# Researchers find new matter state: atomic bubble 'supercluster'

by Charles B. Stevens

Scientists working at the New Jersey Stevens Institute of Technology have reported discovering a new state of matter. The new form of matter acts macroscopically like one atom, but is made up of what would ordinarily be called millions of atoms. If this discovery is experimentally confirmed, it could revolutionize every aspect of existing science and technology. For one thing, this discovery could resolve the mystery of "ball lightning." More generally, this new state of matter can be utilized for entirely new types of investigations into nuclear structure and nuclear reactions, and, even holds open the prospect of constructing a true, nuclear matter laser.

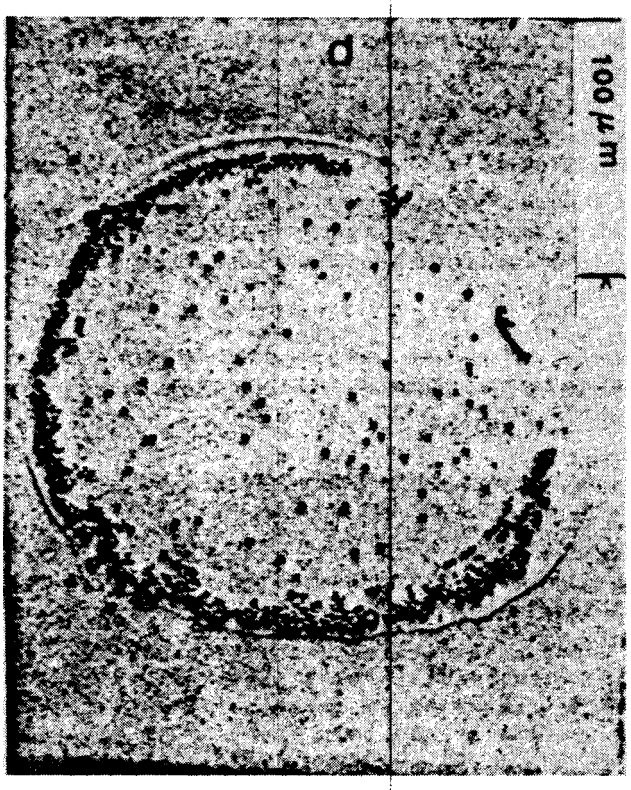
The research team that made this breakthrough is headed by Dr. Vittorio Nardi and was formed under the leadership of the late Prof. Winston Bostick, a leading scientific collaborator of Lyndon H. LaRouche. The experiments were carried out on a small laboratory device called the plasma focus, which generates dense plasma "discharges."

## What is plasma?

Plasma is sometimes called the fourth state of matter—the other three being solid, liquid, and gas. When an electric current passes through a gas, the gas can become ionized. That is, electrons which ordinarily are trapped into orbits around their atomic nucleus, like planets around the Sun, can be energetically kicked out of their orbits and roam freely. These free electrons make such ionized gases very good conductors of electricity. Furthermore, both the free electron and the stripped nucleus are electrically charged relative to a neutral atom, and therefore the ionized gas responds to electric and magnetic fields. Thus, as in magnetic fusion, ionized gases—plasmas—can be trapped into magnetic or even electrostatic bottles. In this way these plasmas can be insulated and heated to temperatures needed for nuclear fusion.

One method of producing such plasmas is that of the plasma pinch (see *EIR*, "The Pinch Effect Revisited," by Winston Bostick, Feb. 8, 15, and 22). In a general sense, a neon light is a plasma pinch. When an electric current is passed through neon gas which is trapped in a vacuum tube, then it becomes a plasma and glows with a radiation output. The electric current passing through the neon plasma generates a magnetic field which traps and pinches the plasma. The plasma focus is just like this, except that a much, much larger current is utilized.

The plasma focus has proven to be an extremely versatile plasma machine. It is small, simple, and cheap to build. It produces very dense plasma pinches which generate significant amounts of nuclear fusion reactions. It is therefore a good source of X-rays and neutrons. The plasma focus is also a natural high-energy particle accelerator, and intense beams of relativistic ions and electrons are found to emanate from the plasma focus pinch.




