

# PSEUDO SCIENCE

WE STARTED OFF BY EXAMINING  
DIFFERENT IDEAS ABOUT HOW SCIENCE  
PROCEEDS

I THINK MOST PEOPLE WOULD AGREE:

SCIENCE IS A SET OF METHODS DESIGNED  
TO DESCRIBE & INTERPRET OBSERVED

AND INFERRED PHENOMENA PAST &

PRESENT — AIMED AT BUILDING A TEST-  
ABLE BODY OF KNOWLEDGE

SO — WHY DO PEOPLE BELIEVE WEIRD THINGS?

— MICHAEL SCHERMER "WHY DO PEOPLE BELIEVE  
WEIRD THINGS" 1997

OBVIOUSLY DEFINITIONS IN THIS AREA  
ARE A BIT ARBITRARY

PSEUDOSCIENCE — CLAIMS PRESENTED SO  
THEY APPEAR TO BE SCIENTIFIC EVEN  
THOUGH THEY LACK SUPPORTING EVIDENCE  
AND PLAUSIBILITY.

THERE SEEMS TO BE SOME SUGGESTION  
OF DISHONESTY HERE — IN MY OPINION  
THAT IS RARELY, IF EVER, TRUE

PSEUDO SCIENCE IS CONTRASTED TO  
PATHOLOGICAL SCIENCE

PATHOLOGICAL SCIENCE :- CASES WHERE  
THERE IS NO DISHONESTY INVOLVED, BUT  
WHERE PEOPLE ARE TRICKED INTO  
FALSE RESULTS BY A LACK OF UNDER-  
STANDING ABOUT HOW HUMANS CAN BE LED  
ASTRAY BY SUBJECTIVE FACTORS, WISHFUL  
THINKING, AND THRESHOLD EFFECTS

-LANGMUIR - PATHOLOGICAL SCIENCE - PHYSICS  
TODAY OCT 1989

IN FACT, MY OPINION IS THAT PSEUDOSCIENCE  
AND PATHOLOGICAL SCIENCE ARE ON A  
CONTINUUM ----- ANYWAY -----

# WHY SHOULD WE CARE ABOUT PSEUDOSCIENCE?

DANGEROUS IF PUBLIC POLICY DECIDED ON BASIS OF PSEUDOSCIENCE (OR WRONG SCIENCE?)

FOR THAT MATTER DANGEROUS IF PERSONAL DECISIONS MADE ON BASIS OF PSEUDOSCIENCE

- HEALTH CARE (VACCINES → AUTISM)
- EXPERT TESTIMONY (HYPNOTISM)
- ENVIRONMENTAL POLICIES (CLIMATE CHANGE)
- SCIENCE EDUCATION (PUPIL "DISCOVERY")
- TRANSPORTATION (HIGH SPEED TRAINS)
- COMMUNICATIONS
- AGRICULTURE (GENETIC ENGINEERING)

PREOCCUPATION OF PUBLIC WITH PSEUDOSCIENCE  
CAN LEAD TO LACK OF CONCERN FOR PROGRESS  
OF GOOD SCIENCE

PREOCCUPATION WITH THE IRRATIONAL

- OCCULT
- PARANORMAL
- HEALTH FADS
- GAMBLING SYSTEMS

⋮

USE OF PSEUDOSCIENTIFIC ARGUMENTS TO  
MARKET

- COMMERCIAL PRODUCTS
- IDEOLOGIES

# LANGMUIR'S 6 SYMPTOMS OF PATHOLOGICAL SCIENCE

- ① MAXIMUM EFFECT THAT IS PRODUCED BY A CAUSATIVE AGENT OF BARELY DETECTABLE INTENSITY. THE MAGNITUDE OF THE EFFECT IS SUBSTANTIALLY INDEPENDENT OF THE INTENSITY OF THE CAUSE.
- ② THE EFFECT IS OF A MAGNITUDE THAT REMAINS CLOSE TO THE LIMIT OF DETECTABILITY — OR, MANY MEASUREMENTS ARE NECESSARY BECAUSE OF THE VERY LOW STATISTICAL SIGNIFICANCE.

