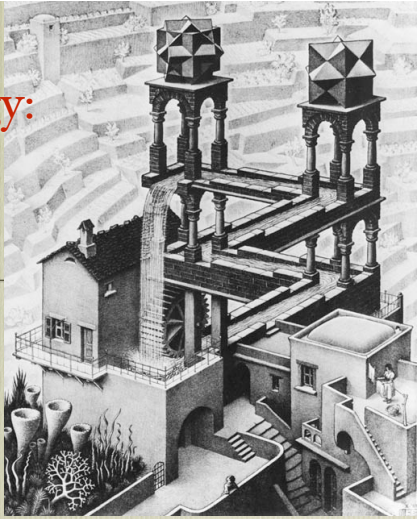


# Cheap Energy: Myth and Reality

There must be Fifty Ways to  
Free your Energy.....



Peter Watson, Dept. of Physics



- Do we teach our students too much good science?

## There's no such thing as a free lunch.....

Milton Freedman, after Robert Heinlein in "The Moon is a Harsh Mistress"

Peter Watson

## BluNext Adapter Plug

No more household power costs ever again



★★★★☆ 10,619 customer's reviews

Order within the next 2 hours and receive it tomorrow, March 29

[Available now - Get yours](#)

- Puts an end all your energy bills - Easy to install .
- Your entire home powered by plugging it in
- Every appliance, electronic, and cooling system works with it

**Have yours now**

## Why is the government trying to suppress obvious sources of energy?

You know I did some research about inventors and scientists whos work in this direction has been supressed or bought out, or who have just been killed.

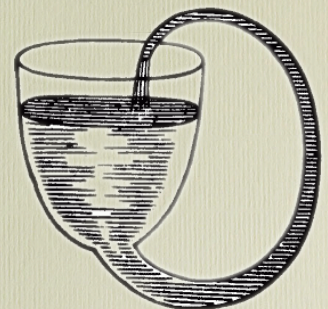
I found that it hasn't been just a 'few' nor a few dozen, not a few hundred, but OVER 1000 inventors have been forcibly shut up, covered up, bullied, threatened, or killed to protect the energy industry.

Peter Watson

A mysterious new energy device has recently hit the market. Experts believe it could kill OPEC, coal and fracking altogether, while creating the world's next trillion dollar industry.  
TopStockAnalysts Digest

## The search for perpetual motion

e.g. capillary action sucks water up a fine tube, can arrange for this to widen out and flow downwards

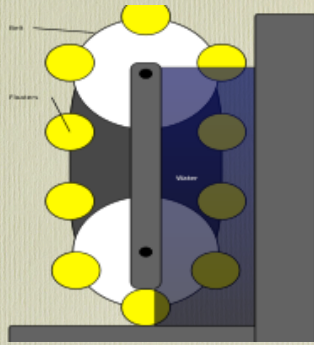


Peter Watson

Peter Watson



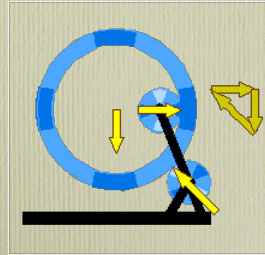
Or using floating blocks



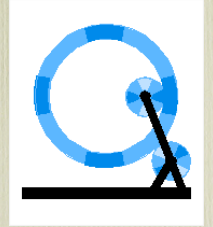
Peter Watson

- But obviously mechanical ones are better, because we can simulate them and prove they work.

- We can arrange for a complicated system of forces on a wheel.

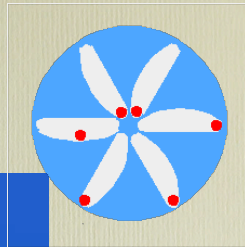
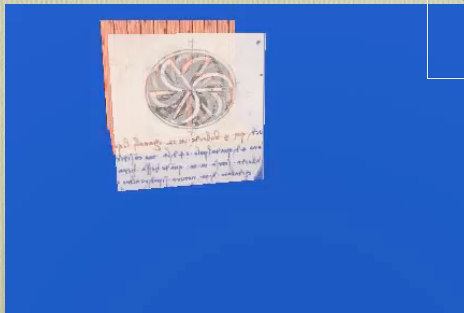


which turns for ever



Peter Watson

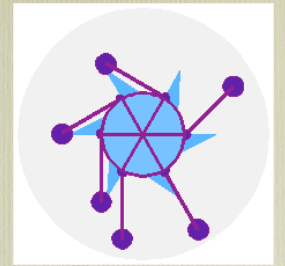
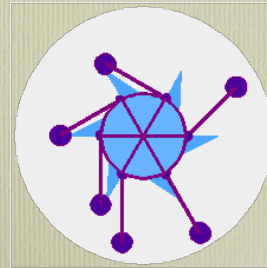
Leonardo da Vinci invented one  
Which also runs for ever



