SOLID STATE FUSION TECHNOLOGIES

21ST CENTURY ENERGY SOLUTIONS

NEWS about this site.
Fortunately work is proceeding well in this field. Unfortunately this requires that some of the detail previously provided on this site is now private. If you are a bonafide researcher interested in this field you may contact us about collaboration on projects.

Russ George
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Real Audio Interview
NPR Science Friday
Click to listen to Russ George and a leading HOT Fusion scientist on the US National Public Radio (Drag the Real Audio slider about 3/4 of the way through the segment to find Fusion)

Other Events & Interviews

"Science is 1% inspiration and 99% perspiration."
Thomas Edison

In The News

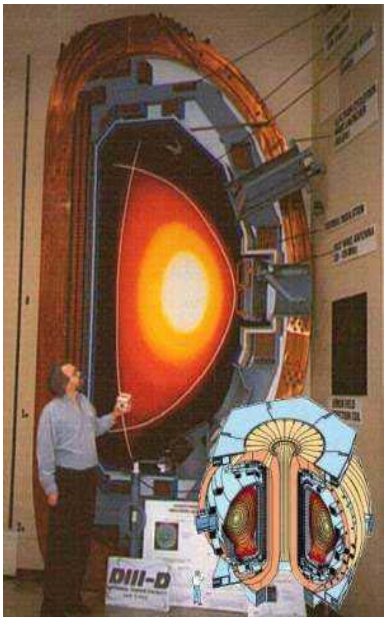
Based in Palo Alto California my work under the auspices of **Saturna Technologies Inc.** involves an expanding collaborative international network of researchers, scientists, and engineers. We pursue work on development of controlled nuclear reactions in condensed matter and commercial energy applications that make use of these reactions. Most of the work focuses on solid state deuterium reactions (***SSDR***) reproducibly observed in various solids saturated with hydrogen isotopes. These reactions have been profoundly demonstrated using experiments including those involving catalysis, nano-technology, electro-chemistry, glow-discharge, and ultrasonic cavitation.

The great blessing of our experiments is that so far **NO** energetic penetrating radiation signatures including neutrons and gammas have been observed in our unique ***SSDR*** experiments. This is not to say that no radiation is present as the quantitative measure of 4He which is born as "alpha radiation" shows intense alpha radiation production. Even in very small experiments the alpha radiation flux is more than 10 billion emitted alphas per second. (Compare this with the conventional neutron beam research devices we use to explore materials taking neutrons from the core of a fission based nuclear reactor provides a mere 10 million neutron emissions per/cm2/second.) *Fortunately alpha radiation (helium nuclei) is completely arrested by traveling through only a few atoms of matter and upon stopping becomes helium. No radiation escapes the reaction vessels.*

Our work has led us to collaborations with many leading fusion research organizations in the world including those in the more traditional HOT fusion arena. HOT fusion is a path to fusion energy that the world has made a major long term commitment to. The Goliath Tokamaks of which there are perhaps 3 or 4 operating in the world have taken 40 years and untold billions of dollars to develop. They draw hundreds to thousands of megawatts of power when turned on for brief HOT fusion experiments lasting a few seconds. During those few seconds of HOT fusion they produce intense penetrating neutron radiation which as yet has proven to be a major obstacle to the technology as the neutron radiation simply destroys the materials that make up the Tokamak. Perhaps very soon we will be performing ***SSDR*** experiments alongside HOT fusion experiments and enjoy the benefit of the great wealth of expertise and know how developed in the decades of work in those labs.

- New York Times Tempest in a Test Tube: 10 Years Later Cold fusion
- San Francisco Chronicle Technology News Report - Power to the People, the return of Cold Fusion.
- BBC ONLINE "Should The Cold Fusion Dream Die?"
- Nov 98 Wired Magazine "What If Cold Fusion is Real" STI Chief Scientist Russ George's work is featured
- Dec 98 Sonofusion in Popular Science "Star in a Jar"
- Why Does The World Need Fusion Energy?
- Energy in the Next Millennium
- Sir Arthur C. Clarke in The Journal Science

"As we enjoy great advantages from the inventions of others, we should be glad of an opportunity to serve others by any invention of ours." - Ben Franklin



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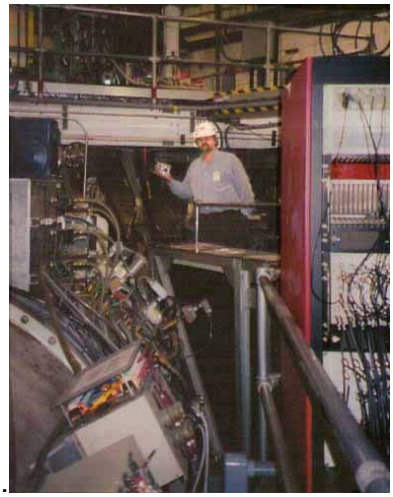

Russ George during a recent visit to General Atomics to present results of his fusion work holds one of his M5 Sonofusion Devices in hand while standing next to the General Atomics DIII-D Tokamak Hot Fusion Machine.

