Construction of Inexpensive and Controlled Clean Desktop Nuclear Power Sources

Clean Nuclear Power Sources

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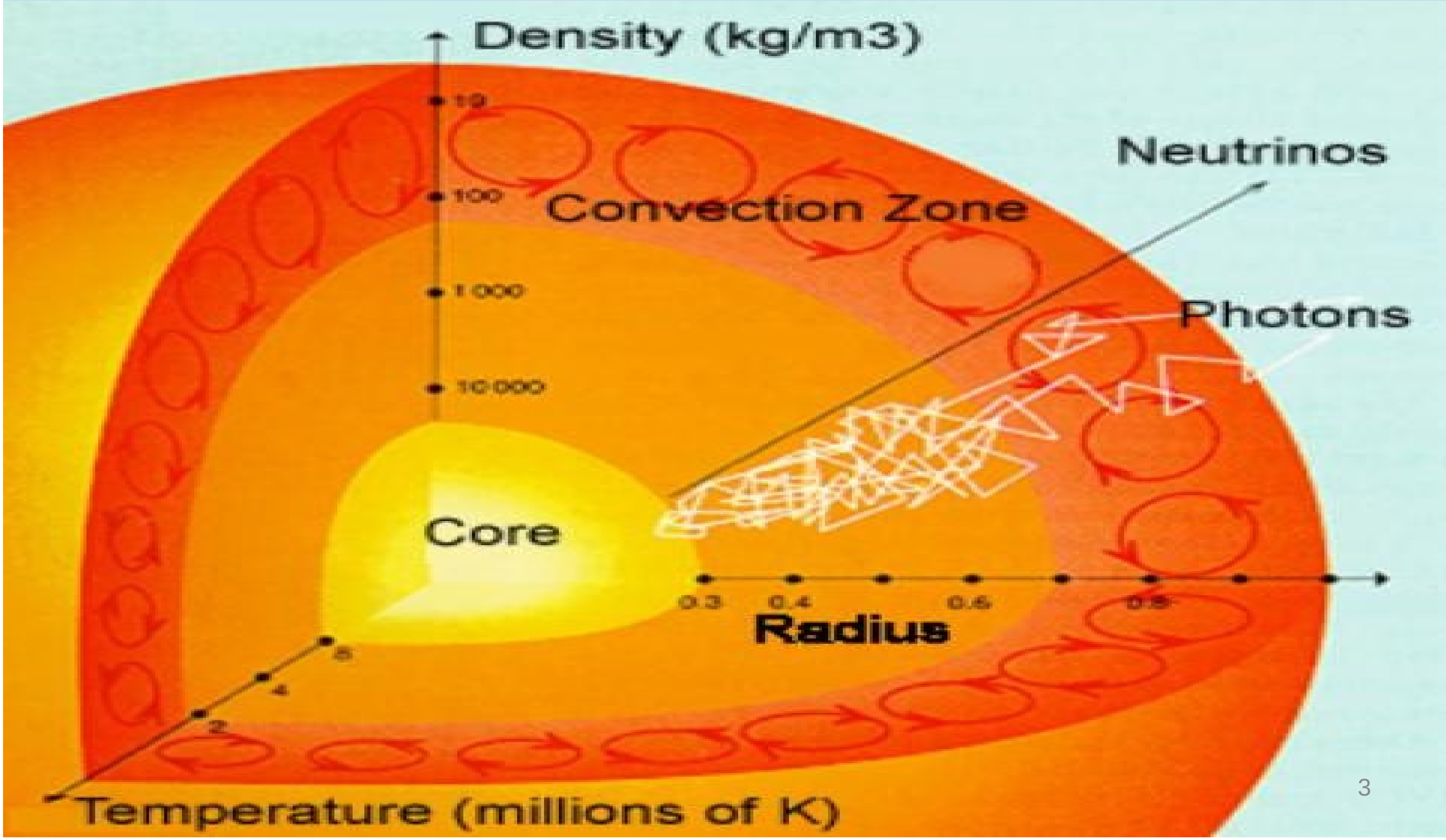
Hot Nuclear Fusion