Peter Watson

- Lots of people have thought of the over-balancing wheel

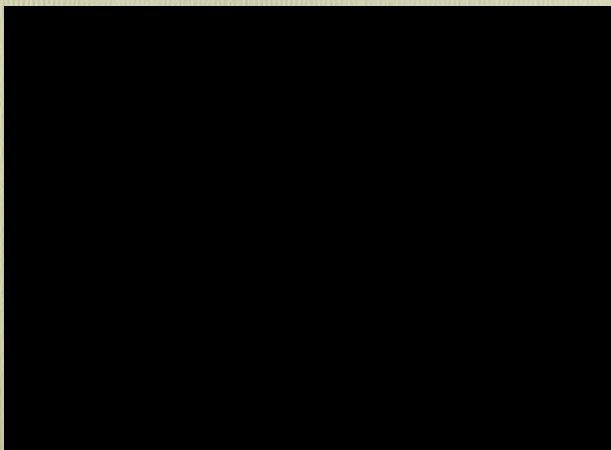
- Here is a modern version



which also turns for ever

Peter Watson

A recent variation



Peter Watson

Or this one

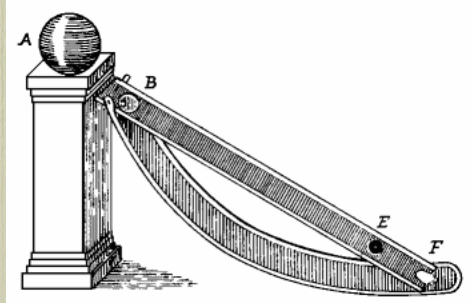


Peter Watson

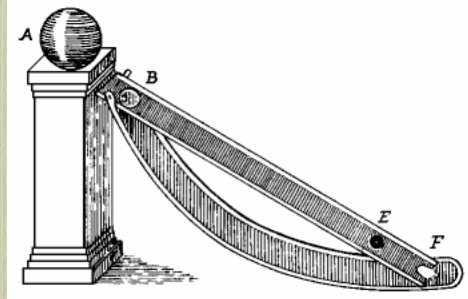


But obviously magnetism will work better

- This is Bishop John Wilkin's machine



Peter Watson



But "the bullet would not fall down through the hole, but ascend to the stone. So that none of all these magnetical experiments which have been as yet discovered, are sufficient for the effecting of a perpetual motion, though these kind of qualities seem most conducive unto it; and perhaps, hereafter, it may be contrived from them."

