DISCOVERY OF MACROCATIONIC CRYSTALLINE H2O CAVITATION REENTRANT JETS & THEIR ROLE IN CAVITATION ZERO POINT ENERGY, FUSION & THE ORIGIN OF LIFE

The Seventh Annual Conference on the Physics, Chemistry & Biology of Water, October 18-21, 2012

Presentation Co-Sponsored by Vermont Photonics and the Maine Space Grant Consortium
MSGC Director’s Fund Grant SG-13-22

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NanoSpire, Inc.
Abstract. Macrocationic, crystallized cavitation reentrant jets were first observed during investigation of directed cavitation reentrant jet nano and micro-machining in water by the author in 2004 in Buxton, ME, on grants funded by the Maine Technology Institute. I again observed the same behavior in 2005 on work funded by the New York State Energy Research and Development Authority as PI, with co-investigators Serge Lebid, EVP NanoSpire, Inc., Prof. Eric Eisenbraun of Albany Nanotech, and others. The extreme pressure and temperature of cavitation bubble collapse was compressing dissociated water H+ and OH- ions at the bubble interface into solid, faceted macrocationic crystals possessing an equilateral triangle crystalline subunit. Reentrant jet impacts formed pit cross-sections that were equilateral triangles, regular or oval-shaped hexagons, twinned crystals such as hourglasses, or hybrids of triangles and hexagons. The presentation will provide an overview of data and theories addressing the structure and dynamics of crystallized cavitation reentrant jets in coherently extracting zero point energy, triggering fusion and driving prebiotic chemistry.

The cavitation reentrant jet crystal has enormous positive electrostatic charge concentration and induces a negative charge on the surface of any nearby object. Electrostatic attraction then draws the positive crystal towards its negative induced charge on a nearby surface and imbeds the crystal with great force, imprinting a fossil image of the crystal’s facets in a wide variety of materials. The crystalline structure presents a concentrated number of protons on the surface giving it a very low pH. Bright red hexagon jet impact pits in green litmus and purple hexagon pits in orange litmus all indicated zero pH. The crystal is short-lived, typically persisting for a few microseconds in water, isolated by a super-cavitating water vapor column. The crystals can form linear or helical strands, with large bacteriophage-like icosahedral hexagonal heads and long narrow whip tails and can join head to toe, forming coils that can also supercoil, like DNA. A new diamond-like tetrahedral SP3 orbital structure is proposed, based on the crystal’s subunit equilateral triangular structure and dissociated water composition. The proposed molecular structure makes the crystal twice as strong as a diamond and up to 5.5 times denser than ordinary water. Sinusoidal reentrant jet buckling data used with the Euler equation indicates that the crystal is ten times stiffer than tungsten.
The cavitation reentrant jet water crystal plays a central role in coherently extracting zero point energy via the LeClair Effect, which triggered intense fusion, fission and transmutation in water during grant funded landmark experiments conducted August 24-25, 2009 in Buxton, ME by Mark L. LeClair and Serge Lebid of NanoSpile, Inc., that produced 2900 watts of hot water flow from 840 watts of electrical input. The transmuted material has been analyzed by SEM-EDAX, XPS and LA-ICP-MS, revealing that the transmuted material was generated by small scale supernova nucleosynthesis forming on the supersonic bow shock surrounding the crystal. Seventy-eight elements were detected, along with short-lived isotopes.

Crystallized cavitation reentrant jets are also the template for the origin of life. Observed large scale cavitation nucleosynthesis seriously challenges the paradigm that supernovas were the primary providers of the building blocks of life. I presented my theory to the NASA Astrobiology Institute in 2001 that cavitation reentrant jets generated by the underwater wake of asteroid and comet ejecta impacting into oceans and lakes during the primordial bombardment generated life. Cavitation was also generated from volcanic eruptions, lightning strikes, wave action and other natural phenomena. Helical cavitation reentrant jets act are exact geometric and molecular templates for the assembly of DNA, RNA and protein. The correct size protein, RNA and DNA reentrant jet templates only form within the same submicron size range where cavitation induces and accelerates unusual chemical reactions. The crystals can join head to toe, just as RNA and DNA 3’ and 5’ ends do, forming helical coils that can be relaxed, or twist and writhe into supercoils. The discovery of the crystal and its effects will have a dramatic impact on the physics, chemistry and biology of water.
About NanoSpire

NanoSpire’s business focus and expertise is harnessing cavitation at a fundamental level. NanoSpire, Inc. is a privately held IP holding corporation. We are currently pursuing licensing, JV and product development in many areas with key strategic partners.

