

Anthropocene Institute



How Close are We to Abundant Cheap Clean Energy from Low Energy, Lattice Enhanced, Nuclear Energy?

Low Energy Nuclear Reaction (LENR) Seminar, 2/9/2016

Carl Page, President and co-founder, Anthropocene Institute

Michael McKubre, SRI International.

Robert Godes, President and Founder, Brillouin Energy Inc.

Objective and Agenda

Objective:

- Broaden Silicon Valley Intelligentsia's awareness of progress/obstacles in LENR.
- Enjoy the company of interesting people.
- Share some of our favorite paradoxes with sharp curious minds.

Agenda:

- 2:10: Panel Presentations
 - Carl Page, President/Founder of the Anthropocene Institute: Goals, Context, Global Status, Sociology
 - Michael McKubre, SRI International
 - Robert Godes, Founder, CTO, and President of [Brillouin Energy](#)
- 3:30: Q & A
- 4:00: Lab Walk Through
- 5:00: Finish

MISSION: NURTURE NEW TECHNOLOGIES AND CULTURAL INSTITUTIONS REQUIRED FOR THE LONG TERM VIABILITY OF HUMANITY.

Contrarian Principles:

- More Good instead of Less Bad.
- Abundance, not Austerity.
- First things first: Tackle big problems before little ones.
- Plan for success, avoid disaster.
- Intellectual Honesty. Threat Analysis. Observation over Ideology.
- Precautionary Principle. When near grave danger, back away to safety.
- 10X Moonshot Objectives.

Anthropocene Institute - Objectives for Energy

Plan for 10 Billion middle-class people concurrent with greater habitats for "natural" biodiversity.

Subgoal: **One Cent Clean Energy.*** Achievable stretch goal for Engineers that Congress, Industry and Public appreciate.

Provides Opportunities to Solve:

- Energy for advanced healthy civilization to do everything with reduced social and natural cost: manufacturing, food production, water, housing, transportation
- Stabilize or correct Ocean pH **before 2050** and other resources "wild" ecosystems require.
- Highly effective cleanup of all forms of pollution.

*1 cent per kilowatt-hour LCOE always-on, low pollution, grid power deployed at scale by 2021 and potentially worldwide shortly thereafter.

Examples of Potential One Cent Energy

- LENR
 - If Proven: Cheapest, Cleanest, Safest → By a mile.
- Efficiency
- Makani Power
 - Google's 10X cheaper wind power System. 1/4 cent kWh?
- Molten Salt Reactor
 - Unpressurized Nuclear Fission. Alvin M. Weinberg's 1953 replacement for the now dominant Light Water Fission Reactor (LWR) he also designed. (Neglected).
 - Thorium optional.
 - Shipyard manufacturing.
- Expanded Hydropower via Run-of-Stream distributed generation, or ocean current (Natel Energy, etc)
- Solar + Cheap Storage or Breakthrough Solar Thermal.

Why I avoided "Cold Fusion"

- I'm not a physicist.
- The consensus in Physics is that it was all some sort of mistake or fraud, which may have engendered a cult of believers akin to UFO stalkers.
- I fear weapons.
- Theoretical Objections. Expecting neutrons. Expecting gamma Rays.
- My subscriptions to Nature and Science keep me up to date with everything real and relevant.
- WikiPedia says it's bogus.
- Pons & Fleischmann fled USA in disgrace.
- Cold Fusion is the popular press's favorite metaphor for self-delusion and pathological science.
- Physicists will sneer and nearly run away if I mention it.
- Government won't fund it.
- The USPTO said it is like a perpetual motion machine.
- My friends will cringe if I mention it and silently wonder if I've lost my mind.

Powerful reasons.

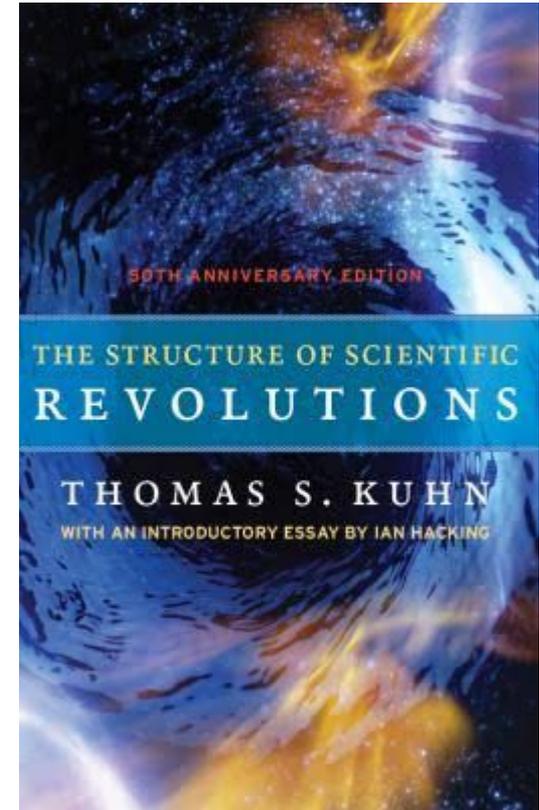
But unscientific.