Days before these photos were taken the DIII-D operated for a 2 second fusion burn. Drawing many megawatts of power the Tokamak produced about e16 fusion reactions ... the same number of fusion reactions reported in Russ' experiments over a course of 28 days.

One exception to the "no penetrating radioactive emission rule" of these simple technologies produces small quantities of tritium (~1 million tritons per second) in very special experiments. Tritium is a heavy isotope of hydrogen and which beta decays to 3He with a half life of about 12 years. Currently the United States uses about $1 billion dollars of tritium per year for domestic non-military applications like emergency lighting, luminous watch dials, and medical biological uses. An important facet of tritium production is that this clearly shows that several perhaps many cold fusion reaction pathways exist.

A promising materials research area with important ramifications to these ***SSDR*** reactions is that of **nanotechnology**. When matter begins to condense in very small domains of a few tens of nanometers we observe that the properties of matter change dramatically from what we've been accustomed to observing in the macro regime. It has been clear for some time that the reactions we work with are not a uniform bulk phenomena but rather must be produced within some unusual domain that is quite extraordinary. Studies of the micro - nano domains within active materials has led to some understanding of the nature of the materials required to enable these reactions.

As alternative fusion reaction pathways came into the world in 1989 many scientists knew the loading of deuterium into metals could be accomplished by simply placing metal powders in contact with deuterium gas. The efficiency of how this works is largely dependent on the size of the particle and how well dispersed it is to maintain contact with the gas.

REVIEW
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Some of the areas we are working in. Details may be available upon request.

First Paper showing Experimental Evidence for SSDR Fusion at the American Physical Society 1998

STI Catalytic Fusion

STI Sono Fusion

STI Double Structure Cathode Fusion

STI Proton and Deuteron Electro-Migration

STI Laboratory Equipment Now Available

Evidence for Micro Nuclear Events in Thin Foils

Helium Bubbles in Nuclear Reactive Palladium

American Chem Soc. April 1994 Paper

Cavitation Induced Micro-Fusion

Electric Power Research Institute Demonstration Project Report

Real Time Mass Spectroscopic Evidence of Massive Helium production from deuterium catalytic fusion

The expectation is that the smallest particles are the most efficient at absorbing deuterium. Early reports by Scaramuzzi in Italy and Menlove at Los Alamos National Laboratory confirmed that the signature of nuclear reactions was present in such gas loading experiments with small particles of various hydrogen loving metals (many others reported similar results). Working from this obvious starting point a number of people moved in the direction of using nanotechnology to produce especially active materials wherein these reactions are more predictably produced.

