Physicist uncovers laser technology that could take the teeth out of COVID-19’s grip

Chris Barty is Laser Focused on Laser World Domination
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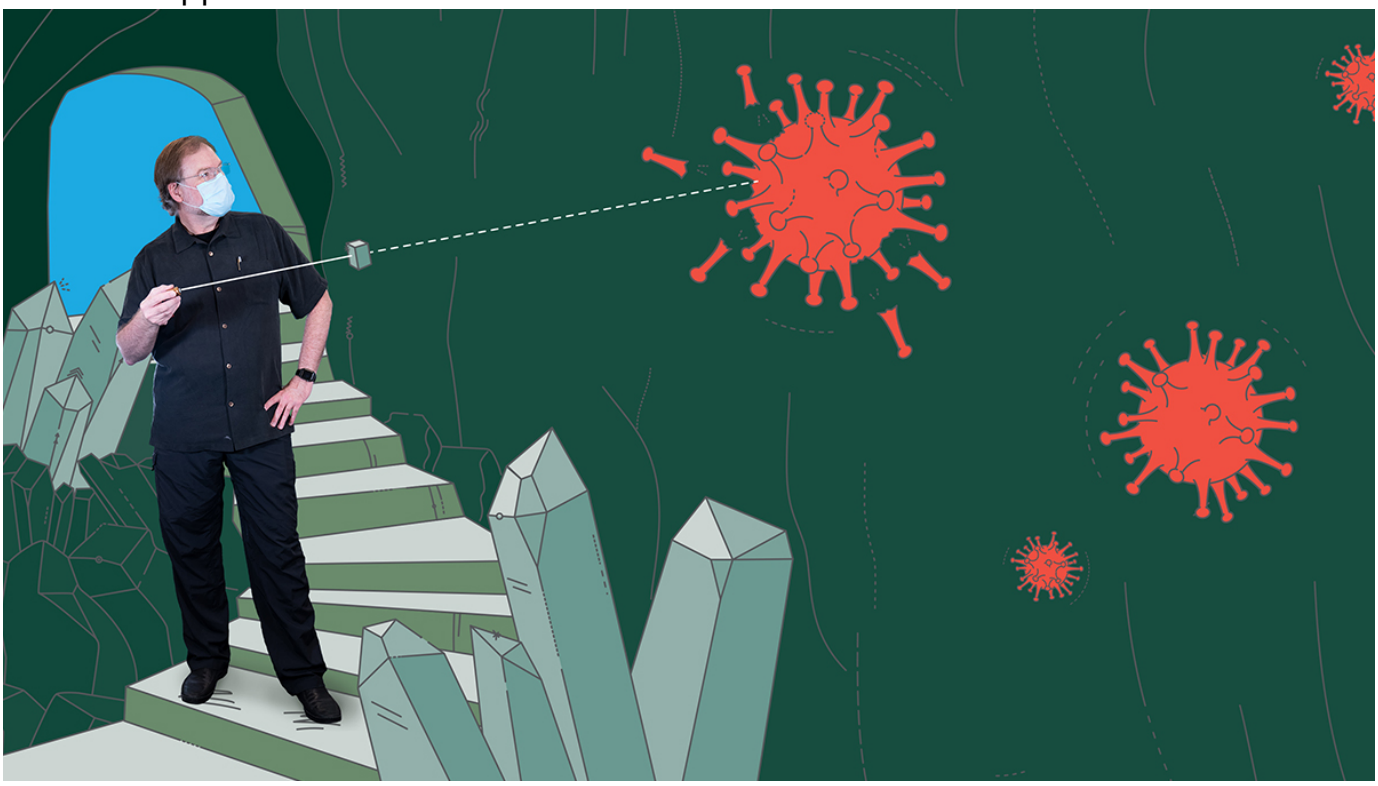
UCI Beall Applied Innovation



When Chris Barty focuses his mind on something, it is with laser precision. The UC Irvine Distinguished Professor of Physics and Astronomy learned from an early age he was drawn to lasers after watching the first episode of the animated sci-fi adventure series “Jonny Quest.”

“Episode one of ‘Jonny Quest’ is the laser episode,” said Barty. “In the episode, [the villains] are burning ships in the Sargasso Sea with a laser… and the episode starts explaining what a laser is.”

Post-“Jonny Quest,” Barty received his bachelor’s degree in chemistry, physics and chemical engineering at North Carolina State University and later received his master’s degree and a doctorate in applied physics at Stanford University.

Though Barty calls out “Jonny Quest” for his original and perhaps subconscious interest in lasers, Barty’s adventures in the wide world of laser technology are anything but science fiction.



Graphic: Julie Kennedy, UCI Beall Applied Innovation

Lasers, Lasers, Nothing but Lasers

After teaching at Stanford for four years, Barty moved to San Diego to run a privately funded research organization where he focused on intense lasers and X-rays created by intense lasers.