Intellectual honesty is hard.

We can show that the LENR reaction is reproducible, and its inputs and outputs have been quantitatively characterized many times using several kinds of apparatus, here and many other places. (China Lake, Melvin Miles!)

Abundant theories of mechanism which don't violate the standard model of physics. Most of them depend on solid state or condensed matter physics that the go-to experts of fusion, Plasma Physicists, aren't trained in.

Resistance to the shift in paradigm follows the pattern described by Thomas Kuhn.



Nomenclature: Why LENR, and why not "Cold Fusion"

Fission: Breaking atoms. Fusion: Combining atoms. What is LENR?

- Chemist: Fusion because the chemical inputs and outputs resemble the sun's.
- Physicist: Cannot be fusion because the high energy particle output, the signature of the underlying mechanism, is six orders of magnitude too weak.

A new term is needed: "Low Energy" hints at the weak force and it may be true that the LENR reaction depends more on weak force than strong force, unlike plasma fusion.

Physical Understanding & Knowledge:

- Fusion is very well understood.
 - Excellent theoretical modeling of the 2 particle interactions
- LENR reactions seem to require millions of coupled atoms that are difficult to model and observe. Our recently emerging understanding of high temperature superconductors, x-ray lasers, and perhaps Memristors, may help us understand them.

Sociology. Why We Don't Hear About LENR

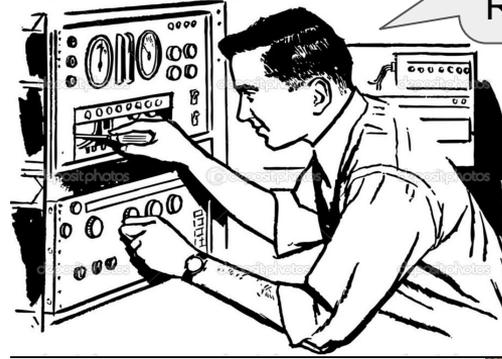
- The LENR Denial Movement
 - Physics community contains a "LENR denial movement", very much akin to "Anti-regulatory extremists against climate change".
 - Denial gets stronger when you provide more detailed and accurate information.
 - Psychology calls it "motivated reasoning".
- Denial not based on physical science. What's going on?

Good Reasons Why Physics Resists LENR

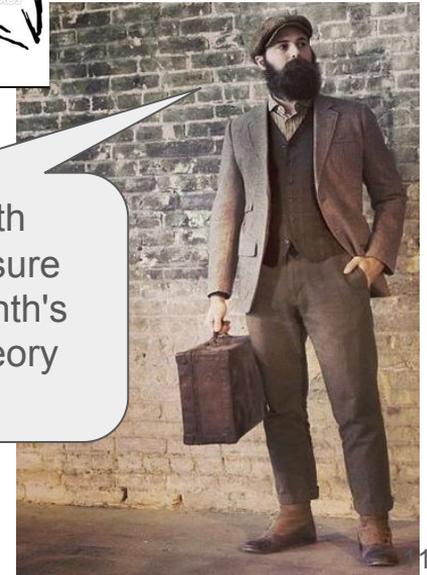
- Repeatability. Experiments should work every time, not like slot machines.
- Really unexpected to not have measurable high energy neutrons or larger amounts of gamma rays. And the lack of neutrons wasn't established in 1989.
- Signatures of fusion are missing so fusion isn't happening.
- We need an accepted theory of the mechanism. Mathematical thinkers do not believe their eyes without calculus in support. Prior to Einstein's special relativity equation, 20 years of accurate speed-of-light measurements had been discarded as "Wrong again!". Sadly LENR probably cannot be described in one line of calculus.
- Measurements of Helium are very hard to do when the quantities are small and He from the atmosphere could contaminate.
- Isotopic enrichment is hard to measure without cooperation of very specialized equipment like proton beams.
- There was a moment in 1990 when an intellectually honest but lazy person could have temporarily concluded it was a mistake or fraud.
- The Bose-Einstein Condensate had yet to be seen in 1989.

