Press Release

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CONTACT: Theresa Bourgeois
(518) 276-2840
bourgt@rpi.edu

Researchers Report Bubble Fusion Results Replicated

Physical Review E publishes paper on fusion experiment conducted with upgraded measurement system

TROY, N.Y. — *Physical Review E* has announced the publication of an article by a team of researchers from Rensselaer Polytechnic Institute (RPI), Purdue University, Oak Ridge National Laboratory (ORNL), and the Russian Academy of Science (RAS) stating that they have replicated and extended previous experimental results that indicated the occurrence of nuclear fusion using a novel approach for plasma confinement.

This approach, called bubble fusion, and the new experimental results are being published in an extensively peer-reviewed article titled “Additional Evidence of Nuclear Emissions During Acoustic Cavitation,” which is scheduled to be posted on *Physical Review E*’s Web site and published in its journal this month.

The research team used a standing ultrasonic wave to help form and then implode the cavitation bubbles of deuterated acetone vapor. The oscillating sound waves caused the bubbles to expand and then violently collapse, creating strong compression shock waves around and inside the bubbles. Moving at about the speed of sound, the internal shock waves impacted at the center of the bubbles causing very high compression and accompanying temperatures of about 100 million Kelvin.

These new data were taken with an upgraded instrumentation system that allowed data acquisition over a much longer time than was possible in the team’s previous bubble fusion experiments. According to the new data, the observed neutron emission was several orders of magnitude greater than background and had extremely high statistical accuracy. Tritium, which also is produced during the fusion reactions, was measured and the amount produced was found to be consistent with the observed neutron production rate.

Earlier test data, which were reported in *Science* (Vol. 295, March 2002), indicated that nuclear fusion had occurred, but these data were questioned because they were taken with less precise instrumentation.

“These extensive new experiments have replicated and extended our earlier results and hopefully answer all of the previous questions surrounding our discovery,” said Richard T. Lahey Jr., the Edward E. Hood Professor of Engineering at Rensselaer and the director of the analytical part of the joint research project.

Other fusion techniques, such as those that use strong magnetic fields or lasers to contain the plasma, cannot easily achieve the necessary compression, Lahey said. In the approach to be published in *Physical Review E*, spherical compression of the plasma was achieved due to the inertia of the liquid surrounding the imploding bubbles.

Professor Lahey also explained that, unlike fission reactors, fusion does not produce a significant amount of radioactive waste products or decay heat. Tritium gas, a radioactive by-product of deuterium-deuterium bubble fusion, is actually a part of the fuel, which can be consumed in deuterium-tritium fusion reactions.

Researchers Rusi Taleyarkhan, Colin West, and Jae-Seon Cho conducted the bubble fusion experiments at ORNL. At Rensselaer and in Russia, Professors Lahey and Robert I. Nigmatulin performed the theoretical analysis of the bubble dynamics and predicted the shock-induced pressures, temperatures, and densities in the imploding vapor bubbles. Robert Block, professor emeritus of nuclear engineering at Rensselaer, helped to design, set up, and calibrate a state-of-the-art neutron and gamma ray detection system for the new experiments.

Special hydrodynamic shock codes have been developed in both Russia and at Rensselaer to support and interpret the ORNL experiments. These computer codes indicated that the peak gas temperatures and densities in the ORNL experiments were sufficiently high to create fusion reactions. Indeed, the theoretical shock code predictions of deuterium-deuterium (D-D) fusion were consistent with the ORNL data.

The research team leaders are all well known authorities in the fields of multiphase flow and heat transfer technology and nuclear engineering. Taleyarkhan, a fellow of the American Nuclear Society (ANS) and the program's director, held the position of Distinguished Scientist at ORNL, and is currently the Ardent Bement Jr. Professor of Nuclear Engineering at Purdue University. Lahey is a fellow of both the ANS and the American Society of Mechanical Engineers (ASME), and is a member of the National Academy of Engineering (NAE). Nigmatulin is a visiting scholar at Rensselaer, a member of the Russian Duma, and the president of the Bashkortonstan branch of the Russian Academy of Sciences (RAS). Block is a fellow of the ANS and is the longtime director of the Gaerttner Linear Accelerator (LINAC) Laboratory at Rensselaer. The bubble fusion research program was supported by a grant from the Defense Advanced Research Projects Agency (DARPA).

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Rensselaer Polytechnic Institute (RPI), 110 8th St., Troy, NY 12180. (518) 276-6000
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