- ③ THERE ARE CLAIMS OF GREAT ACCURACY
- ④ BASED ON FANTASTIC THEORIES CONTRARY TO EXPERIENCE.
- ⑤ CRITICISMS ARE MET BY AD HOC EXCUSES THOUGHT UP ON THE SPUR OF THE MOMENT.
- ⑥ THE RATIO OF SUPPORTERS TO CRITICS RISES RAPIDLY, AND THEN DECLINES AS THE IDEA SINKS INTO OBLIVION.

IT'S NOT OBVIOUS THAT THESE CRITERIA ACTUALLY DO WINNOW OUT "GOOD SCIENCE"

# COMMENTS ON LANGMUIR CRITERIA

- ① SOME AREAS OF SCIENCE DO WORK WITH
- ② DATA AT THE LIMIT OF DETECT ABILITY AND REQUIRE REPEATED MEASUREMENTS TO IMPROVE SIGNAL-TO-NOISE RATIO

THIS IS QUITE AN ACCURATE DESCRIPTION OF MY OWN FIELD OF EXPERIMENTAL PARTICLE PHYSICS

→ I THINK HE HAD IN MIND SOMETHING LIKE POLYWATER → SEE LATER



③ SOME FIELDS DO CLAIM VERY HIGH ACCURACY

— ATOMIC FREQUENCIES AS STANDARDS OF TIME

— AGAIN HIGH ENERGY PARTICLE PHYSICS

— COMPARISON OF THEORY & EXPERIMENT IN QUANTUM ELECTRODYNAMIC

—  $\mu$  MAGNETIC MOMENT

— STANDARD MODEL COUPLINGS

LANGMUIR OBVIOUSLY MEANS

"UNJUSTIFIED" CLAIMS OF ACCURACY

④ HOW ON EARTH DO YOU DEFINE "FANTASTIC THEORIES CONTRARY TO EXPERIENCE" ?

— BIG BANG ?

— 11 DIMENSIONAL SPACE-TIME

— MANY WORLDS QUANTUM MECHANICS

⑤ SOMETIMES (ALWAYS?) PARTS OF A THEORY CAN BE MODIFIED TO PRESERVE CORE IDEAS — FALSIFIABILITY

↳ THESE CAN CERTAINLY BE "THOUGHT UP" IN AN APPARENTLY AD HOC FASHION.

⑥ FOR HOT AREAS OF SCIENCE THERE IS OFTEN AN INITIAL BURST OF ENTHUSIASM FOLLOWED BY A DECLINE IN INTEREST AS PROGRESS BECOMES MORE DIFFICULT.  
↳ HIGH  $T_c$  SUPERCONDUCTIVITY

WHAT IS MORE ODD IS THAT FOR THE MOST PATHOLOGICAL SCIENCE → PSEUDOSCIENCE THERE IS NO DIMINUATION OF SUPPORT WITH TIME

→ HOMEOPATHY

→ SCIENTOLOGY

→ CHIROPRACTICE

----- ∞

# WHAT DO OUR PHILOSOPHICAL FRIENDS SAY?

POPPER — FALSIFIABILITY MAKES THE  
DISTINCTION → WITH THE USUAL  
CAVEATS, I BUY THAT

KUHN — I AM NOT SURE. THE "PARADIGM"  
IDEA SEEMS TO HAVE TROUBLE  
IF THE REIGNING PARADIGM  
HAPPENS TO BE IRRATIONAL

FEYERABEND — THERE IS NO DISTINCTION  
BETWEEN PSEUDOSCIENCE  
AND "SCIENCE"

LAKATOS - PSEUDOSCIENCE FAILS TO MAKE  
NOVEL PREDICTIONS OF PREVIOUSLY  
UNKNOWN PHENOMENA.

SCIENCE MAKES PREDICTIONS OF NOVEL  
PHENOMENA — EVEN IF THESE ARE NOT  
OBSERVED

THE LAST POINT IS INTERESTING.

WHAT IS THE DIFFERENCE BETWEEN NOT  
PREDICTING NEW PHENOMENA AND  
PREDICTING ONES WHICH ARE  
NEVER OBSERVED ?

# WIKIPEDIA ON PSEUDO SCIENCE

① USE OF VAGUE, EXAGGERATED, UNTENABLE, EXTRAORDINARY OR UNTESTABLE THEORIES THAT CONTRADICT WHAT IS ALREADY KNOWN ABOUT NATURE.