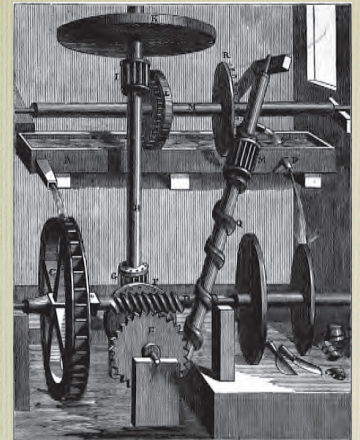
Peter Watson

But fortunately some people have finally got it to work



Peter Watson

But maybe water would work better: this is Robert Fludd's device



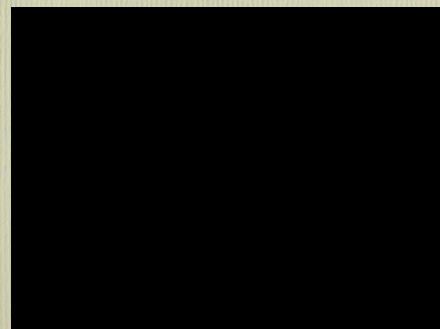
Peter Watson

See, it works



Peter Watson

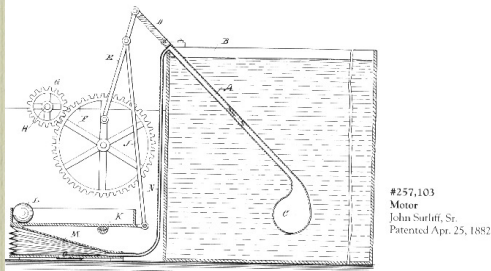
Well, at least this one does



Peter Watson



But actually it will work better if we combine pressure and liquids

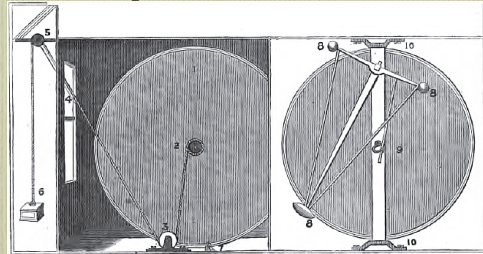


*With the exception of cases involving perpetual motion, a model is not ordinarily required by the Office to demonstrate the operability of a device. If operability of a device is questioned, the applicant must establish it to the satisfaction of the examiner, but he or she may choose his or her own way of so doing.*

USPTO Manual of Patent Examining Practice

Peter Watson

The one that worked:  
Offyreus' wheel: 1712



Rotated at 26 rpm for several months  
Lifted 20 kg  
Smashed by the inventor in a fit of rage

Peter Watson

Perpetual-Motion-Sale

<p><b>HOT DEALS</b></p> <p><b>Academy da Vinci Clock</b></p> <p>Reproduction of a clock based on an</p> <p><b>\$14.70</b> USD</p> <p>amazon.com</p>	<p>Kinetic Orbital Revolving Gadget</p> <p><b>\$9.99</b> \$9.99</p> <p>ebay</p>	<p>Perpetual Motion Casual Shirt, size JR 3</p> <p><b>\$8.00</b> \$8.00</p> <p>swap.com</p>	<p>Perpetual Motion Canvas Print</p> <p><b>\$85.00</b> \$85.00</p> <p>society6</p>
<p>Orion - Electronic Perpetual Motion</p> <p><b>\$7.50</b> USD \$7.50</p> <p>amazon.com</p>	<p>Hot Office Toy Kinetic Orbital Revolving</p> <p><b>\$8.19</b> \$8.19</p> <p>ebay</p>	<p>Bedini Circuit Electric Magnetic Levitation</p> <p><b>\$34.73</b> \$34.73</p> <p>Banggood.com</p>	<p>Euler's Disk</p> <p><b>\$26.99</b> USD</p> <p>amazon.com</p>
			<p>Kinetic Orbital Revolving Gadget</p> <p><b>\$9.49</b> \$9.49</p> <p>ebay</p>

Like this



Peter Watson

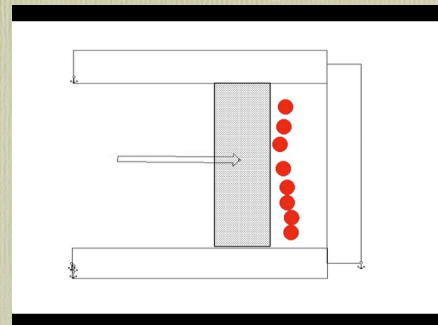
Complicated: filled with Dichloromethane

1. Water evaporates from the felt on the head, lowers temperature
2. Vapour condenses in the head.
3. Pressure drops in the head, liquid is pushed up from the base into head, tipping bird over
4. Bottom end of the neck rises above the surface of the liquid, produces bubble of vapour.
5. Liquid flows back to the bottom bulb, restoring the bird to its vertical position and is heated by air

Note what we have is a (very inefficient) heat engine

Peter Watson

Lots of heat engines: e.g an expanding gas can do work, and the gas cools down (like an auto engine)



hence

**The First Law of Thermodynamics**

We can't build a perpetual motion machine that creates energy

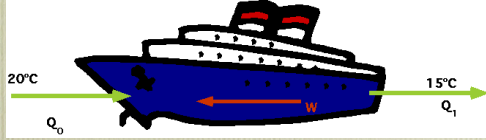
Peter Watson



# The Second Law of Thermodynamics

For example, why can't we have (e.g) a boat that takes in water at 20°C, extracts some heat, turns it into energy and exhausts cold water

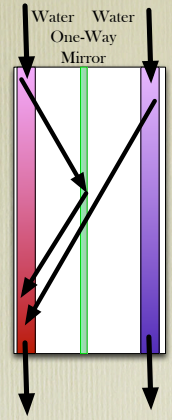
Doesn't violate first law



How could we do it in practice?