Bad Reasons Why Physics Resists LENR

- Wrong Instrumentation for Observation
 - A UCLA Physicist told me: "I don't allow calorimetry in my lab. Too unreliable. Physicists have Instruments!" while pointing to his fancy neutron detector which LENR will never light up.
- Theory Elegance and Theoreticians Dominance
 - String theory is a beautiful, popular, and untestable theory that never falls short of lab funding.
 - See Lee Smolin "*The Trouble with Physics, The Rise of String Theory, The Fall of a Science, and What Comes Next*"



My Instruments Say Cold Fusion is Real!



That's the trouble with instruments. Make sure to update to this month's version of String Theory and try again.

Bad Reasons Why Physics Resists LENR (cont'd)

- Follow the Money
 - Declining science budgets leave zero room for uncertain risk.
 - High energy particle physics is the best endowed field of physical science. A science bureaucrat who puts a \$100m program at risk for \$10m gets fired.
 - ITER gets \$14B promising politicians that it is "The Future of Energy" and providing science with a unique view into the fabric of the universe -- a valuable service but false advertising. To keep that sort of money they may spend 5% on lobbying. Lobbyists, paid on success, aren't always nice to "competitors".
 - Prof: "I can't ethically advise a student to study an area that will not get funded."
- Prestige
 - It was some non-physicists from Utah vs. **CalTech and MIT**.
- The Stigma.
 - Kick the guy who is down. Don't let them eat at the same table. Accuse them of not believing in conservation. Don't review their papers. Don't look at their results.



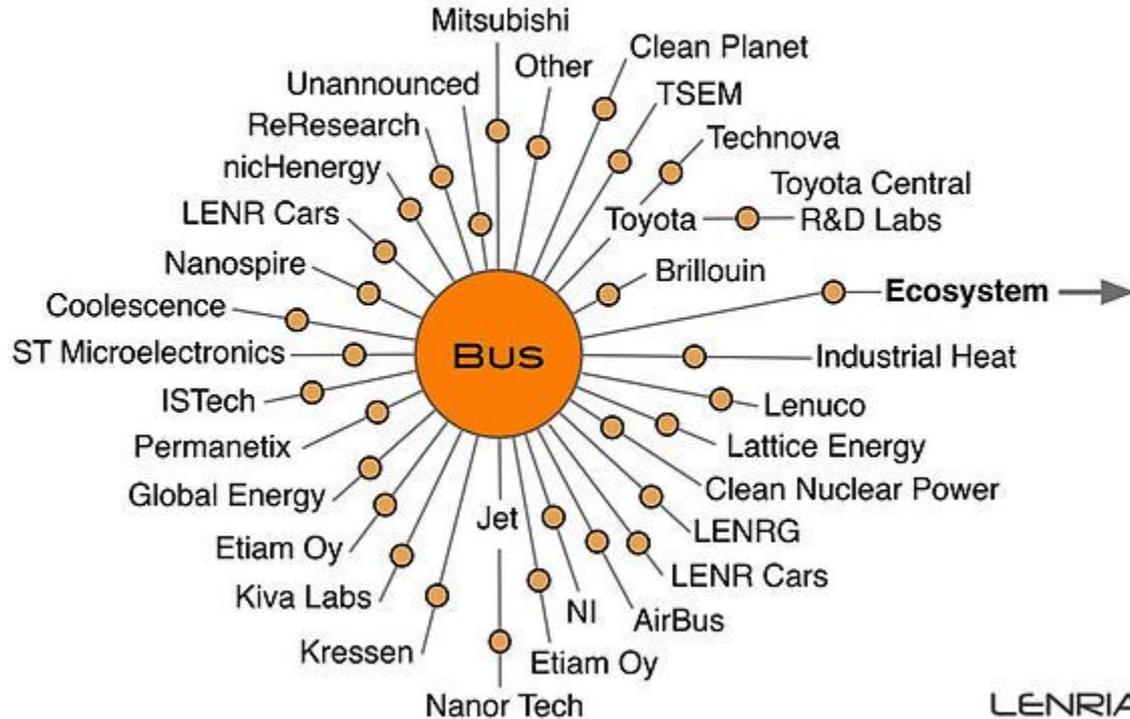
Too Good to be True

- Useful Nuclear power without radiation or waste or proliferation concerns?
 - You may as well argue that Santa Claus exists!
- Nuclear experts have come to terms with the risks vs rewards of nuclear fission energy over the last 60 years. People organize their lives around the question of opening that Pandora's Box.
- People don't expect a free lunch, and are deeply suspicious when one is offered.