② USE OF ALLEGED EXCEPTIONS, ERRORS, ANOMALIES, STRANGE EVENTS, AND SUSPECT CLAIMS — RATHER THAN WELL-ESTABLISHED REGULARITIES OF NATURE

③ INDIFFERENCE TO FACTS

↳ THAT ONE, I AGREE WITH.

## ④ OVERRELIANCE ON CONFIRMATION RATHER THAN REFUTATION

— BEGIN WITH A HYPOTHESIS, OFTEN EMOTIONALLY APPEALING — BUT IMPLAUSIBLE

— ONLY LOOK FOR EVIDENCE WHICH CONFIRMS THE HYPOTHESIS.

## ⑤ LACK OF OPENNESS TO TESTING BY INDEPENDENT EXPERTS

## ⑥ PERSUASION BY PROPAGANDA AND MIS-REPRESENTATION, RATHER THAN BY VALID EVIDENCE.

⑦ PERSONALIZATION OF ISSUES

⑧ MISLEADING USE OF LANGUAGE

— INVENTED VOCABULARY, IN WHICH  
TERMS LACK PRECISE UNAMBIGUOUS  
DEFINITIONS — OR NONE AT ALL

⑨ DELIBERATE CREATION OF MYSTERY BY  
OMITTING CRUCIAL INFORMATION

⑩ APPEAL TO FALSE AUTHORITY, EMOTIONS

⑪ ABSENCE OF PROGRESS OVER TIME

↳ VERY IMPORTANT.



# SIGNS OF BOGUS SCIENCE

R.L. PARK  
DUACKWATCH.COM

- ① DISCOVERER PITCHES CLAIMS DIRECT TO MEDIA RATHER THAN SCIENTIFIC LITERATURE
- ② DISCOVERER CLAIMS POWERFUL ESTABLISHMENT IS TRYING TO SUPPRESS THE WORK
- ③ SCIENTIFIC EFFECT IS ALWAYS AT THE LIMIT OF DETECTION.
- ④ EVIDENCE FOR DISCOVERY IS ANECDOTAL
- ⑤ DISCOVERER SAYS BELIEF IS CREDIBLE BECAUSE IT HAS ENDURED FOR CENTURIES.

⑥ DISCOVERER WORKED IN ISOLATION

⑦ DISCOVERER MUST PROPOSE NEW  
LAWS OF NATURE

# SOME EXAMPLES (WHICH OCCUR TO ME)

OF COURSE SOME ARE MORE OBVIOUS  
THAN OTHERS.

ALIENS & UFOS

ASTROLOGY

CRYPTO ZOOLOGY (YETI, LOCH NESS MONSTER)

CRYSTAL HEALING

DIANETICS

HOMEOPATHY

MAGNET THERAPY

PARANORMAL — PARAPSYCHOLOGY.

# HOW TO DISTINGUISH PROTOSCIENCE ↔ PSEUDOSCIENCE

(SOME REPETITION)

(RATIONAL ENQUIRER)

- HAS SUBJECT SHOWN PROGRESS?
- DOES DISCIPLINE USE TECHNICAL WORDS LIKE "VIBRATION", "ENERGY" WITHOUT DEFINITION?
- WOULD ACCEPTING THESE IDEAS REQUIRE ABANDONMENT OF WELL ESTABLISHED PHYSICAL LAWS?
- DO ARTICLES LACK REFERENCES?

— ANECDOTAL EVIDENCE

— CAN RESULTS BE REPEATED BY OTHER RESEARCHERS?

— DOES PROPONENT CLAIM AIRTIGHT EXPERIMENTS WHERE CHEATING IS IMPOSSIBLE?

— DOES PROPONENT CLAIM SUBJECT IS UNFAIRLY CRITICIZED?

— IS SUBJECT ONLY TAUGHT AT NON-CREDIT INSTITUTIONS?