- Incorporated January, 2002
- Winner of Seven Grants (NY-NYSERDA, ME-MTI, MSGC, Hub Labs)
- Winner of Innovation Technology Award, Nano Tech 2003 + Future Conference, Tokyo, Japan
- Issued Four Fundamental Patents in 2005-2009 for Creating & Controlling High-Speed Cavitation Reentrant Jets Useful in a Broad Array of Applications
NanoSpire Team

Mark L. LeClair, Founder, President & CEO: 30 yrs expertise in cavitation. Proprietor of CFD Associates.Former Trident II underwater launch hydrodynamicist, Lockheed Missiles & Space Co. Worcester Polytechnic Institute (WPI) graduate in mechanical engineering (MSME, BSME w/distinction) with concentration in fluid dynamics, heat transfer, thermodynamics, physics and nuclear engineering.

Cavitation Reentrant Jet Patents

Five Key platform US patents granted:


What is Cavitation?

- Cavitation bubbles are created when an object passes through a liquid rapidly or when a liquid is brought to its boiling point.
- Cavitation bubbles collapse asymmetrically next to an object, causing a high speed liquid jet to shoot towards the object.
- The cavitation “reentrant jet” exits the bubble at up to Mach 4 and can drill a hole through a diamond.
- This behavior is very repeatable. The size, force and direction of the reentrant jet can be controlled and produced with precision using a laser, ultrasound, x-rays, etc.
Cavitation Collapse Sequence

US Patents 7,517,430 & 6,960,307, Method and Apparatus for the Controlled Formation of Cavitation Bubbles, M. L. LeClair

1: A Focused Laser Pulse Vaporizes the Liquid, Causing a Cavitation Bubble to Form above the Control Surface and Rapidly Expand

2: The Fully Expanded Cavitation Bubble is Precisely Positioned Above the Aperture to Collapse Within 6 Bubble Diameters of the Control Surface

3: Cavitation Bubble Collapse is Restricted by the Nearby Control Surface, Causing an Asymmetric Collapse

4: A Reentrant Microjet Forms, Directed Towards the Centroid of the Collapse Restriction, Which for a Flat Plate is 90 Degrees

5: The Reentrant Microjet Passes Through the Aperture at the Restriction Centroid & Strikes the Workpiece

US Patents 7,297,288 & 6,932,914, Method and Apparatus for the Controlled Formation of Cavitation Bubbles Using Target Bubbles, M. L. LeClair

1: Two Cavitation Bubbles are Formed in Close Proximity by Focused Laser Pulses, Either Simultaneously or Slightly Out of Phase

2: The Two Cavitation Bubbles Rapidly Expand

3: The Cavitation Bubbles Collapse Asymmetrically When in Close Proximity (6D)

4: The Reentrant Microjet Formed in the Larger Working Cavitation Bubble is Directed by the Collapse of the Smaller Target Cavitation Bubble Towards Its Center

5: The Reentrant Microjet Exiting the Working Cavitation Bubble Passes Through the Target Cavitation Bubble Center & Strikes the Workpiece
NanoSpire Product Schematics

US Patents 7,517,430 & 6,960,307, Method and Apparatus for the Controlled Formation of Cavitation Bubbles, M. L. LeClair

US Patents 7,297,288 & 6,932,914, Method and Apparatus for the Controlled Formation of Cavitation Bubbles Using Target Bubbles, M. L. LeClair
Cavitation Reentrant Jet Micro/Nanofabrication Technology