- Nature employs very high temperatures (more than tens of millions of degrees) in the core of the Sun to cause nuclear fusion which produces enough energy to sustain all life on our favorite planet the Earth
- For 50 years, in US, Europe & South Corea extremely expensive projects (over 100 billion US dollars) have been spent to reach temperatures in the centre of the Sun to cause controlled hot fusion in Earth labs
- Alas without success (Chief of US hot fusion project : no hot fusion device until after the year 2050!).

Sun’s Interior



Nuclear Fission

- On the other hand, nuclear fission has not only led to atomic bombs but has been successfully harnessed to produce nuclear energy (over half of the energy needs of France are supplied by nuclear power)
- There are vigorous efforts under way -in Italy and in India in particular- to install several new generation of nuclear power plants.

Disadvantages of Nuclear Fission:

- The main disadvantage of nuclear fission power plants is nuclear waste exceedingly harmful to humans through deadly radiation produced as end products of nuclear fission chain reaction.
- Needless to add that any nuclear fission power plant can be readily converted into a nuclear bomb making device which leads to dire prospects resulting from their employment by belligerent governments and of course terrorists.

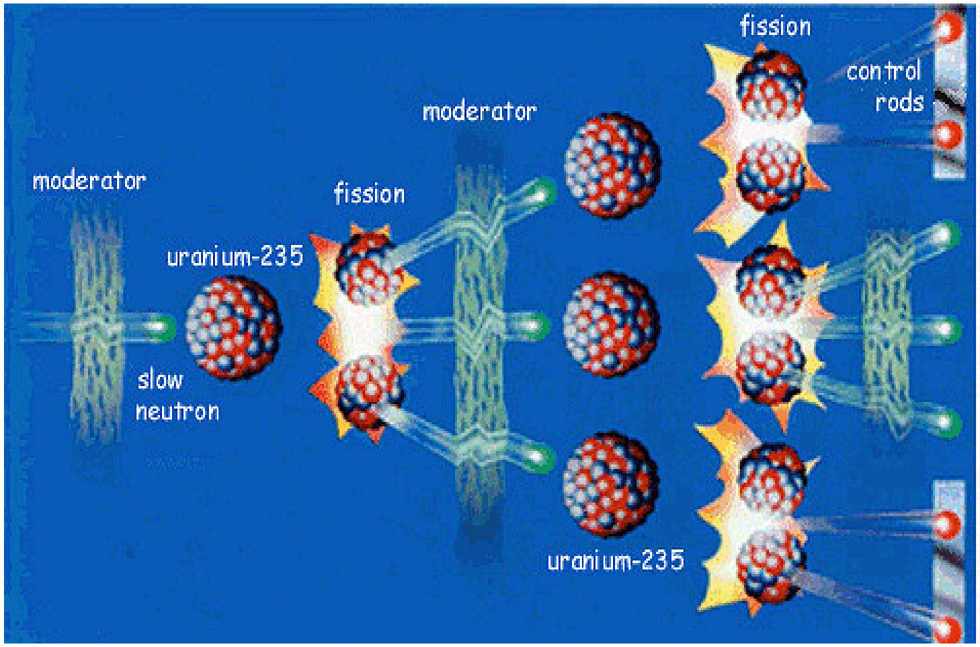
Nuclear Fission Power I

Tricastin Nuclear Power Plant is one of 59 French plants that provide ~75% of French electricity.

South Carolina plant is one of many supplying ~10% of USA electricity.