- ARE TEXTS ON THE SUBJECT DECADES OLD → NO PROGRESS.
- RESPONDS BY ATTACKING CRITIC NOT THE CRITICISM.
- APPEALS TO HISTORY, AUTHORITY
- SHYNESS EFFECT — PRESENCE OF CRITICS OR SKEPTICS STOPS EFFECT FROM HAPPENING.



| science   | pseudoscience  | comment  |
|---|--|--|
| The primary goal of science is to achieve a more complete and more unified understanding of the physical world.   | Pseudosciences are more likely to be driven by ideological, cultural, or commercial goals.   | Some examples: <a href="#">astrology</a> (from ancient Babylonian culture,) <a href="#">UFO-ology</a> (popular culture and mistrust of government), <a href="#">Creation Science</a> (attempt to justify a literal interpretation of the Bible), " <a href="#">structure-altered waters</a> " (commercial quackery.) |
| Most scientific fields are the subjects of intense research which result in the continual expansion of knowledge in the discipline.   | The field has evolved very little since it was first established. The small amount of research and experimentation that is carried out is generally done more to justify the belief than to extend it.                               | The search for new knowledge is the driving force behind the evolution of any scientific field. Nearly every new finding raises new questions that beg exploration. There is little evidence of this in the pseudosciences.  |
| Workers in the field commonly seek out counterexamples or findings that appear to be inconsistent with accepted theories.   | In the pseudosciences, a challenge to accepted dogma is often considered a hostile act if not heresy, and leads to bitter disputes or even schisms.  | Sciences advance by accommodating themselves to change as new information is obtained.<br><br>In science, the person who shows that a generally accepted belief is wrong or incomplete is more likely to be considered a hero than a heretic.  |
| Observations or data that are not consistent with current scientific understanding, once shown to be credible, generate intense interest among scientists and stimulate additional studies. | Observations or data that are not consistent with established beliefs tend to be ignored or actively suppressed.   | Have you noticed how self-styled psychics always seem eager to announce their predictions for the new year, but never like to talk about how many of last years' predictions were correct?   |
| Science is a process in which each principle must be tested in the crucible of experience and remains subject to being questioned or rejected at any time.                                  | The major tenets and principles of the field are often not falsifiable, and are unlikely ever to be altered or shown to be wrong.  | Enthusiasts incorrectly take the logical impossibility of disproving a pseudoscientific principle as evidence of its validity.   |
| Scientific ideas and concepts must stand or fall on their own merits, based on existing knowledge and on evidence.  | Pseudoscientific concepts tend to be shaped by individual egos and personalities, almost always by individuals who are not in contact with mainstream science. They often invoke authority (a famous name, for example) for support. | Have you ever noticed how proponents of pseudoscientific ideas are more likely to list all of the degrees they have?   |
| Scientific explanations must be stated in clear, unambiguous terms.   | Pseudoscientific explanations tend to be vague and ambiguous, often invoking scientific terms in dubious contexts.   | Phrases such as "energy vibrations" or "subtle energy fields" may sound impressive, but they are essentially meaningless.  |

# WHAT IS PSEUDOSCIENCE?

SCIENTIFIC AMERICAN

M. SCHERMER AUG 2011

- NOT SO SIMPLE - BOUNDARY BETWEEN SCIENCE & PSEUDOSCIENCE FRAUGHT WITH DEFINITIONAL DISAGREEMENT
  - OFTEN JUST USED AS A WAY OF INSULTING PEOPLE ONE DISAGREES WITH
  - POPPER CALLED THIS THE DEMARKATION PROBLEM
- "NONSENSE ON STILTS"  
MASSIMO PIGLIUCCI } THE BOUNDARIES SEPARATING SCIENCE AND PSEUDOSCIENCE ARE MUCH FUZZIER THAN POPPER, AND MOST SCIENTISTS THINK



CLASSICAL EXAMPLE MOST SCIENTIST USE

EINSTEIN ↔ FREUD.

AS WE HAVE SEEN, THE PROBLEM IS  
THAT MANY AREAS WHICH LOOK & SMELL  
LIKE SCIENCE, CAN'T BE FALSIFIED (YET?)

— STRING THEORY

— NEUROSCIENCE AS A BASIS FOR  
UNDERSTANDING HUMAN CONSCIOUSNESS

— MACRO ECONOMIC MODELS

— EXTRA TERRESTRIAL LIFE.

NEED SOME KIND OF "FUZZY LOGIC"

→ JUDGEMENT.

"THE PSEUDOSCIENCE WARS" M. D. GORDIN 2012

NO ONE IN HISTORY EVER SELF-IDENTIFIED  
AS A PSEUDO SCIENTIST.