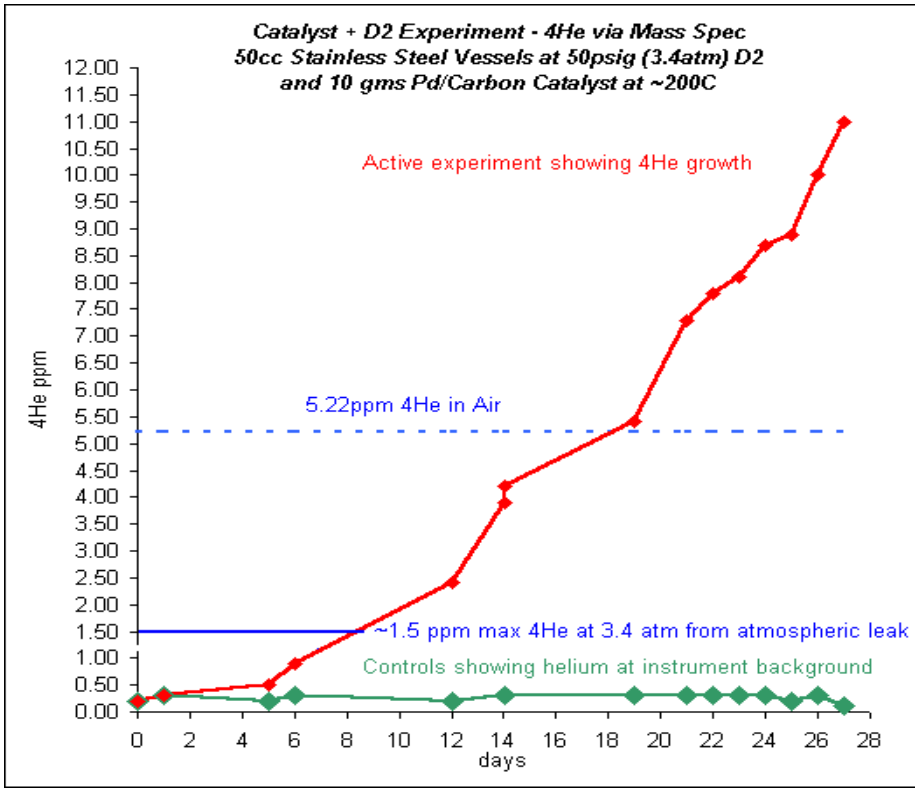
Our most active efforts at this time are focused on reproducing special nano-structured materials for use in experiments which produce both anomalous heat and nuclear products (primarily 4He). These nanotechnological experimental protocols have the benefit of being very readily reproduced, robust, and lend themselves to being scaled to large size. Recently we have confirmed, using high resolution real time on-line mass spectroscopy, that helium is indeed produced in abundant amounts from nano-powders of palladium. More information on this area typified by work we call *CATALYTIC FUSION* is being prepared.

Russ' SRI/EPRI Extrel Quadrapole Mass Spec On-line Experiment. Somewhat less complicated than the General Atomics DIII-D Tokamak device but capable of producing the same level of fusion results.

Data from Saturna/SRI/EPRI experiment below.

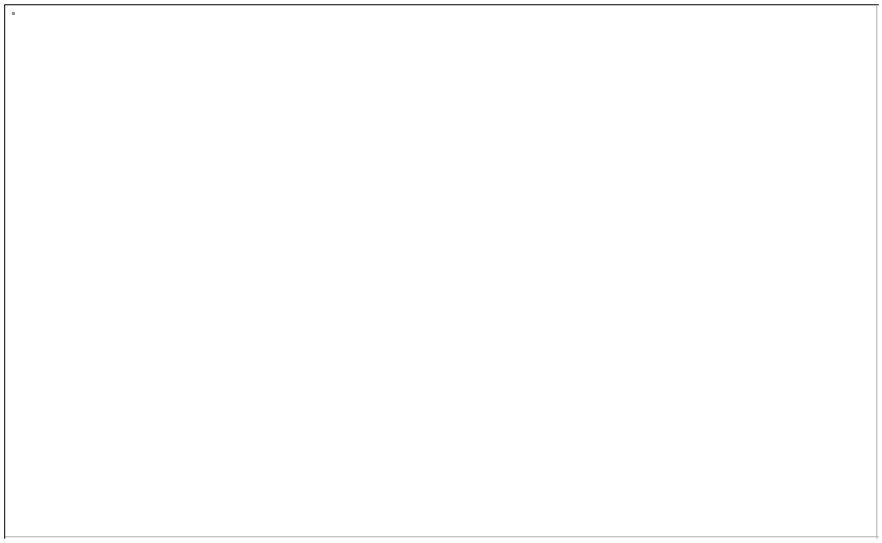
Where There Is Nuclear Fire You Must Find Nuclear Ash!

Y. Arata's 1997 Japan Academy Paper showing heat and helium isotopes using the DS Cathode



This simple plot of experimental data above from on line helium mass spectroscopy shows dramatic evidence of helium production for 28 days in a deuterium cell (red line) - no helium increase is seen in the sister control cell (green line). (Zoom on the chart to see more detail.)

August 99 - New work confirming highly enriched 3He emerging from deuterated metals our latest finding that has us excited here at Saturna. The work is in progress but the identification is quite certain. Helium-3 is a rare isotope of helium and is found on earth ordinarily at a ratio of only 1:800,000 (3He:4He). We reported a number of years ago at a meeting of the American Chemical Society finding, in cooperation with Rockwell Labs, enriched helium and of special note 3He in metals at a ratio 3He:4He of 1:200. Unfortunately we had only a small amount of data to work with at that time. New much more abundant data collected on much higher resolution and sensitive equipment confirms very highly enriched (many orders of magnitude) 3He accompanies 4He production. The mass spectra below is typical of the instrument resolution used to make this determination. Instrument sensitivity for 3He is in the range of a few thousand atoms. Tritium is ruled out as a source of the 3He. We hope to report on this work in greater detail at the ACS meeting in early October in Ontario, California.