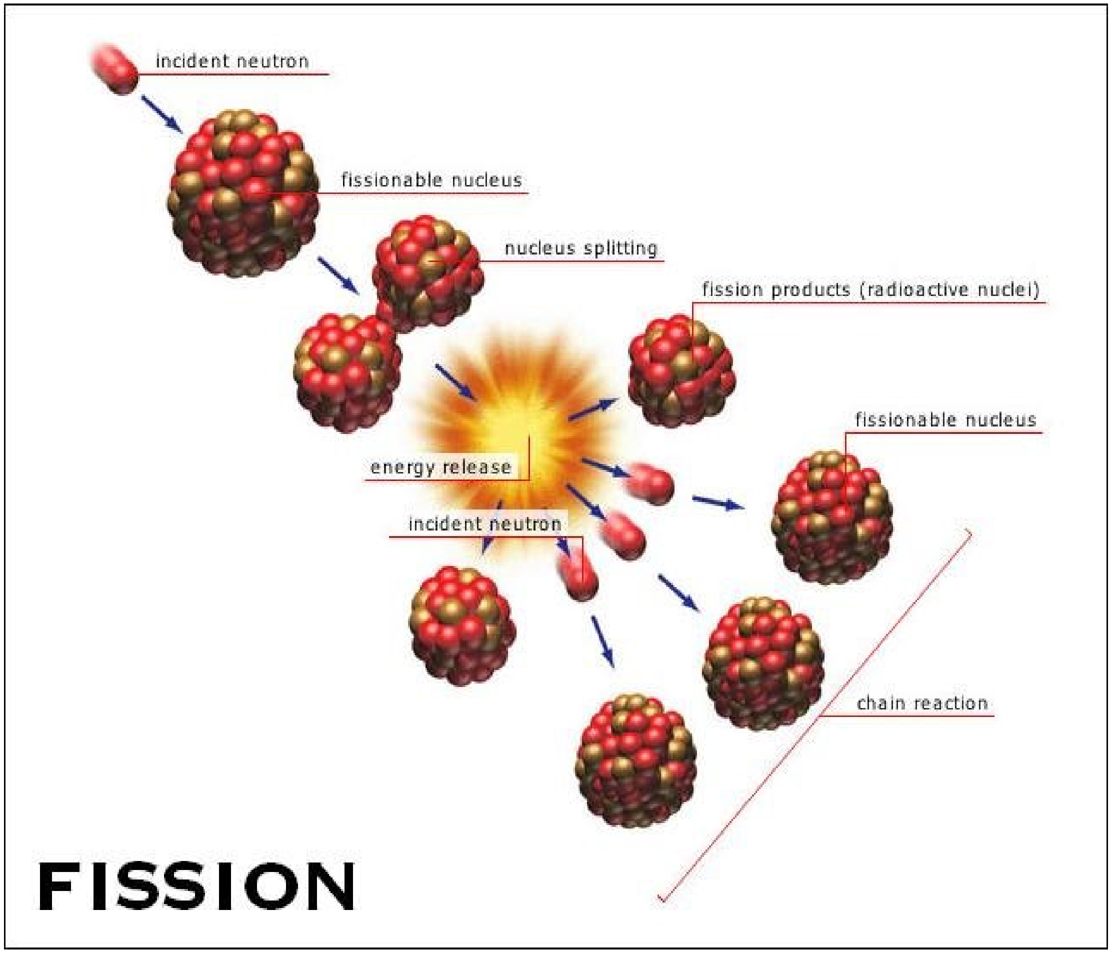
Nuclear Fission Power II

Remains of Chernobyl



Problems of Chain Reaction Fission Going too Rapidly

Nuclear Fission Power III

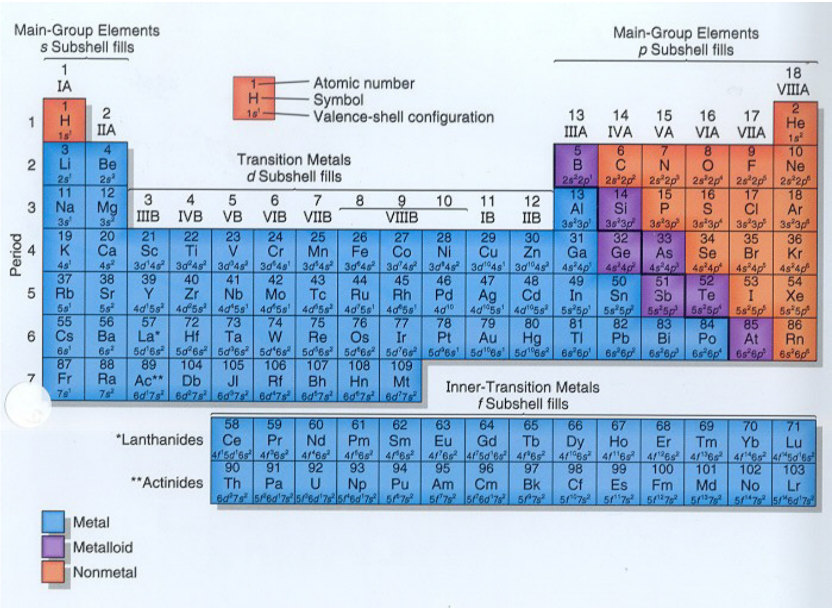


Nuclear Fission Power IV

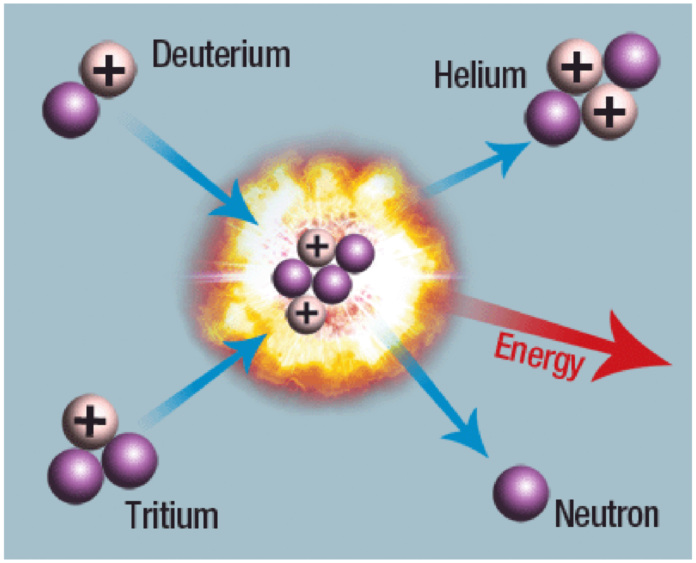
High level waste appears from hot concentrated nitric acid