"I'LL JUST HEAD INTO MY PSEUDOLAB, AND  
DO SOME PSEUDOEXPERIMENTS"

INDIVIDUAL SCIENTISTS (AS OPPOSED TO THE  
SCIENTIFIC COMMUNITY) ONLY DENIGRATE A  
DOCTRINE AS PSEUDOSCIENCE WHEN THEY  
FEEL THREATEND

NOT NECESSARILY BY THE CONTENT OF  
IDEAS, BUT BY THEIR IMPACT ON THE  
AUTHORITY OF SCIENCE.

IF ONE IS NOT THREATENED, THERE IS NO  
NEED TO WASH OUT AT PSEUDOSCIENCE

GET ON WITH YOUR WORK & IGNORE THE CRANKS

"WHO CARES WHAT STUPID PEOPLE THINK"

↳ LOOK BACK AT WHY WE SHOULD TAKE  
PSEUDOSCIENCE SERIOUSLY

FOR EXAMPLE - CREATION SCIENCE IS TARRIED  
AS PSEUDOSCIENCE BECAUSE IT THREATENS  
SCIENCE EDUCATION. IT BREACHES THE WALL  
BETWEEN CHURCH & STATE - CONFUSES PEOPLE  
ABOUT HOW SCIENCE IS CONDUCTED  
BUT IN ESSENCE IT SHOULDN'T MATTER  
WHAT PEOPLE THINK.

SO, HERE ARE M. D. GORDIN'S CRITERIA

DOES A NEW IDEA

- GENERATE ANY INTEREST IN SCIENTISTS ADOPTING IT FOR THEIR WORK?
- DOES IT PRODUCE NEW LINES OF RESEARCH?
- DOES IT LEAD TO NEW DISCOVERIES?
- DOES IT INFLUENCE EXISTING THEORIES MODELS, OR HYPOTHESES?

IF NOT → IT IS MOST PROBABLY  
PSEUDOSCIENCE

THE DEMARCAION IS LESS ABOUT WHAT  
SCIENCE IS, MORE ABOUT WHAT SCIENTISTS DO.

IF A COMMUNITY OF SCIENTISTS ADOPTS A  
NEW IDEA AND IT SPREADS THROUGH THE FIELD  
AND IS INCORPORATED IN RESEARCH WHICH  
PRODUCES USEFUL/INTERESTING RESULTS

→ THEN IT IS MOST PROBABLY

GOOD SCIENCE

THIS SOUNDS A BIT LIKE LATAKOS?

