Chicago Tribune
INTERNET EDITION

U. of I. study casts doubt on bubble fusion report

Chicago Tribune; Chicago, Ill.; Jul 25, 2002; Jeremy Manier, Tribune staff reporter;

Abstract:
Experts say the Illinois team's new study shows how the heat in a single compressed bubble is converted into light, chemical reactions and other forms of energy. Although [Kenneth Suslick]'s method could not be used to attempt fusion, he said the work suggests that nuclear fusion would be difficult to achieve because chemical reactions "eat up all the energy in the bubble."

Full Text:

Studying tiny water bubbles that collapse in intense flashes of light and heat, scientists at the University of Illinois at Urbana- Champaign have added a skeptical note to a growing controversy over whether similar bubbles could create cheap energy through nuclear fusion.

The Illinois team's work, published Thursday in the journal Nature, may cast more doubt on a disputed report from earlier this year in which physicists at Oak Ridge National Laboratory in Oak Ridge, Tenn., said they had detected fusion reactions in bubble experiments. Some researchers criticized the work as inconclusive, recalling a furor in the 1980s over unfounded claims that scientists had discovered the key to limitless energy using "cold fusion."

Nuclear fusion, the potent energy source that powers the sun and hydrogen bombs, has been produced in a controlled way only in vast and expensive experimental facilities. The instruments used achieve fusion by subjecting a form of hydrogen to intense heat and pressure, causing the atoms to fuse.

If successful, bubble fusion could replicate that process in devices that fit on a tabletop, possibly providing a cheap and clean source of energy.

In contrast to the cold fusion debacle, the concept of bubble fusion is at least theoretically plausible, experts say. The technique consists of bombarding a small container of liquid with powerful sound waves, causing gas bubbles in the fluid to implode violently.

Even if the Oak Ridge team did not detect fusion reactions, other groups are attempting the feat, and experts say one of those teams may succeed soon.

If anyone could prove that bubble fusion works, "It would be one of the most important discoveries of the century," said Lawrence Crum, a physicist at the Applied Physics Lab of the University of Washington at Seattle. Though doubtful of the Oak Ridge team's findings, Crum said he has seen promising unpublished results from other researchers.

The U. of I. team's study suggests that such efforts may face daunting obstacles. Measuring the reactions that occur when a gas bubble inside a water container is blasted with ultrasound, Illinois chemistry professor Kenneth Suslick found that much of the energy needed for fusion is used up in small-scale chemical reactions.

Still, Suslick said, "The concept of getting fusion this way is not in any way crackpot--as opposed to cold fusion, which had no underlying basis at all."

The potential for a new source of fusion is attracting attention for an obscure branch of science devoted to the study of energetic little bubbles. For more than 60 years, physicists have known that when bubbles in a liquid are excited by intense sound waves, they can expand and then suddenly collapse in flashes of light.

Similar but less intense bubble implosions are what make the sound of a boat propeller or a babbling brook.

Researchers still do not know precisely how the energy in sound waves becomes focused enough in the collapsing bubbles to emit light. A 1994 paper by researchers at the University of California at Los Angeles was the first to propose that an intense bubble collapse, creating temperatures of thousands or even millions of degrees, could result in nuclear fusion.

Experts say the Illinois team's new study shows how the heat in a single compressed bubble is converted into light, chemical reactions and other forms of energy. Although Suslick's method could not be used to attempt fusion, he said the work suggests that nuclear fusion would be difficult to achieve because chemical reactions "eat up all the energy in the bubble."

Most researchers say the real test of bubble fusion will come in experiments using far more powerful acoustic energies.

Scientists at Oak Ridge still believe they detected fusion during a bubble experiment published in March in the journal Science. While directing ultrasound at a vessel containing liquid acetone and a form of hydrogen, the researchers found emissions of neutrons--a byproduct of nuclear fusion.

"We're absolutely sure," said Dick Lahey, a co-author on the Oak Ridge study and a professor of engineering at Rensselaer Polytechnic Institute, in Troy, N.Y.

But other experts saw serious flaws in the team's experimental techniques. For example, neutron readings did not always occur at the same time as the bubble flashes, said Seth Putterman, a UCLA physics professor and co-author of the 1994 paper outlining bubble fusion.

Such flaws led Putterman, Crum and Suslick, who were official reviewers for the journal Science, to conclude that the study was not ready for publication. Putterman said he is still puzzled as to how that first claim of bubble fusion passed peer review. "I'm lost," he said. "I don't know anyone who backs those findings."

Even if successful, the scale of bubble fusion would be extremely small. In most experiments to date, even the biggest bubbles are barely visible.

"To someone who's interested in new sources for power stations, it would be very boring," Putterman said. "We haven't let ourselves think of that next step."

[Illustration]
GRAPHIC; Caption: GRAPHIC: Squeezing energy from a bubble For decades, scientists have sought ways of obtaining cheap, clean energy created from fusion, or the joining of atoms. Sources: Nature and Science. Chicago Tribune/Larry Rowe and Phil Geib. - See microfilm for complete graphic.

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*Sic:***8220***Sic:***611310**
Sub Title: [North Sports Final Edition]
Start Page: 9
ISSN: 10856706
Subject Terms: Studies
Fusion
Alternative energy sources
Companies: **University of Illinois***Sic:***8220***Sic:***611310**
