

Physics Professor Seth Putterman wins Newton Award for Transformative Ideas

Physics Professor Seth Putterman has been selected to receive a \$50,000 Newton Award for Transformative Ideas during the COVID-19 Pandemic from the U.S. Department of Defense.

“We were blown away by the overwhelming response and the ingenuity and creativity in the proposals we reviewed,” said JihFen Lei, acting director of defense research and engineering for research and technology.

The award, named in honor of Isaac Newton’s achievements in mathematics, optics and gravitation during the Great Plague of London in 1665, sought “transformative ideas” to resolve challenges, advance frontiers, and set new paradigms in research of immense potential benefit to the country during the COVID-19 pandemic. Putterman received one of 13 awards.

Putterman’s research project concerns nuclear fusion, which is a safe, nearly limitless energy source. It is a nuclear process, where energy is produced by smashing together light atoms. The sun is powered by fusion reactions taking place in its hot dense core, generating light and heat.

Research into developing controlled fusion inside fusion reactors has been conducted since the 1940s, but with limited success so far.

University of Cambridge scientist and Chancellor John William Strutt, 3rd Baron Rayleigh won the 1904 Nobel Prize in Physics for his “investigations of the densities of the most important gases and for his discovery of argon in connection with these studies.” Rayleigh studied the collapse of a cavity surrounded by water as a source of damage to ships’ propellers. Putterman has studied light emission from collapsing bubbles, called sonoluminescence, in [his UCLA laboratory](#).

One of Putterman’s key research insights is that “a bubble can focus energy by 12 orders of magnitude to make a dense plasma, which is the source of light. If the focusing could be increased by an additional two-to-three orders of magnitude conditions for nuclear fusion would be achieved,” Putterman said.

The compressibility of water limits the energies previously achieved to about 17,500 degrees Fahrenheit. Putterman intends to use the Newton award is to develop the idea that fusion can be reached by “realizing the phenomenon of cavitation in fluids which are more incompressible than water. The leading candidate for such a fluid is one where the bulk modulus is dominated by the repulsive forces between overlapping electron shells.”

How difficult will this be to achieve? Putterman noted this DOD program is high-risk, high-gain.

The Newton award challenged researchers to propose novel conceptual frameworks or theory-based approaches that utilized analytical reasoning, calculations, simulations and thought experiments. DOD received 548 proposals for the Newton Award. These proposals came from 184 institutions.

“I am optimistic that my lab will advance the field by working on an important and difficult issue at the forefront of nonlinear science and multiscale physics,” Putterman said.