THIS DEMARICATION OF USEFULNESS HAS

THE ADVANTAGES OF BEING

BOTTOM-UP NOT TOP-DOWN

EGALITARIAN NOT ELITIST

NON DISCRIMINATORY NOT PREJUDICIAL

SCIENCE CONSUMERS IN THE MARKET PLACE

OF IDEAS DETERMINE WHAT IS

GOOD SCIENCE

# SOME EXAMPLES OF PATHOLOGICAL SCIENCE

N-RAYS

COULD HAVE BEEN AVERTED IF RESEARCHERS

POLY WATER

WERE NOT SO ENTHUSED WITH THEIR RESULTS

WATER MEMORY

THAT THEY PUBLISHED THEM BEFORE

COLD-FUSION

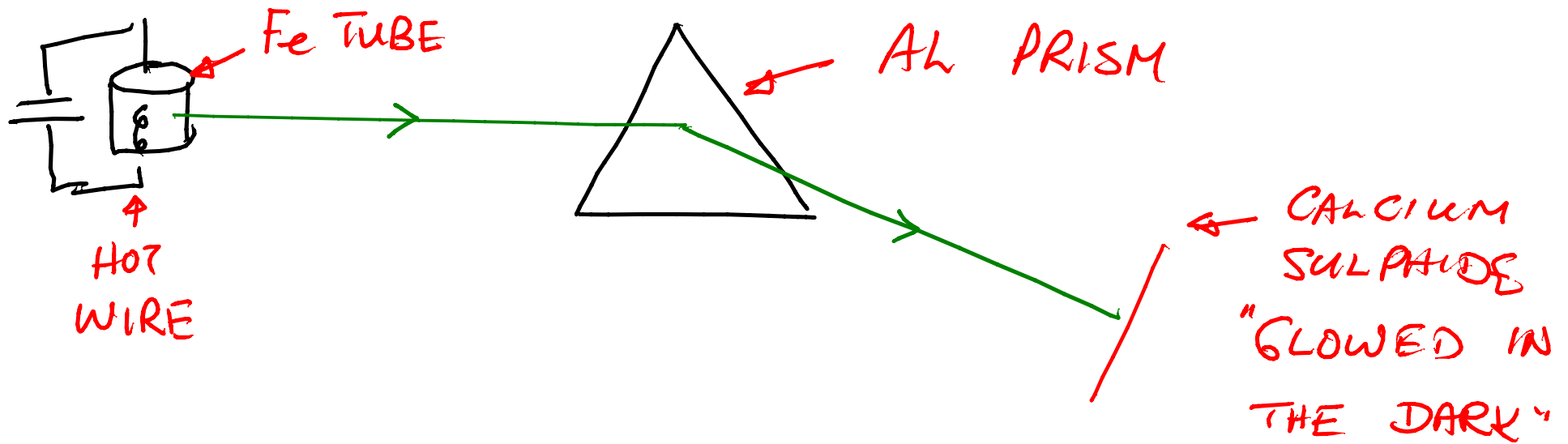
THEY HAD RECEIVED A PROPER

INDEPENDENT REVIEW

HUMAN NATURE MEANS THAT THERE IS ALWAYS SOME DANGER OF THIS HAPPENING

MOST PRESTIGIOUS JOURNALS DECLINE TO PUBLISH WORK THAT HAS BEEN MADE PUBLIC ELSEWHERE.

# N-RAYS RENE PROSPER BLONDLOT 1849-1930



"DISCOVERED" NEW RADIATION SHORTLY AFTER

RÖNTGEN DISCOVERED X-RAYS

MANY OTHER SCIENTISTS CONFIRMED.

DECEIVED THEMSELVES BY SEEING IN THEIR

INSTRUMENTS WHAT THEY WANTED TO SEE

N-RAYS HAD IMPOSSIBLE PROPERTIES

eg. EMITTED BY ALL MATERIALS EXCEPT  
GREEN WOOD.



THE JOURNAL NATURE SENT ROBERT W. WOOD OF JOHN'S HOPKINS TO INVESTIGATE.

N-RAYS WERE OBSERVED IN DARK BY MAKING A STRIP OF CALCIUM SULPHIDE GLOW FAINTLY

IN THE DARK WOOD QUIETLY REMOVED PRISM  
→ ASSISTANT STILL "SAW" N-RAYS

ASSISTANT MISTOOK WOOD REPLACING PRISM FOR HIM REMOVING IT AND CLAIMED N-RAYS HAD VANISHED

WAS BLONDLOT STUPID, INCOMPETENT?