solutions containing the dissolved spent fuel rods from the nuclear power processes and is still so radioactive that it generates large amounts of heat.

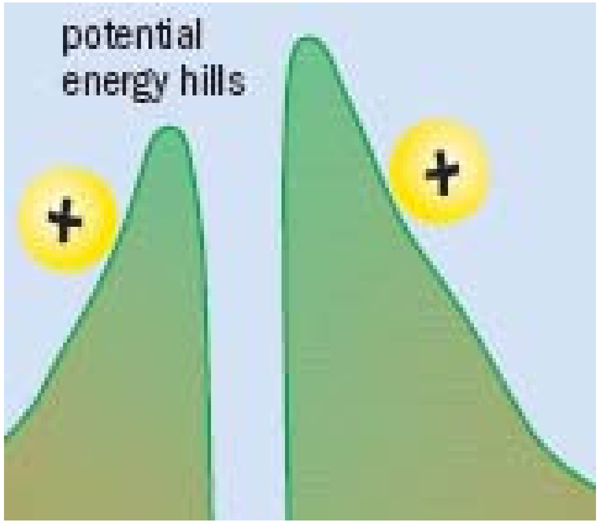
Half of the chemicals from Zinc to the late lanthanides (Z=30 to Z=70) appear in radioactive isotopes in the high level fission waste products.

