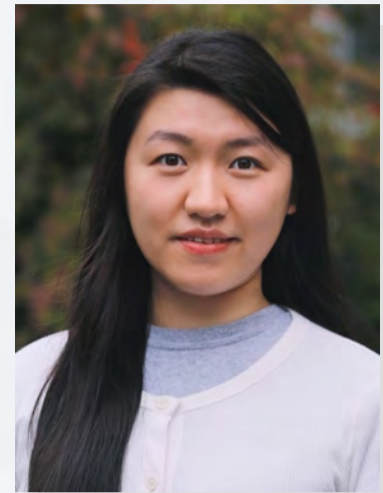




# Dynamic beam shaping for advanced laser material processing applications



**30 Mar 2023 (Thu) | 10:30 am**

**Seminar Link:** <https://cityu.zoom.us/j/97625542827>

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## Abstract

Lasers are widely used in material processing, additive manufacturing, high-resolution imaging, and diagnostics. Increasing the precision and functionality of laser-based material manufacturing requires fine control of the laser beam characteristics. Instead of defining the laser beam parameters in advance, the recent development of varifocal optical elements has enabled flexible beam shaping to deliver energy effectively and responsively to any 3D location on the fly.

This talk presents an innovative beam shaping method using a liquid acoustics lens, which uses acoustic pressure waves to modulate its refractive index at kHz-MHz. First, an analytical model to understand the lens mechanics is presented. Next, two focus axial scanning methods, continuous and synchronous axial scanning, will be discussed to achieve ultrafast oscillating focal points and quasi-simultaneous multi-focal laser processing. Furthermore, a dynamic axial scanning method for optical detection applications will be discussed, providing a novel approach to auto-focusing and optical metrology.

## About the Speaker

Xiaohan Du is a PhD candidate in Mechanical Engineering and Material Science at Princeton University. She graduated from the Hong Kong University of Science and Technology in 2017 with a Bachelor of Mechanical Engineering and a Bachelor of Business Administration. Her research interest includes laser material processing, novel beam control methods and applications in materials manufacturing. Throughout her PhD studies, she worked on designing adaptive optical devices based on piezoelectric and liquid resonance and implementing dynamic beam shaping techniques for novel optical sensing and laser processing applications. Successful applications include dynamic detection and multi-focal laser marking. She has co-authored eight papers in peer-reviewed journals and international conferences and holds one US patent. Her first-authored conference paper received the Best Paper Award at the 2022 Photonics West Conference. She has received the Francis Robbins Upton Scholarship, the Guggenheim Foundation Scholarship, and the Crocco Award for Excellence in Teaching while studying at Princeton University.