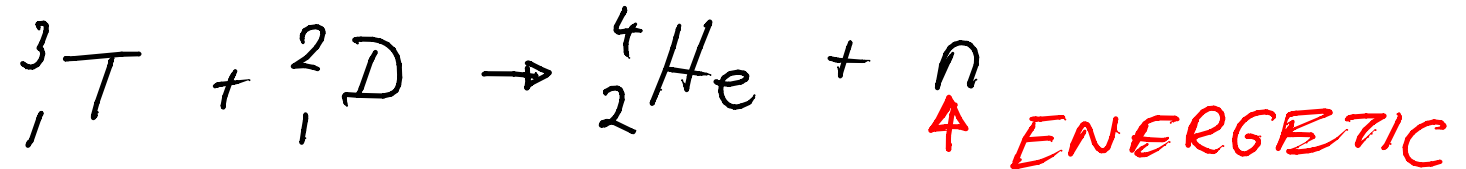
NO - HE WROTE WELL REGARDED TEXT BOOKS ON ELECTRICITY & THERMODYNAMICS

- PSYCHOLOGY OF PERCEPTION } MARTIN GARDNER

# COLD FUSION

PONS & FLEISCHMANN 1989

FOR NUCLEI TO FUSE, THEY HAVE TO  
OVERCOME COULOMB REPULSIONS



IT REQUIRES HIGH TEMPERATURE AND  
PRESSURE

→ A STAR

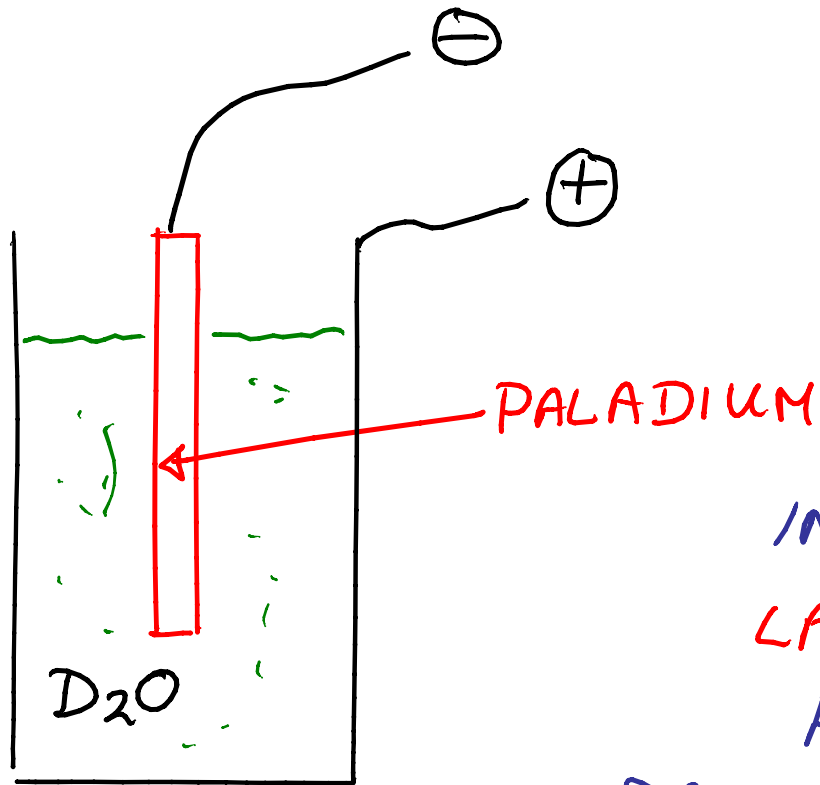
→ ITER → \$20 BILLION

→ NIF → \$10 BILLION

THE LATTER TWO DO NOT WORK (YET?)

IF ONLY THERE WAS A SIMPLER WAY TO

DO IT → CLEAN ENERGY FOR FREE  
FOR EVER



IDEA WAS THAT  
DEUTERIUM WOULD  
BE INCORPORATED

IN PALADIUM CRYSTAL  
LATTICE

FORCED INTO CLOSE  
PROXIMITY BY INTENSE  
ELECTRIC FIELDS IN CRYSTAL

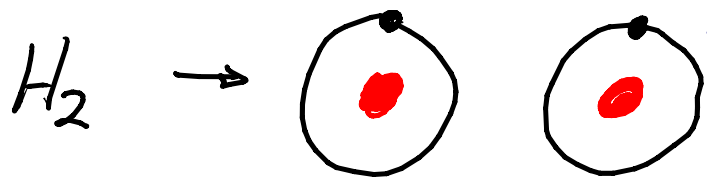
MOST OF THE TIME POWER OUT = POWER IN  $30^{\circ}\text{C}$

BUT SOME TIMES TEMPERATURE ROSE TO  
 $50^{\circ}\text{C}$  FOR DAYS AT A TIME

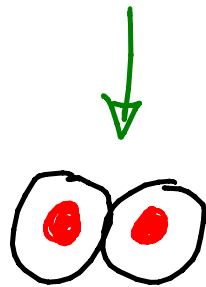
PONS & FLEISCHMANN APPLIED TO U.S. DEPT.  
OF ENERGY FOR \$\$

REVIEWED BY STEVEN JONES AN EXPERT  
ON MUON CATALYZED FUSION

→ REAL EFFECT IN LIQUID HYDROGEN



← REPLACE ELECTRON  
WITH MUON  $\frac{m_\mu}{m_e} \sim 200$



→  $\mu$  GOES INTO ORBIT  
OF SMALLER RADIUS

→ PULLS PROTONS  
TOGETHER

→ FUSION

ALL THREE PEOPLE AGREED TO SUBMIT  
A PAPER TO JOURNAL OF ELECTROCHEMICAL  
RESEARCH MARCH 1989

- UNDER PRESSURE FROM UNIVERSITY OF UTAH
- P & F RELEASED RESULTS AT PRESS CONFERENCE
- UNIVERSITY OF UTAH WANTED PATENT
- JONES UPSET → SENT HIS OWN PAPER TO NATURE & HAD HIS OWN PRESS CONFERENCE