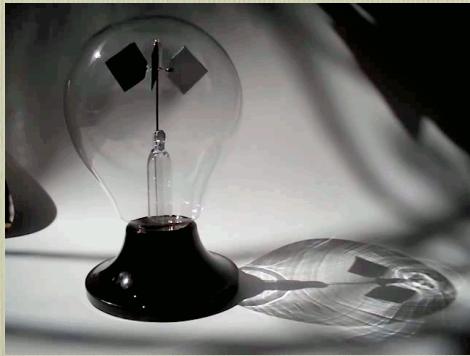
- Two pipes with water flowing with one-way mirror between them
- Radiation from the left pipe will be reflected back and reabsorbed.
- Radiation from the right pipe passes through the one-way mirror to be absorbed by the other pipe.
- Water on left heats up & boils, water on right cools down
- Can run a steam engine



Shares in the company will be available afterwards



But we can use radiation!



- *A good many times I have been present at gatherings of people who .. are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: 'Have you read a work of Shakespeare's?'*

- **C. P. Snow, *The Two Cultures***

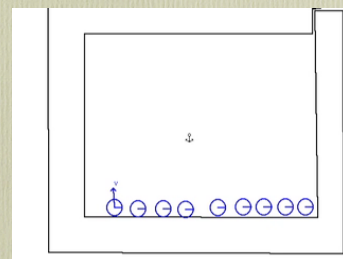


- In order to get work out of a system, one must have a very asymmetrical system
- e.g. High pressure one side of a piston, low pressure the other side. Can this arise by chance?
- e.g. high temp. one side of a piston Can this arise by chance?



# Entropy

- Essentially the relative probability of finding a particular arrangement by chance. If arrangement is improbable, we can always get work out of it.

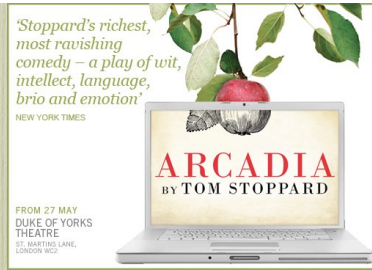




Fortunately some people still have a respect for physics



Peter Watson



Peter Watson

THOMASINA: When you stir your rice pudding, Septimus, the spoonful of jam spreads itself round making red trails like the picture of a meteor in my astronomical atlas. But if you need stir backward, the jam will not come together again. Indeed, the pudding does not notice and continues to turn pink just as before. Do you think this odd?

- THOMASINA: "Well, it is odd. Heat goes to cold. It's a one-way street. Your tea will end up at room temperature. What's happening to everything everywhere. The sun and the stars. It'll take a while but we're all going to end up at room temperature."
- Stoppard, Arcadia

Peter Watson

## Murphy's versions of the laws of thermodynamics

- 1st: You can't win
- 2nd: You can't break even
- 3rd: You can't quit the game

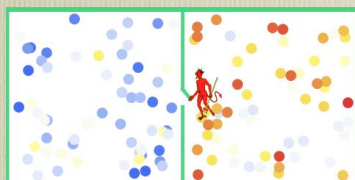
• Can we beat this?

Peter Watson

## Maxwell's Demon

The demon can see atoms, and open a trap-door if they are hot

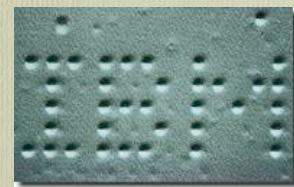
Allows us to separate warm into hot and cold



And hence to defeat the second law !!!!!!!!!!!!!!!