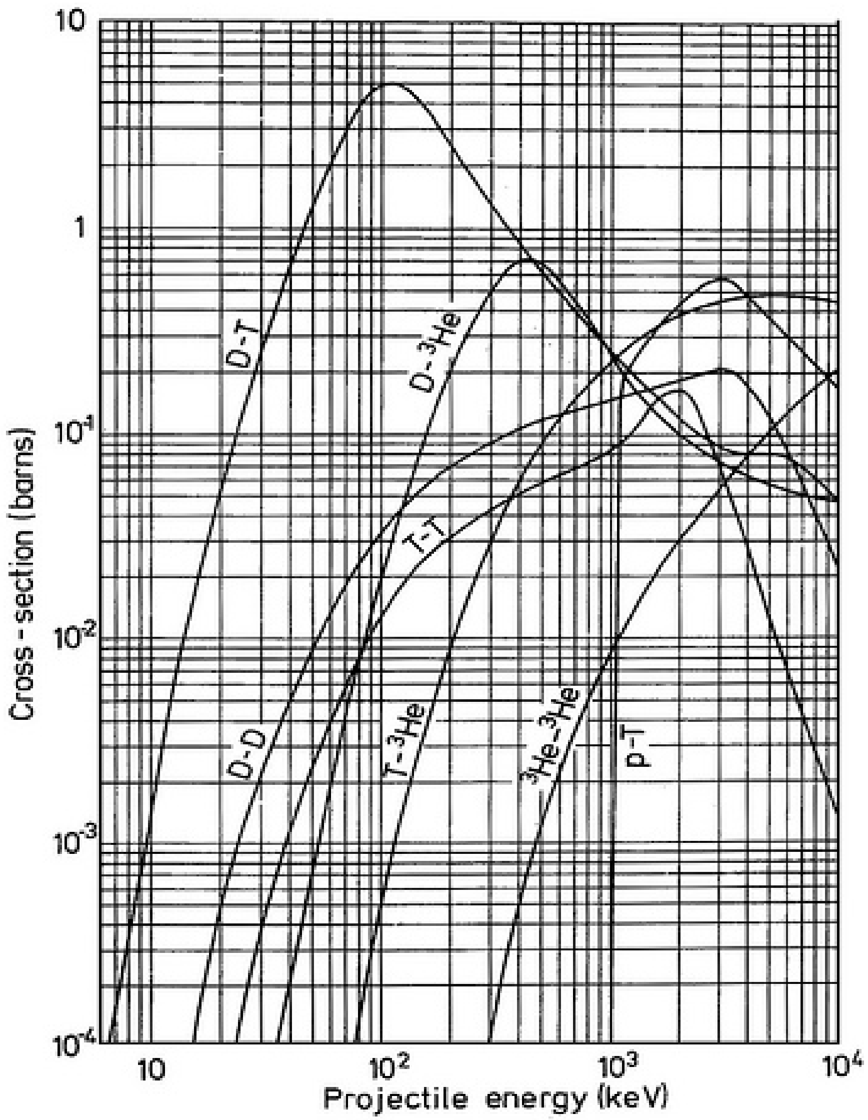
Chemicals with Z<30 are relatively safe with respect to long lived radioactive byproducts.