Today: Growing Interest, Mostly Private Companies

- The Impossible Rossi
- Increasingly well attended meetings.
 - ICCF19 in Galileo's home town, Padova Italy.
- Increasing government funding abroad.
- Continual support by big companies.
- **LENRIA** The Industrial Association for LENR

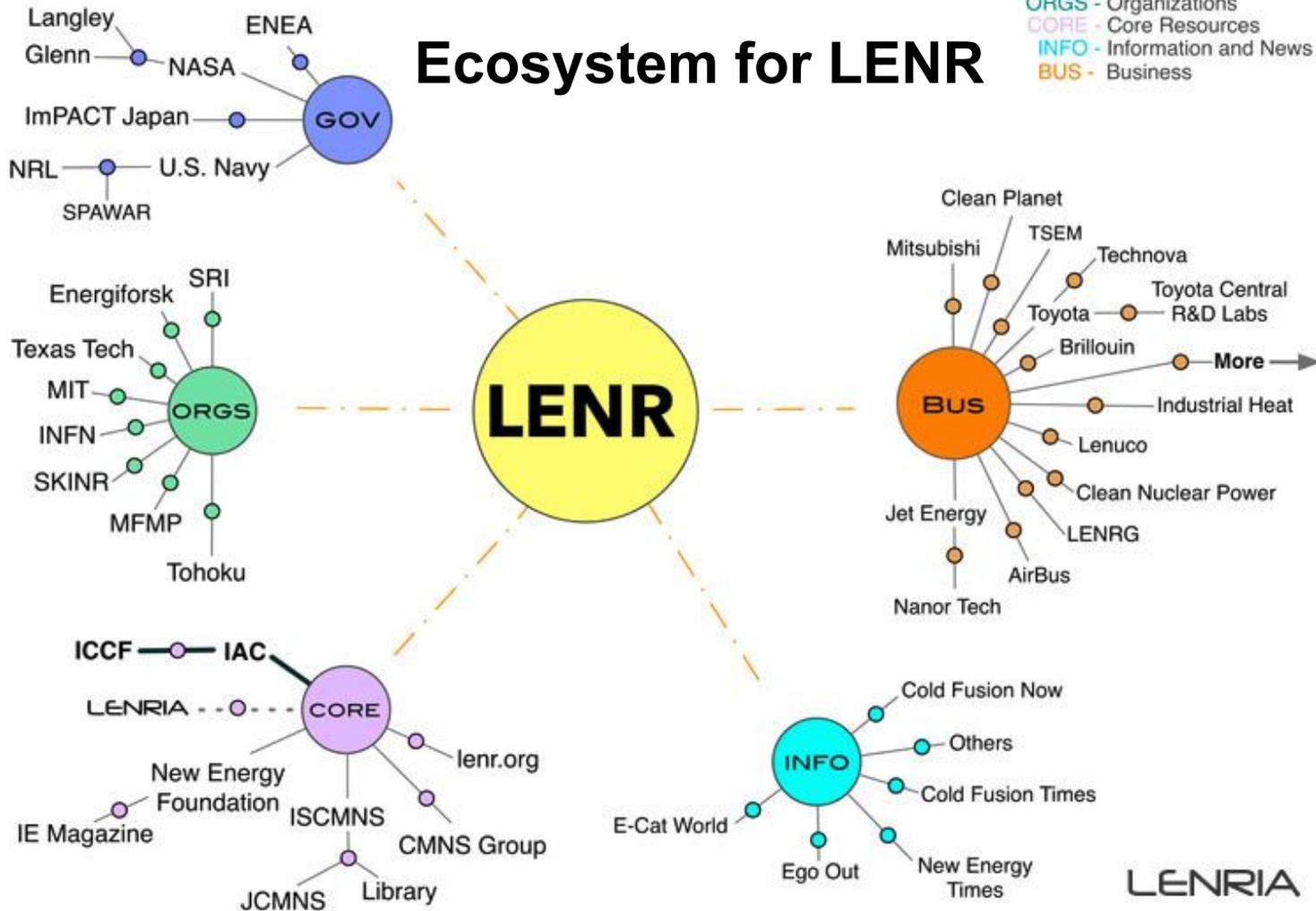
LENR Business Sub-Ecosystem



LENRIA

Ecosystem for LENR