Peter Watson

- Would need to manipulate single atoms
- But we can!
- this is constructed in Xenon atoms by STEM

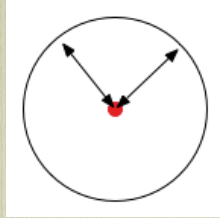


Peter Watson

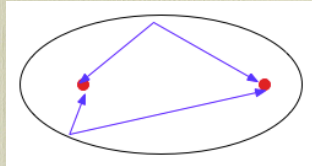


## How about this

- A sphere will reflect radiation to its centre

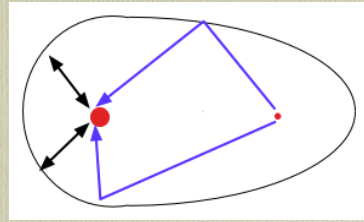


- An ellipse will reflect radiation from one focus to another



Peter Watson

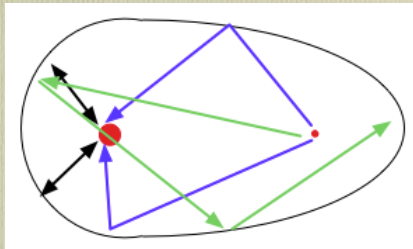
- Suppose we combine the two?



- Heat will flow from one to the other:
- the hot one will get hotter and the cold one colder

Peter Watson

- Unfortunately it only works until the unwanted reflections build up



- and the cavity just fills up with radiation
- so maybe we can get cheap energy

Peter Watson

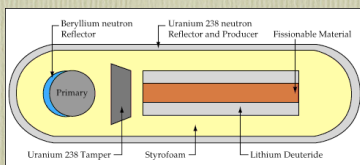
Controlled fusion  
now what that does  
his masterpiece

Macbeth



Peter Watson

- Hydrogen bomb: heat small amount of gas up to  $\sim 10$  billion  $^{\circ}\text{C}$  for a very short time, by imploding layer.



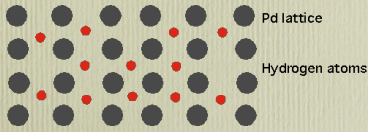
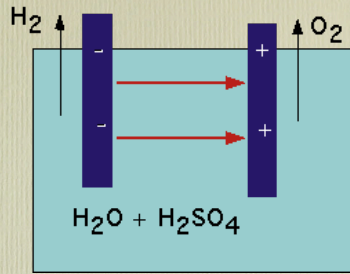
Peter Watson

- SO wouldn't it be nice if we could fuse atoms in an ordinary lab.
- Cold fusion discovered in March 1989 by Stanley Pons and Martin Fleischmann: (university of Utah)
- confirmed by Steve Jones (Brigham Young University) shortly afterwards

Peter Watson



- Two essential tricks:
- Electrolysis separates water into oxygen and hydrogen

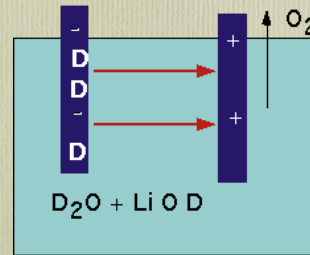


- Palladium absorbs hydrogen



Peter Watson

- So the trick is to electrolyse heavy water with Pd electrodes
- deuterium gets trapped



Peter Watson

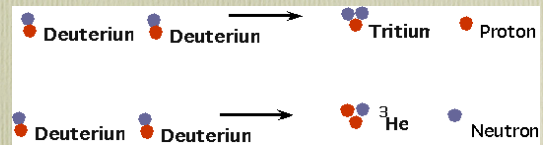
- When electric current is stopped, electrodes continue to release heat: up to 100 W.
- Helium is found in residual gas.
- Only possible interpretation is
- Deuteron + Deuteron → Helium + energy



Peter Watson



- Doesn't occur in stars:
- instead would expect



SO would expect to get lots of neutrons and lots of tritium as well



Peter Watson

## Why does it work?

- deuterium atoms in heavy hydrogen **will** fuse together
- just slowly!
- rate is  $R \sim 10^{-80} \text{ s}^{-1}$
- (meaning that in our galaxy, it's happened once since the Big Bang!)



Peter Watson

## Why does it work?

Lots of reasons:

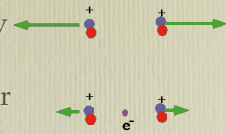
- Obviously what the Pd lattice does is to compress the deuterons together to allow the process to run much faster rate
- $R \sim 10^9 \text{ s}^{-1}$
- Pressure in Pd can be calculated at  $10^{26}$  atmospheres (Centre of sun is  $10^9$  atmos)



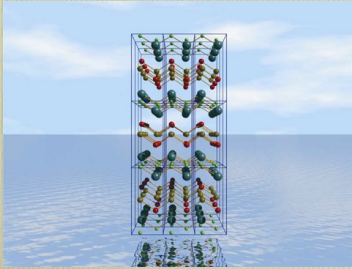
Peter Watson



- Electron screening: forces between nuclei is reduced by intermediate electrons allowing them to come closer together