*The above ring-like structure is made by the high energy particles of the "plasma" bubble supercluster as it breaks up when it has a final collision with a diagnostic film.*

## Removing the pinhole

One of the reasons that researchers had not discovered this new form of matter being produced in the plasma focus was that their diagnostics were too small.

One major diagnostic system is just like the old pinhole camera, that is, it is a box with a small hole. The light, or radiation, or high-energy particle beams emanating from the plasma pinch, pass through the hole and impinge on a film. The picture when it is "developed" then provides a means for measuring the "what" and the "how much" of the light, radiation and/or high-energy particle beams that are recorded. (Various material filters and electric and magnetic fields can be combined with films of various materials to measure a particular form of beam.)

The problem with the atomic bubble superclusters was that they were bigger than the pinhole and would therefore "break up" before going through the pinhole. (Typically, these bubbles are from 100 to 200 microns in diameter.) Once the pinhole was significantly widened or removed, actual images of the atomic bubble superclusters were found by researchers.

## Atomic bubble supercluster measurements

The superclusters are either formed within the pinch, or by the combination of the electron and ion beams emission of the pinch plasma. In any case the superclusters can be separated from the plasma focus pinch by sticking a glass tube near the pinch to permit a route along which the supercluster can travel.

The supercluster consists of millions of electrons and ions that are organized in the most unusual fashion. They form a spherical bubble with virtually all of the material being on the surface of the sphere. There are extremely high magnetic fields in the bubble—hundreds of megagauss in strength. The bubble is highly resilient and will bounce many times on the film before breaking up.

When the superclusters break up, the components come out with very high energies, like those found in a particle accelerator. Also the energy of the component electrons and ions is very coherent—monoenergetic. As a result of these measurements, it is found that the supercluster is acting like one big atom or "quantum" system. Furthermore, the density of the bubble surface is near that of solid materials.

The measured energy densities are quite high, and of the order needed to drive inertial fusion targets. Copious quantities of nuclear reactions are observed. Furthermore, more detailed nuclear reaction studies have observed significant numbers of heavy element nuclear fusion reactions—when these heavy elements are added to the hydrogen gas usually utilized in plasma focus discharges. These high rates of heavy element fusion reactions would not ordinarily be expected to take place in even the high-energy conditions found in the plasma focus pinch.

The supercluster bubbles are described as having a "negative temperature." This means that the supercluster will always transfer energy to matter with positive temperatures, no matter how high that temperature may be. Furthermore, this means that the supercluster bubble will not absorb electromagnetic radiation. (It is like the electromagnetic "shields" which are so often described in science fiction movies.) The bubbles are therefore negentropic relative to the observations of closed systems of ordinary matter-energy.

This "negative temperature" concept is often utilized in describing how lasers and superconductors work. In a superconductor we have "free electrons," like those in the plasma,

## Nuclear studies endangered

Today, nuclear science is about to become extinct in the United States. With the virtual ban on nuclear teaching reactors located in or near universities, experimental nuclear studies have been reduced to a few locations. And these reduced sites are primarily utilizing high-energy particle accelerators. From the standpoint of making theoretical analysis of experiments most simple, the accelerator would appear to provide the path of least resistance for nuclear studies. But the path of least resistance is not always the most fruitful in terms of frontier research.

As these new plasma focus results indicate, significant advances can be obtained from what are not considered to be the most antiseptic circumstances determined by the existing theoretical overview. In fact, the accelerator-based nuclear research cannot access reactions with short-lived excited states. By combining creative theory with development of new diagnostics, it is possible to take a more "messy" experimental situation, like the plasma focus plasma pinch, and extract entirely new approaches.