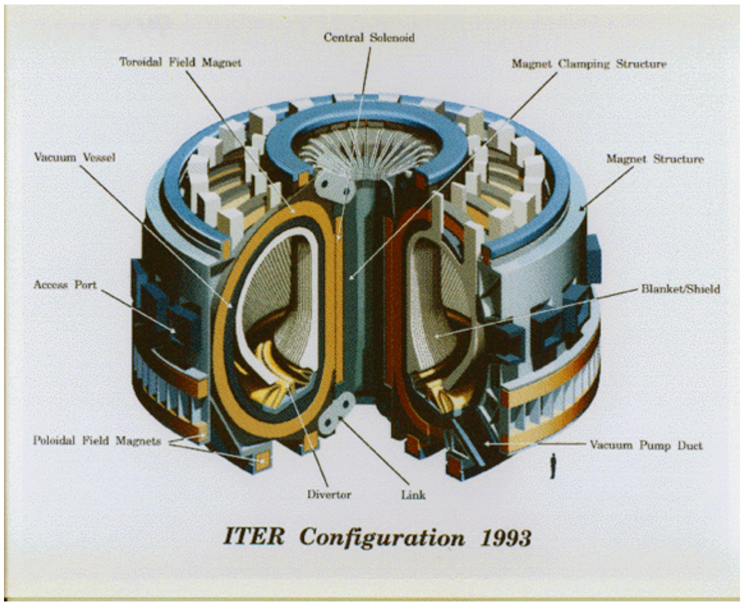
Nuclear Hot Fusion Power I

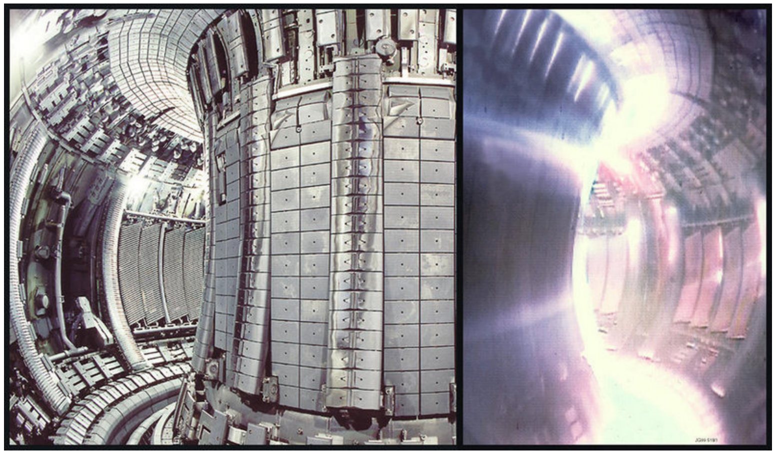






Nuclear Hot Fusion Power II



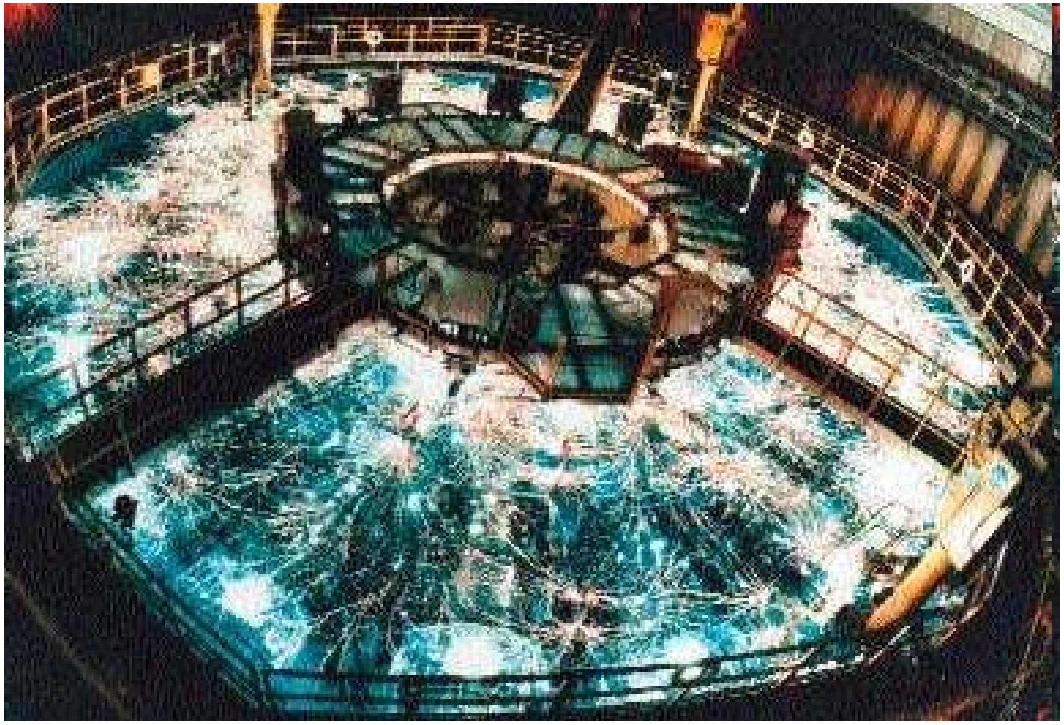


American confinement tokamak "Magnetic Bottle" for a hot fusion reactor power source

European confinement ITER "Magnetic Bottle" for a hot fusion reactor power source

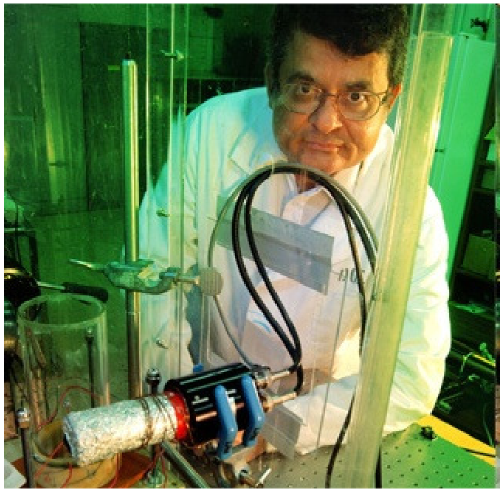
Hot fusion magnetic bottles have not been working after ~40 years because confinement times are too short to derive appreciable output energy.