Typical resolution from the Micromass type VG 5400 instrument showing full baseline separation of 3He from HD and H3.

Recently reported in conference news (July 99)
Society for Scientific Exploration's 18th Annual Meeting, University of New Mexico in Albuquerque June 3, 1999

"Dr. Michael McKubre (of SRI International) spoke on June 3, 1999 at the Society for Scientific Exploration's 18th Annual Meeting, which was held at the University of New Mexico in Albuquerque. McKubre reiterated the SRI results first divulged at the APS meeting in March 99 by Russ George of Saturna Technologies, Inc. He described the now famous experiment that produced a steady heat output and monotonic increase of helium reaching about 11 ppm from day 5 to 30 of the run (about twice the laboratory and standard atmospheric background of 5.2 ppm). This and similar experiments at SRI employed sealed 50 cc metal cells connected to a sensitive mass spectrometer, which is well able to separate out the D2 peak from the 4He peak. A control cell containing H2 gas produced absolutely no excess heat or helium. McKubre suggested that excess heat output of about 0.25 to 0.5 watt was possible evidence for the fusion reaction of two deuterium nuclei to helium-4 with an energy release of about 23.8 MeV. The most important news is that SRI has run about a dozen similar cells, with a success rate of about one in two or three."

Bio for STI Chief Scientist Russ George

Catalytic - Nano Fusion

Since the announcement in the spring of 1989 that cold fusion occurs in the presence of palladium and deuterium many people have assumed something akin to catalysis must be producing the reactions. After all palladium has long been known as one of the most useful hydrogenation

Real Audio NPR Science Friday Interview
Click to listen to Russ and a leading HOT Fusion scientist on the US National Public Radio April 9th,99 (Drag the Real Audio slider about 3/4 of the way through the segment to find Cold Fusion)

Lecture on Alternative Fusion Reaction Paths. Seminar at General Atomics April 99

Seminar on New Fusion Mechanisms - 10am May 13th Lockheed Martin Solar Physics Laboratory Palo Alto, CA

Contact Russ to arrange speaking engagements
rgeorge@rsrch.com

"If you steal from one person, they call that plagiarism. I steal from everyone, they call that research!" *- Woody Guthrie*

Quotes for paradigm challenged individuals

"It is not as uncommon for engineers to accept the reality of phenomena that are not yet understood, as it is very common for physicists to disbelieve the reality of phenomena that seem to contradict contemporary beliefs of physics " H. Bauer

"The most exciting phrase to hear in science, the one that heralds new

catalysts and any reaction where hydrogen and palladium are combined might have something to do with the catalytic properties of palladium.

Work by many scientists including those now working with STI dating back to 1989 have reported evidence which hints of catalytic like activity when deuterium is applied under different catalytic like conditions with palladium and other platinum group metals. Particular attention to this issue has been provided Scaramuzzi of Italy, Menlove of Los Alamos National Labs, Srinivasn of the Bhaba Institute in India, Donald Cram (Nobel Laureate in Chemistry) at UCLA, Yoshiaki Arata of Osaka, and more recently by Les Case of New Hampshire (who attributes his getting on the trail of catalytic fusion to his hearing of the work of Dr. E. Yamaguchi of NTT labs in Japan.)

Currently Russ George STI Chief Scientist is collaborating with several of these scientists on studies of the nano-chemical nature of the catalyst materials as well as on demonstration of the catalytic fusion technology in leading U.S. National Laboratories. Experiments are underway under with an on-line mass spectrometers capable of real time on-line quantitative measure of the 4He and 3He, the principal nuclear signature products of these reactions. Additional attention is being focused on the engineering needed to scale the process to commercial size.

Recent data has shown irrefutable evidence of production of 4He in a catalytic fusion experiment conducted using an on-line Extrel quadrapole Mass Spectrometer owned by the Electric Power Research Institute and located in a laboratory at SRI International in Menlo Park, California. The experiment revealed a steadily increasing concentration of 4He over a period of 4 weeks. At the start of the experiment the concentration of 4He in deuterium gas was measured in the sealed experiment at under 1 ppm, by the end of the experiment the concentration had risen to over 10ppm.

Catalytic Fusion Experiment in Dr. Brian Oliver's (pictured) Helium Isotope Lab at Pacific Northwest National Laboratory. The fusion apparatus is the lower right black and white object.