Many body effects (sometimes a billion electrons do not behave like a billion times one electron: e.g. in superconductors)



Peter Watson

## Why does it work?

Lots of reasons:

- e.g. Electron screening: forces between nuclei is reduced by intermediate electrons allowing them to come closer together

- $R \sim 10^{-40} \text{ s}^{-1}$

Peter Watson

- “It is no longer possible to lightly dismiss the reality of cold fusion” Julian Schwinger (Nobel laureate)
- Why is the scientific establishment suppressing the most exciting scientific discoveries of the 20<sup>th</sup> century?
- Could it be that it is being done by the oil companies?!?!?!?!

Peter Watson

## The sad truth

- Not nearly enough neutrons are seen (if any!)
- Tritium shows up as a contaminant almost everywhere (and the quantities are tiny)
- The energy released (if it is real) is probably just caused by distortion of the lattice of atoms

Peter Watson

## Success or failure of the scientific method?

- A resounding success.
- A very provocative and exciting idea caused hundreds of people (including me!) to drop everything to investigate it.
- The cumulative work showed that there is NO appreciable effect: it probably cost M\$10 to show this.
- If it had been real, we’d be talking T\$10/year!

Peter Watson

## But the cold fusion story is much older than this

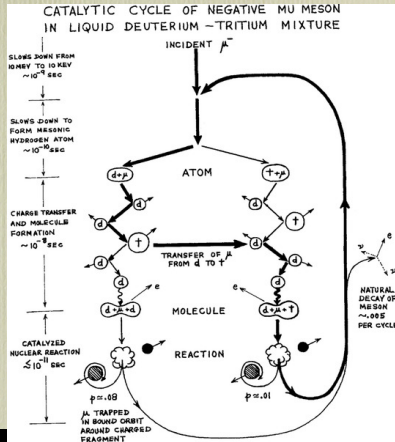
- Muon-catalyzed fusion:
  - muonic hydrogen has  $a_0 \sim a_{\text{Bohr}} m_e/m_\mu$
  - Behaves like (large) neutron
  - $(\mu p) + d \rightarrow t + \mu + 5\text{MeV}$
  - Predicted by Frank, Sakharov, Zeldovich
  - Found by Alvarez

Peter Watson

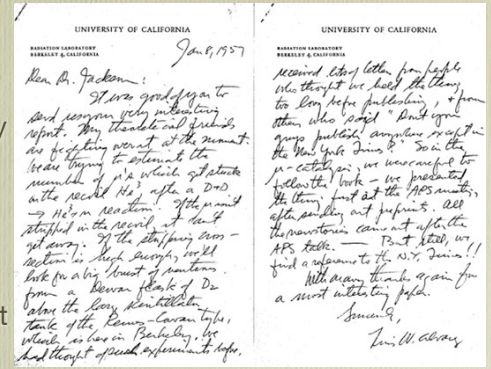


# So just produce $\mu$ 's, dump into t-d mix and ....

- David Jackson studied it in detail
- (from his talk)



- Need ~ 50 fusions for breakeven
- $\mu$  gets retained by t after about 10:
- (Actually, it's much worse than this: producing one  $\mu$  costs about 10 TeV at TRIUMF)



## But the oddest twist ...

- Mario Mariscotti (Prof of physics in Buenos Aires) wanted to know why the physics dept had a cyclotron in the 1950's....

El Secreto Atómico de Huemul (Crónica del origen de la energía atómica en la Argentina), M.A.J. Mariscotti, Ed. Sudamericana-Planeta (Buenos Aires), 1st edition 1984, 2nd edition 1987, 3rd edition 1997, 286 páginas.

- Ronald Richter (Nazi refugee) persuaded Perón to fund construction of controlled fusion plant

- on Huemel Island

- Li-d mixture injected into spark gap...

- fusion occurs, releases heat...

- has to be contained: concrete walls 4m thick



- Estimated cost of M\$10: say 1% of Argentinian GDP (~B\$20 for Canada today...)

- What happened to Richter...?