Nuclear Hot Fusion Power III



The PBFA2 facility (Sandia laboratories, Albuquerque, USA) for studying inertial fusion using light ion beams.

Nuclear Hot Fusion Power IV

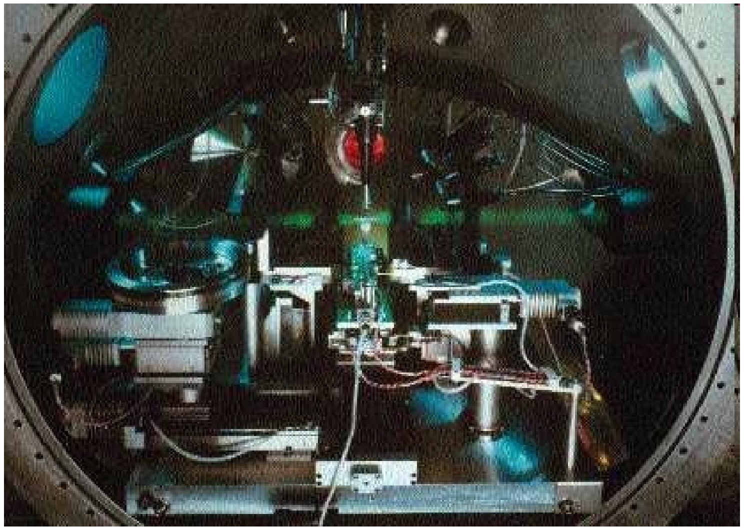


"Star in a Jar" Bubble Fusion

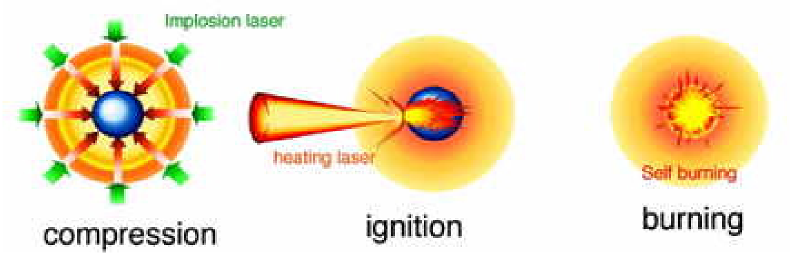
Scientific American (July 21, 2008): Bubble Fusion Researcher Charged with Misconduct. Second inquiry into Purdue's Rusi Taleyarkhan finds evidence of wrongdoing.