The plasma focus offers an ideal platform for a wide range of advanced scientific research at all levels in a university. It is easy to build, cheap, and easy to run. The level of research is only limited by the insight of the operators. If plasma foci were to be proliferated throughout the institutions of higher learning in the U.S., it would be possible to generate a renaissance of physical science. But the institutional political investment in the existing, large "antiseptic" "pinhole" approach provided by particle accelerators seems to preclude this most promising alternative.

which therefore make the superconductor an extremely good conductor of electricity. But these "free electrons" are still bound together in pairs as though they were in a fixed orbit around the nucleus of an atom. Because the free electrons in a superconductor appear to move without any resistance through the lattice of the superconductor crystal, it is said that this orbit pairing of electrons transforms them into something like the photon of light. Therefore, it would appear that the concept of "negative temperature" is a means of describing what are really new "orbits" through space-time which travel between many atoms. And this is what is physically seen in the supercluster bubbles.

In practical terms these supercluster bubbles open up the prospect for an entirely new approach to nuclear research. Because of their high energy and high particle densities at the time of their breakup, these supercluster bubbles generate extremely intense fluxes of ions. Given the intersection of these beams within a single cluster breaking up, it is possible to not only induce nuclear reactions, but to have the products of one reaction be "kicked" by the beam into an excited nuclear state. In this way very short-lived nuclear products can be reacted to find entirely new reaction chains.

These new reaction chains—one reaction, followed by another previously never seen because the input reactant is so short-lived—could help to explain how the spectrum of observed elements within the solar system were generated. The current theory is that only the explosion of very large stars, which are thereafter called supernovae, can explain the production of the heavier elements. Given the observation of enhanced heavy element fusion reactions, though, associated with the supercluster bubbles found in the plasma focus, this entire theory may be experimentally displaced. The Sun during its formation may have indeed generated the fusion reactions required, locally.

## Nuclear lasers

The ability to generate and react superexcited nuclear states would be of crucial importance for general nuclear research. The current methodology—given the previous inaccessibility of excited states for reaction studies—is to work backwards from reactions producing long-lived products. This method could be grossly distorting the actual reaction kinetics.

The ability to access and react short-lived excited state nuclei could greatly improve the prospects for constructing a nuclear laser. The idea would be to produce a significant number of superexcited nuclei of the same type. These could then be stimulated to emit in one coherent beam. The difference, though, is that the resulting beam would be almost infinitely more coherent and intense than any conventional laser. This would in turn create an immensely useful tool for examining the structure of nuclear matter and even, possibly, the structure of space-time, such as in the so-called matter/anti-matter reaction.

# The 'other' war zone: holocaust in Africa

by Jutta Dinkermann

The world is looking to the war zone in the Persian Gulf region. But another war zone, even bigger in terms of the number of victims, risks being overlooked: Africa. Every 20 seconds a child dies in this world—most of them in the African countries.

## Epidemics

As Lyndon LaRouche has repeatedly warned, the policy of inhibiting Third World development gives rise to deadly epidemics. The unchecked spread throughout Africa of AIDS, and the reappearance of diseases like cholera in several countries, notably Zambia and Uganda, tell the story. A recent U.S. statistical study estimates that in the year 2015, some 70 million people in Africa will be infected with HIV (the AIDS virus)—this means every 12th person. In some cities of Tanzania, 40% of the adults are infected with HIV; in Kigali, the capital of Rwanda, 30% are infected. In the hospitals of Zambia, almost 80% of all patients are infected. AIDS will be the main cause of death in sub-Saharan Africa in 2015, and "some areas have reached this point already now," the study says.

An Ivory Coast government study says that in parts of their country, whose total population is 12 million, 700,000 are infected with HIV; in the capital, Abidjan, it's every 10th person. AIDS is the number-one cause of death overall, and number two for women in the capital. Twelve percent of pregnant woman are infected with AIDS. In the other Ivory Coast cities, the rate of infection is about 7.5%; in the villages, almost 5%. Hospitals are filled to overflowing and do not have the equipment to help people. If there is medicine, it is only to help against pain, diarrhea, and itching. In the Rakai district of Uganda, a rural area with about 330,000 people, some 40,000 children have lost their parents to AIDS; 250,000 African children are orphans for this reason. By the year 2015 the number may have climbed to 16 million.

## Famine

Relief groups warn that 20-30 million Africans will face famine this year. Especially threatened are Ethiopia, Sudan, Mozambique, Angola, and Liberia. The German aid organization Caritas has warned that this will be the year of famine in the Sahel. Especially in the West African nations, a decline