- Amplified his effect by using loudspeakers close to spark-gap, but they were burned by discharge:

- after Perón's fall he was charged with destruction of Government property

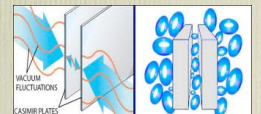
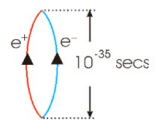
- Jailed and released in general amnesty

## So anywhere else we can go?

- How about the zero-point energy of the vacuum?

- Empty space has some energy due to creation and annihilation of virtual particles

- Casimir effect is observable consequence: attractive force between two plates in vacuum





- So we should be able to remove energy from empty space

## United States Patent Haisch et al.

### QUANTUM VACUUM ENERGY EXTRACTION

(16) Patent No.: US 7,379,286 B2  
(45) Date of Patent: May 27, 2008

Cole, D. C. and Zou, Yi 2003, Quantum Mechanical Ground State of Hydrogen Obtained from Classical Electrodynamics, Physics Letters A, vol. 317, No. 1-2, pp. 14-20 (Oct. 13, 2003), quant-ph/0307154

(Continued)

Primary Examiner—Nikita Wells  
(74) Attorney, Agent, or Firm—Pritzkau Patent Group, LLC

(57) ABSTRACT

A system is disclosed for converting energy from the electromagnetic quantum vacuum available at any point in the universe to usable energy in the form of heat, electricity, mechanical energy or other forms of power. By suppressing electromagnetic quantum vacuum energy at appropriate frequencies a change may be effected in the electron energy levels which will result in the emission or release of energy. Mode suppression of electromagnetic quantum vacuum radiation is known to take place in Casimir cavities. A

Peter Watson

## Unfortunately

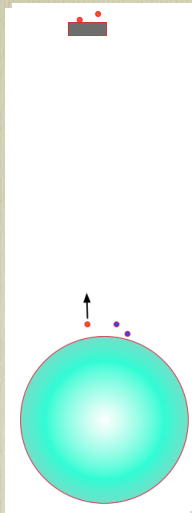


- We can figure out the total dark energy contained in (e.g) this room
- roughly 1 nJ (billionth of a Joule).

Peter Watson

## One more idea

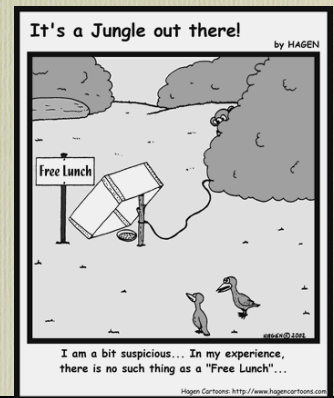
1. Suppose anti-matter has negative mass.
2. Then an anti-proton would fall upwards (!)
3. creating more protons ( $E=mc^2$ )
4. which would fall downwards
5. creating anti-protons ...
6. go to 2.



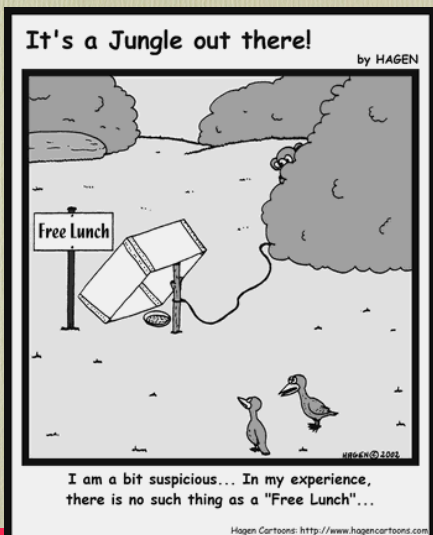
Peter Watson

## Unfortunately

- This just proves antimatter has to fall downwards
- (and it does!)



Peter Watson



Hagen Cartoons: <http://www.hagencartoons.com>

- Two pipes with water flowing with one-way mirror between them

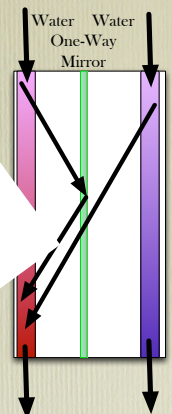
- Radiation from the left pipe reflected back and reabsorbed

- Radiation from the right pipe absorbed by the mirror

- Water in right pipe can be used for power

- Can run a perpetual motion machine

So why doesn't it work?



Shares in the company will be available afterwards

Peter Watson



