



Featured Inventor: Kevin P. Chen, PhD; Shou Li, PhD

## 3D Laser

### Value Proposition

For laser companies who want to build lasers with compact, light-weight and rigid construction, our innovative laser frame enabled with 3D printing technology has the potential to transform the laser manufacturing industry. Unlike vendors such as Thorlabs and Newport that sell off-the-shelf optomechanics parts, we allow laser companies to fully customize their products at reduced cost with advanced features.

### Market Opportunity

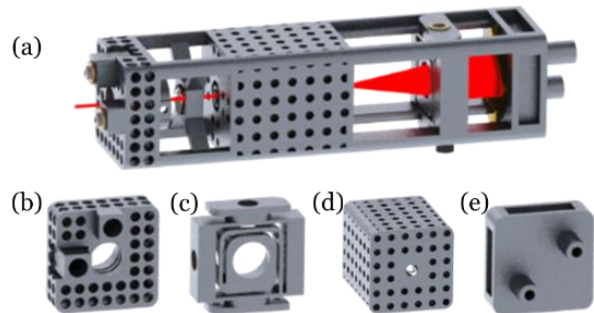
Worldwide laser sales are forecasted to be nearly \$10.5 billion in the year of 2016. Our proposed laser system can be used in various remote sensing applications, such as laser induced breakdown spectroscopy and Raman spectroscopy. These two research areas have been studied intensively in the laboratory. Today there is strong demand to apply such technology in field work. For field-portable sensing applications, a compact, light-weight and robust laser source is needed and may be provided by our 3D-printed laser system.

### Competitive Landscape

Today, most of the optomechanical components used in the lab are from vendors such as Thorlabs and Newport. However, these parts can't be customized. By using additive manufacturing technology, we can develop customized optical parts that fulfill all customer's special needs.

### IP Landscape

An invention disclosure has been filed with University of Pittsburgh Innovation Institute, October 2016.



Schematic of 3D printed laser with all the optical parts integrated into the frame

### Technology

Motivated by the concept that additive manufacturing can revolutionize the way laser devices are manufactured, our 3D-printed laser technology broadly encompasses all potential applications of manufacturing laser systems, including unibody design, flexure mounts and cellular cooling structures.

To our knowledge, no competing technology has attempted to build laser system using additive manufacturing. For the first time, a compact, lightweight unibody Nd:YAG Q-switched laser can be manufactured using such technology.

### Stage of Development

Prototype has been developed and successfully tested. Work is now focused on improving its performance.

### Funding

# FEATURED INVENTORS:

## *Kevin Chen, PhD*

Dr. Kevin P. Chen is Paul E. Lego Professor in Electrical Engineering and (with second appointment with Bio-engineering). He joined the University of Pittsburgh after completing his Ph.D. training from the University of Toronto in 2002. In Pittsburgh, Dr. Chen's group performs interdisciplinary photonics research in laser photonics, 3D lightwave circuits, advanced manufacturing, fiber optics, and nuclear micro-engineering. Research in Dr. Chen's group are supported by over \$10M dollar research funding from National Science Foundation, Department of Energy, DTRA, DARPA, AmericaMake NASA, Navy, Pennsylvanian government, and industry. Dr. Chen has published over 180 refereed technical papers in scientific journals and conferences and 6 US patents (granted or pending). He is principal investigator of 10 NSF research grants including a NSF CAREER award since 2005.

### **Education**

1998.9-2002.8: Doctor of Philosophy, Electrical Engineering, University of Toronto, Toronto, Ontario, Canada

1995.9-1998.4: Master of Science, Physics, University of British Columbia, Vancouver, British Columbia, Canada

1990.9-1994.6: Bachelor of Sciences, dual majors in Control Science & Physics, Xiamen University, Xiamen, Fujian, China

### **Publications**

1. Li, Shuo and Liu, Lei and Chen, Rongzhang and Nelsen, Bryan and Huang, Xi and Lu, Yongfeng and Chen, Kevin, Review of Scientific Instruments, 87, 033114 (2016), DOI:<http://dx.doi.org/10.1063/1.4944856> List relevant publications
2. S. Li, B. Nelsen, r. chen, and K. Chen, "Unibody, Compact, and Lightweight Q-switched Lasers Enabled by Additive Manufacturing," in Conference on Lasers and Electro-Optics, OSA Technical Digest (online) (Optical Society of America, 2016), paper AF1J.5.

## *Shuo Li, PhD*

Shuo Li is a graduate student in Kevin Chen's lab. His research area is to use 3D printing technology to build novel photonics systems.

### **Education**

2013.9-now: Doctor of Philosophy, Electrical Engineering, University of Pittsburgh, Pennsylvania, USA

2010.9-2013.6: Master of Science, Physics, University of Pittsburgh, Pennsylvania, USA

2006.9-2010.6: Bachelor of Science, Physics, Nankai University, Tianjin, China

### **Publications**

1. Li, Shuo and Liu, Lei and Chen, Rongzhang and Nelsen, Bryan and Huang, Xi and Lu, Yongfeng and Chen, Kevin, Review of Scientific Instruments, 87, 033114 (2016), DOI:<http://dx.doi.org/10.1063/1.4944856> List relevant publications
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### **Innovation Institute**

George Coulston, PhD, MBA  
Technology Licensing Manager  
(412) 648-2236  
[gcoulston@innovation.pitt.edu](mailto:gcoulston@innovation.pitt.edu)

### **Innovation Institute**

1<sup>st</sup> Floor Gardner Steel Conference Center  
130 Thackeray Avenue  
Pittsburgh, PA 15260  
(412) 383-7670  
[www.innovation.pitt.edu](http://www.innovation.pitt.edu)