In 2000, Barty left San Diego to work as the chief scientific officer at Lawrence Livermore National Lab (LLNL)’s laser division.

“I was like a kid in a candy store,” said Barty. “I was doing laser weapons work. I was doing lasers for fusion energy, for clean energy, lasers for medicine, and lasers for nuclear materials detection. The joke about Livermore is that Lawrence Livermore National Lab isn’t what LLNL stands for … it stands for ‘lasers, lasers, nothing but

lasers.’”

Barty’s division primarily focused on national security, including the use of a laser-Compton system – a laser-based X-ray machine – to recognize Uranium 235 from Uranium 238, two very similar nuclear materials with a major difference.

“Uranium 238 is considered ballast but 235 is Hiroshima,” said Barty. “The big worry is that somebody could ship 235 into a port and detonate it and every port in the world could shut down causing a trillion dollar impact on the word economy overnight.”

This mission provided his team at LLNL about $70 million in funding to develop the detection technology in addition to another $150 million at the Stanford Linear Accelerator Center (SLAC) to develop an accelerator technology.

Thirteen of the patents resulting from the LLNL activities were licensed by Lumitron Technologies and are the foundation of the company.



Chris Barty, Ph.D., UCI distinguished professor of Physics and Astronomy, work with lasers in Lumitron Technologies’ Laser Lab located in University Research Park in Irvine. Photo: Julie Kennedy, UCI Beall Applied Innovation

Lumitron Technologies

In 2016, Lumitron Technologies was formed as a company that develops and commercializes unique X-ray systems. The company is based on $220 million worth of R&D from LLNL and SLAC.

With co-founder and Executive Chairman Maurie Stang, Barty, co-founder, executive director and chief technology officer, decided to set up shop in Irvine.

In January, Lumitron completed a $34 million funding round, with the help of Roth Capital Partners in Newport Beach, in addition to $11.6 million from Defense Advanced Research Projects Agency. With the funding, Lumitron aims to build its first commercial X-ray systems.

The company is developing a HyperVIEW platform that will provide high-resolution X-ray images, which improves image resolution up to 1,000 times compared to conventional X-rays while, at the same time, imparts a significantly less harmful dose of radiation to the patient – all from a device the size of a modern CT machine.

“The impact of Lumitron’s breakthrough will touch a wide array of human endeavors, both in imaging of unsurpassed resolution and new therapies, which will leverage our ability to image and treat simultaneously at a near-cellular level,” said Stang.

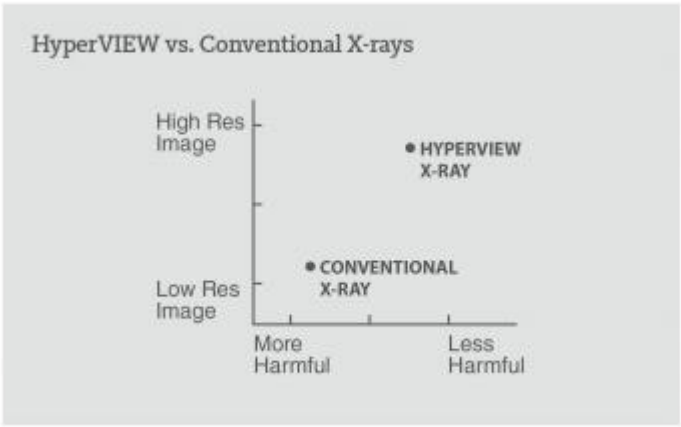


Chart: Rachel Noble, UCI Beall Applied Innovation

As Barty describes, since the platform’s technology can see down to a cellular level, the potential to detect and treat diseases like cancer can be done in ways that no one has been able to do before. The HyperVIEW platform can detect and treat

cancer without introducing radioactive materials to the body.

Although commonly used in the medical and research sectors, the technology is also applicable for 3D printing, mining, security, semiconductor manufacturing and nondestructive material evaluation.

COSI Lab

In the summer of 2017, Barty became the senior faculty member and first hire of UCI's Convergence Optical Science Initiative (COSI). COSI lab space is located at the Cove @ UCI, UCI Beall Applied Innovation's headquarters, and is dedicated to studying laser activity – a space he describes as "the intersection of physical science, engineering, biology, medicine and industry all around something photonic."