*discoveries, is not 'Eureka!' (I found it) - but **'That's funny...'"*** Isaac Asimov.

"A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it." Max Planck

"There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investment of fact." Mark Twain, Life on the Mississippi

"There is not the slightest indication that nuclear energy will ever be obtainable. It would mean that the atom would have to be shattered at will." Albert Einstein, 1932

"...after a few more flashes in the pan, we shall hear very little more of Edison or his electric lamp. Every claim he makes has been tested and proved impracticable." *New York Times, January 16, 1880*

"We don't like their sound, and guitar music is on the way out." Decca Recording Co. turning down the Beatles, 1962

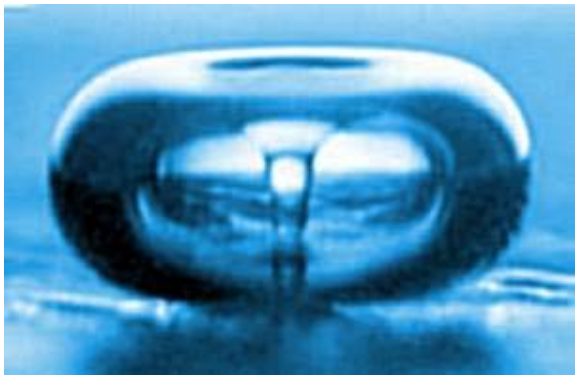
"There is no reason anyone

This method of catalytic fusion introduces deuterium to a suitable proprietary hydrogenation catalyst under specific catalysis conditions. The nano particles of palladium (and other platinum group catalyst metals) in association with certain catalyst support material produce anomalous heating and helium when in the presence of deuterium.

Sono Fusion

Another specialty technique we work with is *SONOFUSION* a branch of physical acoustics closely related to the popularly known phenomenon sonoluminescence.

Sonoluminescence is a phenomenon where tiny bubbles created and sustained with sound waves in a liquid are observed to ***cavitate*** (grow and collapse) in the sound field and emit a faint blue white light. The source and nature of the light is the subject of a grand mystery and the focus of many academic research projects. In some of our work at we take cavitation a step further and utilize the energy concentration effects within a collapsing bubble to produce and control nuclear reactions in the associated solid state lattices, Sonofusion.



Photograph of an acoustically driven bubble at the point of collapse on a target surface. The internal Vortex/Jet is clearly visible which presents super dense deuteron ion flux to dynamically load the target material.

would want a computer in their home." Ken Olson, Chairman and founder Digital Equipment Corp., 1977

More Quotes and Jewels from Great Minds for the skeptical reader

References and Reading Materials

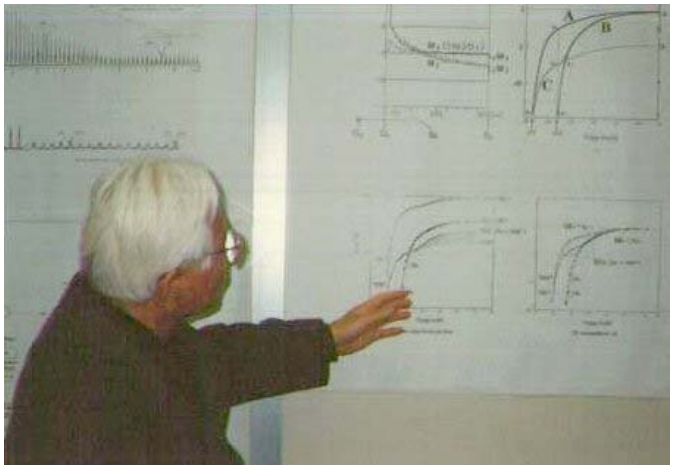
Dr. Zhang and David Kubiak in the Arata lab at the University of Osaka work on an M5 Sonofusion experiment. The M5 device is a small cube at the bottom in a tall case seen on the right behind Kubiak San.

This work derives from the pioneering efforts of many scientists who have innovative original patents in this arena including Flynn, Fukushima, Crum, Suslick, Putterman, Stringham, George, and others.

Double Structure Palladium Cathode Electrochemical Cold Fusion Experiments

Having had the opportunity to spend many months with and in the laboratory of Dr. Y. Arata of Osaka and then helping to bring the Arata Double Structure Cathode experiments to SRI International we are now committed to constructing and operating our own DS cathode experiments. Initial results are very promising for this methodology as the efforts in our own labs and those of SRI are proving highly productive. This is a technology very well suited for technology transfer to laboratories wishing to have cold fusion experiments operating and producing the effect in a timely and efficient fashion.