- Top Down: Drill, cut, mill, anneal, shotpeen, materials at a few nanometers
- Bottom Up: Weld, coat, implant, & assemble nanostructures
- Process Wide range of materials (diamond, glass, silicon, ceramics, metals, etc.)
- Up to 500 kHz cutting potential

- Nanophase & Engineered Materials
- Coatings
- Sensors
- MEMS/NEMS
- Micro/Nano Fabrication
- Biotechnology
- Solar Energy
- Cavitation Powered Drill Bits for Oil & Gas Exploration
- Breakthrough Biodiesel Production

NanoSpire, Inc.
Micro-Hole Drilling Registration Accuracy

First Results Funded by Maine Technology Institute Achieved a +/- 1.27 Degree Average Accuracy with a Repeatability of 0.25 Degrees Standard Deviation

SEM Photos Courtesy of Albany Nanotech, MTI SG1424

Machining of Linear Array in Glass
100X Mag
Pit size: 30 Microns,
Spacing: 300 Microns
MTI Grant SG1424

Later Results Improved to +/- 0.08 Degrees Accuracy, Grant Funded by New York State Energy Research & Development Authority, Grant Agreement #8250

NanoSpire, Inc.
NanoSpire Nanomaterials Processes

- Dispersion
- Emulsification
- Cell Rupture
- Homogenization
- High Shear Mixing
- Microencapsulation
- Wet Milling
- Nanomaterials Synthesis

NanoSpire Nanomaterials Markets

- Biotech
- Cosmetics
- Chemicals
- Dairy
- Food/Beverage
- Ceramics
- Engineered materials
- Semiconductors
- Catalysts
- Inks/Paints/Coatings
- Polymers
- Personal Care
- Petrochemical
- Composites
- Ceramics
- Nanotubes / Nanowires
- Waste & Water Treatment

Cavitation Reentrant Jet High-Shear Mixers
NanoSpire Grants


Cavitation Erosion and Fusion

van der Waals Repulsion Energy

E_{total} = E_{(Impact)} + E_{(van der Waals Repulsion)}

Impact Energy Compression

Soft Material:

Medium Hardness Material:

Hard Material:

van der Waals Pressure Zone Thickness vs Material Properties

van der Waals Cavitation Reentrant Jet Impact Pressure vs Material Properties for Various Substrate Materials

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NanoSpire Redefines Cavitation Erosion Prediction State of the Art:


“The resistance of specific metals or other materials to liquid erosion, which is commonly evaluated by ASTM G32(Standard Method for Vibratory Cavitation Erosion Test), does not depend on any one property, although many attempts have been made to correlate erosion damage with different intrinsic properties … hardness, true stress at fracture, corrosion fatigue strength, work hardening rate and ultimate resilience (one half the square of the ultimate strength, divided by the modulus of elasticity. From Liquid Erosion Failures, Metals Handbook, vol. 10, 1975.”
Faceted Cavitation Reentrant Jet Impact Pits

Photo: L. A. Crum
The Water Crystal

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Cavitation Water Crystal Molecular Structure & Proposed Brown’s Gas Seed


- OXYGEN -
- HYDROGEN -

The Crystal Can Form Linear Strands By Covalent & Co-located O-H Bonds Along the Crystal Axis: (H2O)n

The Crystal can also Form Closed Loops via Covalent O-H Bonds Connecting Head to Tail. This is the Proposed Meta-Stable Seed Structure for Brown’s Gas Seed. Seed Size is 0.5 Microns or Less to Remain in Suspension and not Settle.