- THIS ANNOUNCEMENT CAUSED A SENSATION
- MANY ATTEMPTS TO REPRODUCE. SOME REPORTED EXCESS HEAT SOME DID NOT
- FIRST CONFIRMING PAPER SUBMITTED TO NATURE PASSED PEER REVIEW BUT WAS REJECTED SINCE EDITORS KNEW OF OTHER NEGATIVE RESULTS
- MANY CONFERENCE REPORTS ON MANY EXPERIMENTS — INCONCLUSIVE
- BUT FUSION SHOULD PRODUCE NEUTRONS
- PEOPLE STARTED LOOKING FOR NEUTRONS

- NEUTRON DETECTION DIFFICULT
- MANY BACK GROUND RADIOACTIVE DECAYS  
(IN CONCRETE -----) PRODUCE NEUTRONS
- CALTECH, CERN ----- SAW NO NEUTRONS
- GEORGIA TECH CLAIMED NEUTRONS  
THEN WITHDREW
- AFTER SOME CONFUSION, CONSENSUS WAS  
THAT IT WAS A SPURIOUS EFFECT

NONE THE LESS IN APRIL 1989 P&F PUBLISHED  
A PAPER WHICH PURPORTED TO SHOW A  
GAMMA RAY PEAK FROM FUSION  
BUT THIS JUST LOOKED LIKE BACKGROUND

- IN JULY - NOVEMBER NATURE PUBLISHED  
PAPERS CRITICAL OF COLD FUSION

- ALSO PHYS REV LETTERS, SCIENCE, PHYS. REV

IN SPITE OF ALL THIS, IN AUGUST 1989

UNIVERSITY OF UTAH ENDOWED AN

INSTITUTE OF COLD FUSION RESEARCH

FOR \$4.5 MILLION



IN NOVEMBER 1989 A US DEPARTMENT OF ENERGY PANEL REPORTED THAT

"THERE IS NO EVIDENCE FOR COLD FUSION"

IS IT REALLY DEAD?

-2012 UNIVERSITY OF MISSOURI USED \$6 MILLION TO SET UP COLD FUSION LAB

- RESEARCH STILL GOES ON ITALY  
US NAVY  
JAPAN

PONS & FLEISCHMANN HAVE NEVER

ACCEPTED THAT THEIR RESULTS ARE WRONG.

# POLY WATER

NIKOLAI FEDYAKIN 1960  
KOSTROMA USSR

- FEDYAKIN WORKED ON WATER CONDENSED THROUGH FINE CAPILLARIES MADE OF QUARK
- SEEMED TO RESULT IN WATER WITH ODD PROPERTIES HIGH VISCOSITY, STRANGE FREEZING & BOILING POINTS
- WORK REPEATED BY DERJAGUIN AT INSTITUTE FOR PHYSICAL CHEMISTRY - MOSCOW

FREEZING POINT  $-40^{\circ}\text{C}$

BOILING POINT  $+150^{\circ}\text{C}$

DENSITY  $1.2 \text{ gm/cm}^3$

- WESTERN SCIENCE TOOK UP RESEARCH
- WIDELY DISCUSSED IN 1970s
- ROUSSEAU & PORTO BELL LABS  
INFRARED SPECTROSCOPY
  - POLY WATER MAINLY SODIUM  
AND CHLORINE
  - MICROSCOPY SHOWED SILICA + PHOSPHOLID  
PARTICLES

SPECIALLY CLEANED GLASS WARE → <sup>NO</sup> POLYWATER

BY 1973 EVERYONE ACCEPTED THAT  
THEY HAD BEEN MEASURING PROPERTIES  
OF CONTAMINATED WATER.

ICE NINE IN "CAT'S CRADLE"

KURT  
VONNEGUT

FEYMAN HAD LAST WORD (AS USUAL)

- IF POLY WATER HAS A HIGHER BOILING POINT THAN WATER
- IT IS MORE STABLE
- A WHOLE COLUMN OF WATER SEEDED BY POLY WATER SHOULD CHANGE INTO POLY WATER
- EVOLUTION SHOULD HAVE PRODUCED AN ANIMAL WHICH DOES NOT NEED FOOD
- IT INGESTS WATER, EXCRETES POLY WATER AND LIVES ON THE ENERGY RELEASED.