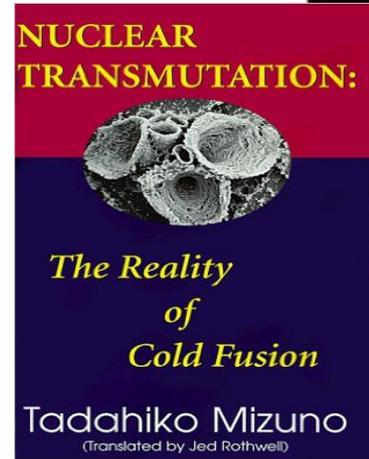
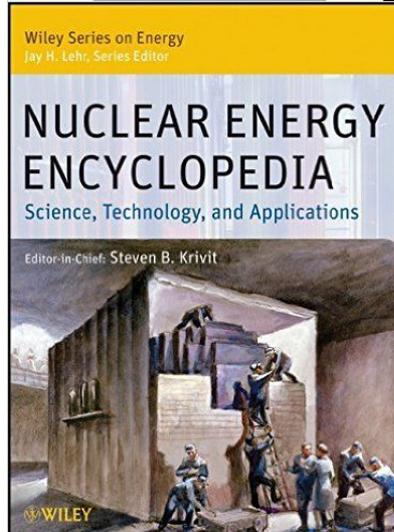
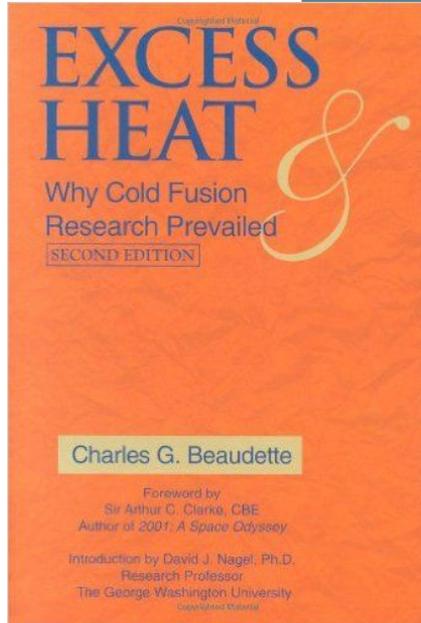
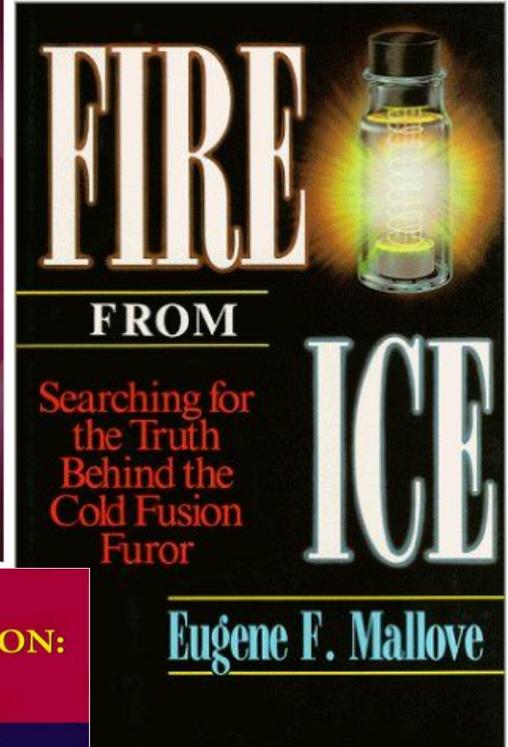
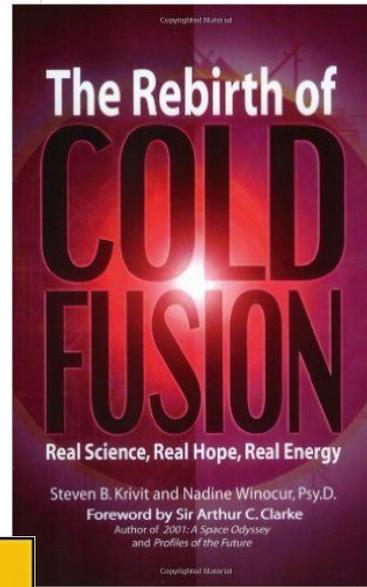
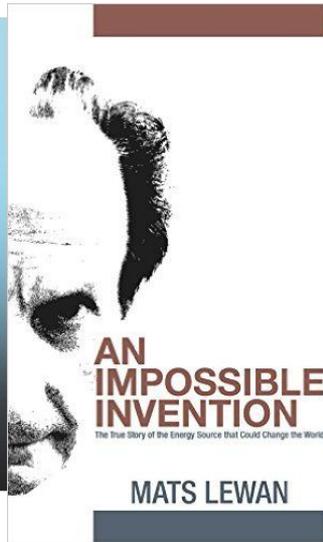
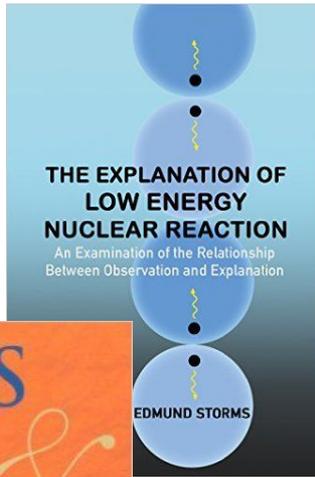
- GOV - Government Labs
- ORGS - Organizations
- CORE - Core Resources
- INFO - Information and News
- BUS - Business