The Crystal Loop Can Break, The LeClair Effect Then Accelerates the Strand, Releasing Zero Point Energy & Can Trigger Nuclear Reactions Ahead of the Crystal’s Supersonic Bow Shock

The Crystal Subunit is an Equilateral Triangle. These can Link Into Hexagons and Larger Structures, Bound Together in the Plane by Either Weak Hydrogen Bonds or Co-located Hydrogen Atoms. A Combination of O-H Covalent Bonds along the Axis with Hydrogen Bonds in the Plane Classifies the Water Crystal as a Hybrid, a Type of Van der Waals Crystal. The Specific Gravity can Vary: Ranging From 5.5 Max for the All Co-located Hydrogen Case Down to 0.73 for the Case where the Bonds Alternate Between O-H Covalent (0.19 nm) and Hydrogen Bonds (0.28 nm) in All Directions. The Crystal is not a Form of Ice, Forming at the Ultra High Pressures of Cavitation Collapse and Reentrant Jet Impact

Electrostatic Crystalized Jet Impact into Steel

Crystalized Jet Impact into Green Litmus Paper: Zero pH

Electrostatic Crystalized Jet Impact into Orange Litmus Paper: Zero pH

Electrostatic Crystalized Jet Impact into Paper

Electrostatic Crystalized Jet Impact into Rust

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Spiraling LeClair Effect Crystalized Reentrant Jet Trenches on Copper
The leading face of the highly charged crystal and bow shock are in sub-micron proximity, their closely spaced conductive faces, separated by a near vacuum, satisfy the conditions for forming a resonant quantum harmonic oscillator, producing the Casimir force. The Casimir force, along with electrostatic attraction, cause the bow shock to draw the crystal towards it, this propels the crystal. The Casimir force coherently extracts zero point energy as a result of the zero point electron cloud positional fluctuation of the closely spaced conductive surfaces. The highly fixed particle positions pinned on the bow shock from high pressure invoke the Heisenberg Uncertainty Principal, which then imposes random, zero point momentum fluctuations of the electrons and other particles on the bow shock. Forced to respond with random momentum by the Heisenberg Uncertainty Principal, the highly fixed position bow shock particles can not respond with an equal and opposite reaction, thereby conflicting with Newton’s Law’s of Motion and violating the First and Second Laws of Thermodynamics.
July 22, 2009 Cavitation ZPE Reactor Experiments

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Majority of Transmuted Material was Diamond
August 24-25, 2009
Cavitation ZPE Reactor Experiments
April 12, 2010 NRL Cavitation Reactor Experiment

NanoSpire, Inc.
NanoSpire, Inc.

10/20/2012

August 24, 2009 NanoSpire Experiment Temperature History

Delta T = 18 deg C = 32.2 deg F

Reactor Inlet Temperature

Pump Shut-off → System Drained → Core Endcap Removed

Short-lived Transmuted Isotopes Undergo Radioactive Decay, Generating "Heat After Death"

\[ \text{Vol Flow Rate} = 0.6 \text{ gpm} = 3.8 \times 10^{-5} \text{ m}^3/\text{sec} \]
\[ \text{Mass Flow Rate} = 3.8 \times 10^{-5} \text{ m}^3/\text{sec} \times 1000 \text{ kg/m}^3 = 3.8 \times 2 \text{ kg/sec} \]

\[ \text{Thermal Output Power} = \text{Mass Flow Rate} \times C_p \times \Delta T \]
\[ = (3.8 \times 10^{-2}) \times (4190) \times (18) = 2866 \text{ Watts} \]

Power Input = 7 amps \times 120 Volts = 840 Watts

\[ \text{COP} = \frac{2866}{840} = 3.4 \]

Core Extracted, & Thermocouples Unplugged
Stable 35Cl (natural abundance 75.77%) and 37Cl (natural abundance 24.23%) become radioactive 39Cl in PVC Reactor Enclosure, half life = 55.6 minutes (beta minus decay, gamma = 3.441 MeV), by adding deuterium to 37Cl and alpha particles to 35Cl from fusion.
Nuclear Tracks from Transmuted Material

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Transmuted particles were analyzed by SEM-EDAX (U. ME Orono, Media Sciences and Dr. Ed Storms) XPS (U. ME Orono) and LA-ICP-MS (Evans Analytical)

Blue Chip

Orange Chip

Rust

White Chip

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10/20/2012
2009-Aug NanoSpike EDS Analysis