The apparatus is rather simple in form though very complicated to fabricate. Untutored attempts to replicate the DS cathode experiment have not met with success due to unexpected features intrinsic in the materials and assembly methods.



Above Sensai Arata in his laboratory gesturing toward helium data.

Below a schematic of a DS cathode cell.

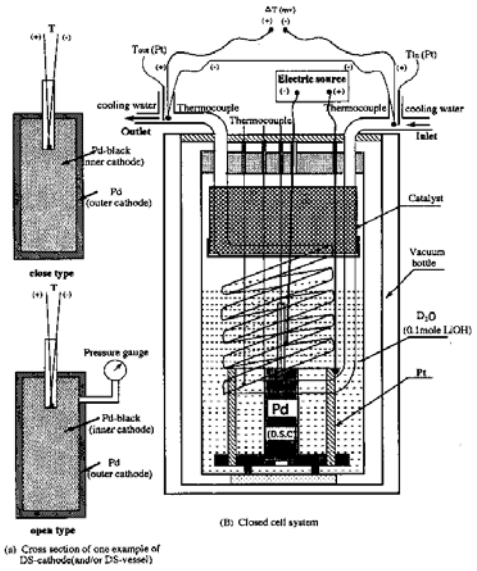


Fig. 5 Closed cell system with DS-cathode

You can read some of Arata's earlier results using this technique in his 1997 Japan Academy Paper.

Details on obtaining assistance in acquiring and setting up double structure cathode type experiments is available on our lab devices page.

Deuterium Electro-Migration Experiments

Research is also underway on the application of electro-migration of hydrogen isotopes where materials loaded with hydrogen isotopes are subjected to powerful electro-migration currents. This has the feature of concentrating the hydrogen isotopes in defined regions. This new protocol

offers an opportunity to dynamically control and study the loading ratios of hydrogen isotope : solid matrix. Development of advanced materials highly suited to hydrogen conduction and coherent behavior are the key to this work. A range of unexpected phenomena have been observed using this protocol including high temperature superconductivity.

Technology Transfer

In all of our work our goal is directed toward developing commercial heat technologies. At present however we are dedicated to the design, manufacture, and distribution of the worlds first line of laboratory research instruments that reliably produce these "cold fusion" reactions on demand. Energy researchers and physicists find these instruments the perfect tools to further research and development goals in this new domain of physics and nuclear energy production. Bonafide scientists wishing to establish a collaborative working relationship are invited to contact the author at rgeorge@rsrch.com

Fusion Science Bio for Russ George,

Russ George operating the Extrel Quad MS owned by EPRI located at SRI International 1998

In addition to the work in my own lab over the past nine years I have spent extended periods of time as a visiting scientist at Los Alamos National Labs, the University of Osaka, SRI International, and under contract with the Electric Power Research Institute working on various research experiments to understand this phenomenon. This has included studies using high resolution mass spectroscopy, various radiation emission (neutron and gamma) detection methods, dynamic and TOF SIMS, Scanning Electron Microscopy, calorimetry, Prompt Gamma Neutron Activation Isotope Analysis, and a number of other disciplines. I have had or have active research collaborations with scientists at Los Alamos, Rockwell International, US Bureau of Mines, Naval Research Laboratory, Pacific Northwest Labs/ Battelle, Charles Evans and Associates, and a number of other labs around the world. I've also been invited to Japan to act as an advisor to the Japanese government New Hydrogen Energy committee of MITI. I have been invited and have prepared briefings on this

work for members of the U.S. cabinet and top brass in the Navy. I have lectured on this topic in national labs, corporate research facilities, and to energy organizations and consortiums in the USA, Canada, Japan, and Europe. I do from time to time provide private briefings and seminars on this topic and will make an effort to continue to do so.

If your organization is interested in a briefing or seminar on this important emerging energy topic I am happy to explore the possibility of working in a consultative capacity.

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1999 and 1998 American Physical Society Papers

Russ George has presented his work in papers at APS meetings in 1998 and 1999. The 1998 paper was the first paper the American Physical Society has accepted that presents data showing proof of "sonofusion and cold fusion." This years (1999) presentation showed additional evidence of this phenomenon in observations of helium production. (The 1999 paper was prepared too late to appear in the APS Conference Abstracts but is presented in full on this web site.) For the 1998 paper See the **APS Web Site (http://www.aps.org/BAPSMAR98/abs/S4170002.html)**

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