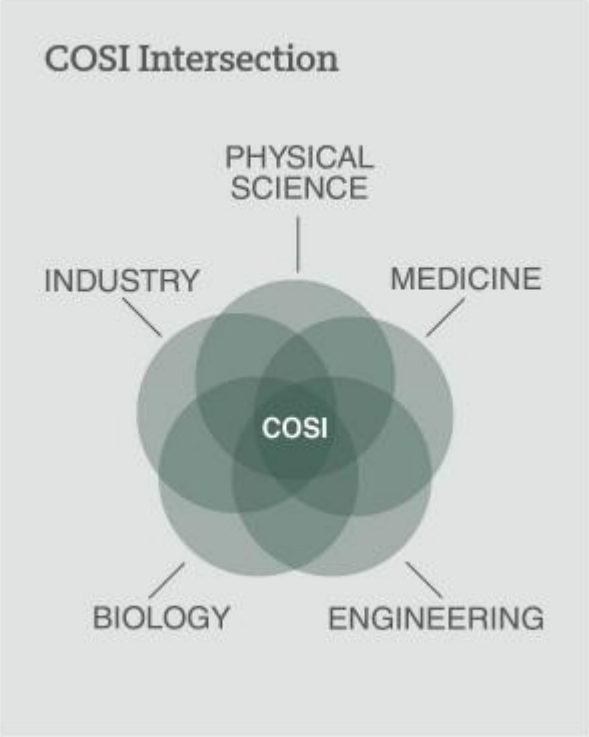


Chart: Rachel Noble, UCI Beall Applied Innovation

"I have a lot of crazy ideas, all the time. That's what I do," said Barty. "The academic side is about things that might be two or three or four generations down the road, for how you might either make the machine better or use the machine in a different way."

With Barty's appointments in the School of Physical Sciences, School of Medicine and the Beckman Laser Institute and Medical Clinic, he recruits doctorate students to the lab to study the applications of his technologies.

Most of what happens in the COSI Lab relates to laser activity, like investigating new applications of common laser technologies.

Lasers and COVID-19

Most recently, Barty and his research team at UCI are developing a new technique in the fight against COVID-19 using diode lasers found in a Blu-ray players. The technology can be used as a way to rapidly sterilize surfaces and/or clean the air.



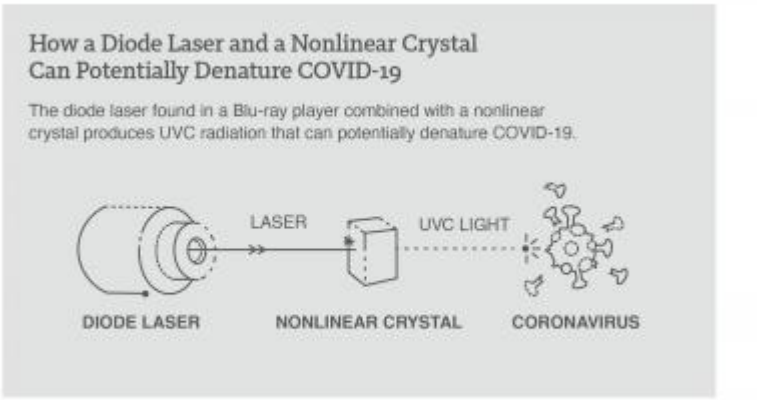
Pictured is a diode laser found in a Blu-ray player. These small but mighty pieces can be used to sterilize surfaces, clean the air and possibly denature COVID-19. Photo: Steve Zylius

It would be less expensive and safer than mercury discharge lamps used in hospitals, according to Barty, since the mercury lamps emit UVA and UVB light. The technology, which is created by using the laser in the Blu-ray player, produces a shorter wavelength – UVC radiation that can potentially denature COVID-19.

“There is medical literature that suggests that short-wavelength UVC is not that bad for you because the dead skin cells that are on your body are enough to absorb the UVC. The teardrop on your eye is enough to absorb very short wavelength UVC,” said Barty. “It doesn’t really damage your skin, your living skin or living tissue in the same way that UVA and UVB does. In practice, it’s not widely used, because it’s expensive.”

To create UVC light, it takes $100,000 worth of equipment, according to Barty. However, once Barty and his team put a nonlinear crystal in front of the Blu-ray player’s diode laser, it can create UVC light. The team only needs to spend $50 for the Blu-ray laser diode part.

“The semiconductor industry that made the Blu-ray diode lasers has perfected the art of doing that and it’s now become cheap,” said Barty. “They’ve built the fab lines and everything. You’re winning, because somebody else paid the money to do it.”



Graphic: Rachel Noble, UCI Beall Applied Innovation

Barty and his team are currently setting up to investigate the modified laser’s effects on COVID-19. If effective against COVID-19, this technology could be utilized within a building’s air conditioning duct or utilized within light fixtures to constantly clean circulating air.

“You could imagine having something where a mask actually has one of these in it,” said Barty. “Every time you take a breath, you’re getting air that has been cleaned, or every time you exhale, all that stuff that you exhale is being cleaned.”

Laser-Focused Future

Between Lumitron and creating new technologies from the COSI Lab, Barty has one thing in mind for the future of his company: World domination … with lasers, of course.

Barty is currently focused on bringing down the cost of the technology so hospitals can easily become equipped with Lumitron's advanced machines.

"I want a Lumitron machine in every hospital," said Barty. "I want 10 machines in every hospital. My mother died of breast cancer. I've got plenty of people in the company who've had people that have been impacted by cancer. If we can do anything to solve that, I'm all for it."

Learn more about Lumitron.

**Main Graphic: Julie Kennedy, UCI Beall Applied Innovation*
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