Black sphere 1 esc.fit.spec

Blue chip 1 EDAX esc.fit.spec

Blue chip 2 EDAX esc.fit.spec

Conglomerate esc.fit.spec

Cu 1 esc.fit.spec

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Path = C:\Users\moulzeo\Documents\IAEST\NanoSpike 09-Aug-2009 20:32:11 pg 2 of 3
The nanospire sample was analyzed using XPS. The power was 240 W (12 kV at 20 mA) using the Al anode. All scans were done at 100 eV pass energy for high S/N. The sample was placed on a piece of silicon; due to the perforations in the sample and the large analysis area, the silicon sample contributed peaks to the spectrum. Several scans were taken. The sample definitely contains carbon, oxygen, sulfur, nitrogen and aluminum. Two silicon peaks were seen – one from the silicon piece and the other from the native silicon oxide on the piece or the sample. The wide scan below shows silicon, aluminum, oxygen, and carbon.

The most populated region showed a variety of peaks. Here you can clearly see the aluminum, silicon (double state) and sulfur. The other unknown peaks are possibly chlorine or boron.
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Transmuted Particle Elemental Composition by Atomic Number & Weight (SEM-EDAX & LA-ICP-MS)

Fission Fragment Yield for Uranium & Selected Transuranic Isotopes
Transmuted Particle Elemental Concentration vs Carbon Concentration Similar to Supernovas

LeClair Effect Transmutation Diagram

Type 2 Core Collapse Supernova, Slow & Rapid Neutron Addition Nucleosynthesis, Elements + Fe

$Fe > 0.351$

C-O White Dwarf Explosion

NanoSpire, Inc.

10/20/2012
There were 3 cells that were abnormal and had chromosome aberrations. Figure 6 shows that one cell had a deletion in chromosome 2. Figure 7 shows that one cell had a translocation between chromosomes 5 and 13. Figure 8 shows that one cell contained aberrations that involved three different chromosomes involving chromosomes 2, 3 and 11.

"The results from this preliminary analysis show that both donors had chromosome aberrations… It is plausible that the damage was caused by radiation. Prof. Doug Boreham"

Figure 2: Chromosome 3 damage was observed in one metaphase spread. The chromosome on the left is the normal chromosome 3. The chromosome in the middle is a shorter abnormal chromosome 3 that is missing a fragment and the corresponding small fragment is seen on the right.
Cavitation Fusion in Other LENR Devices

- Ultrasonics/Sonofusion: Stringham, Impulse Devices
- Pons-Fleischmann Cells, Taleyarkhan, JET, Energetics Technologies, Ltd.
- Cavitating Rotor-Stators: Griggs Hydrosonic Pump (Hydrodynamics, Inc.), Potapov
- Brillouin? Defkalion? Rossi?
Cavitation Reentrant Jet Origin of Life Theory

Cavitation dynamics naturally create DNA, RNA and proteins, and assemble them into bacteria, archea and viruses. Primordial cavitation fusion transmutation from comet and asteroid impact into the oceans provided the bulk of elements necessary for life, not supernovas as is commonly believed.
Summary

• Cavitation reentrant jets generating the LeClair Effect are the key to harnessing fusion and producing transmuted material on an industrial scale. NanoSpire’s cavitation reactor generated 2900 watts of hot water flow using only 840 watts of electrical input, a coefficient of performance (COP) of 3.4

• The LeClair Effect and its theoretical predictions correctly explain excess heat and transmutation seen in many other cavitating liquid phase LENR (LeClair Effect Nuclear Reactions) devices without the need for new physics, such as heavy electrons, plasmons or other newly proposed particles or reactions. The LeClair Effect produces intense fusion with many different substrates and most importantly, even without a substrate in a liquid under the right conditions. This means that no electrochemistry, lattice-based theories, palladium, nickel, platinum, other catalysts, nanophase material or heavy water are required to produce fusion.

• Crystalized cavitation reentrant jets are the missing link, providing the ideal molecular template for synthesizing RNA, DNA & protein. Cavitation reentrant jet dynamics could have assembled the first life forms, including archea, viruses and bacteria