Projections - Outcomes in next 5 years

- Based on my observations of progress in the field, I'm expecting a device for home heating to emerge in 2 years that outperforms a heat pump, economically. I expect rapid growth of the industry because there will be few regulatory hurdles to manufacturing them.
- I'm expecting a device replacing coal in a thermal power plant to be commercialized in 5 years. Deployment will be much faster than natural gas turbines have been because it needs no gas supply.
- I'm expecting a consensus on a full theoretical understanding of LENR to be proven soon after the government funded science institutions spend \$100m wisely (\$0.30 /American). Given the resistance, I can't say when that will be.

Books



For Further Study

<http://anthropoceneinstitute.com/LENR>

<https://www.lenr-forum.com>

<http://lenr-canr.org/>

<http://iccf19.com/>

<http://www.currentscience.ac.in/php/feat.php?feature=Special%20Section:%20Low%20Energy%20Nuclear%20Reactions&featid=10094>

Or basic science I like this old article...

New Scientist : https://drive.google.com/open?id=0B_78LEUIcszoOWNmdDNQV2ImSnc "Reasonable doubt"

SPAWARS : https://drive.google.com/open?id=0B_78LEUIcszoYUhLcW9MZ0tIQ1k

Mitchel Schwartz's site ["Cold Fusion Times"](#) is quite good.

Introduction to Michael McKubre

A native New Zealander, Michael McKubre has become one of the most outspoken – and tenacious – advocate for the orphan science of cold fusion. Despite shunning from the formal science community and poor funding, McKubre remains committed to development of this elusive form of energy simply because he believes in it.

EDUCATION

Michael McKubre actually began his college career at George Washington University. However, he transferred to Victoria University in New Zealand, where he earned his B.Sc., his M. Sc. which he received with honors, and his Ph. D. As he was working on his Ph. D, McKubre taught at Victoria University, covering Electrochemistry, Electronics, and Surface Chemistry. Once he finished his Ph. D., Dr. McKubre was awarded a 2 year Postdoctoral Research Fellowship to Southampton University in England.

At Southampton, McKubre began research and development of flow-through electrochemical reactors, studying, especially, the kinetic processes of electrochemicals. He also supervised graduate and postgraduate students as they conducted experiments in derivative fields.

Introduction to Robert Godes

Founder, President and Chief Technology Officer of Brillouin Energy

After 25 years experience as an innovator in identifying and developing various clean technology products, Robert Godes founded Brillouin Energy. He has closely studied and has a deep understanding of applied science, most engineering disciplines, quantum mechanics, general physics, high energy and condensed matter physics, electronics, control systems, programming, and electrochemistry. Mr. Godes holds a B.Sc. in Electrical Engineering from Ohio Northern University.

Videos

<https://www.youtube.com/watch?v=v9n9ysfop9Q> Anthropocene LENR

Ed Storms' awesome Youtube NPA-19 John Chappel Lecturer 7/27/2012 [here](#)

MIT Cold Fusion [alienScientist](#)