Lawrence Livermore National Laboratory's National Ignition Facility. No success after ~40 years. Explosion asymmetry is the problem.

Nuclear Hot Fusion Power V



The ABC laser device is run by ENEA in Frascati. In the implosion chamber, alignment with the capsule is achieved using a beam of green laser light.



A chain of laser amplifiers (CEA, Limeil, France).

Novelty of Our project

- A benign nuclear alternative does exist and what is most unfortunate is that even many competent scientists are sadly unaware that Nature itself uses these alternatives for generating nuclear reactions at low temperatures

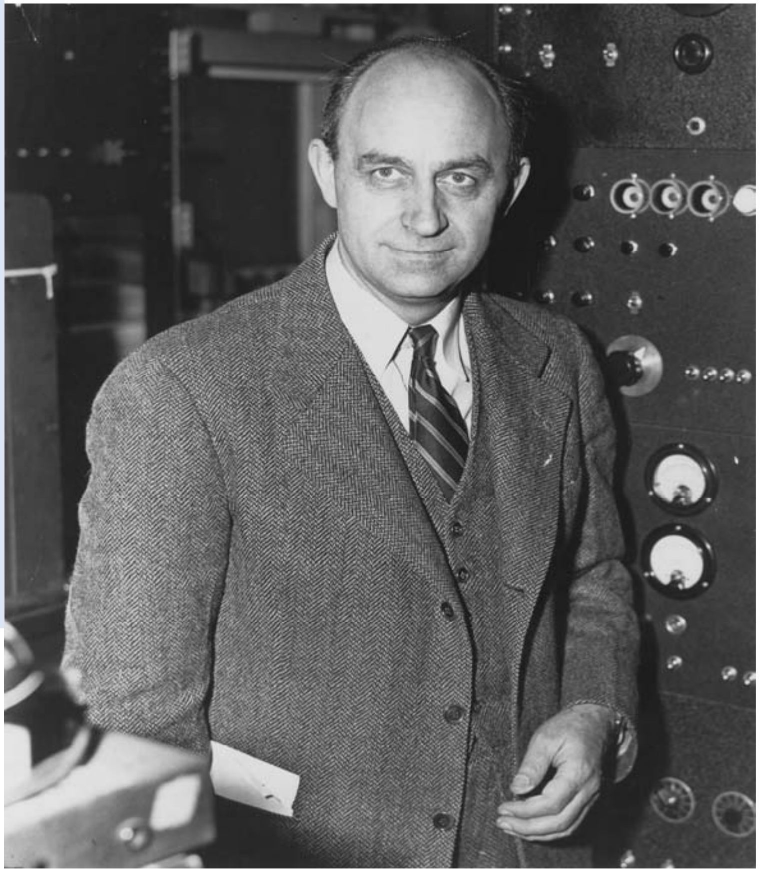
Electromagnetics Driven Nuclear Reactions

Instead of high temperatures providing the initial [start up] energy for nuclear transmutations, Nature also uses gentler forms such as the internal electric and magnetic energies as startup devices.

Two examples of electromagnetically assisted nuclear reactions occurring naturally around us

If a high enough electric current is passed (and discharged) through a thin wire, neutrons are produced

As the great Italian genius Enrico Fermi was fond of saying:
Give me enough neutrons, I shall give you the entire periodic table.



Exploding Wires in the Sky

Lightning Produces Neutrons

Lightning (the great big wire in the sky, carrying huge electric currents) has been shown to produce neutrons by an Indian team at the high altitude laboratory in Gulmarg, Kashmir.

Allan and I are Scientific Advisors to a set of sophisticated experiments under way by a new Indian team to study lightning and understand nuclear transmutations therein.

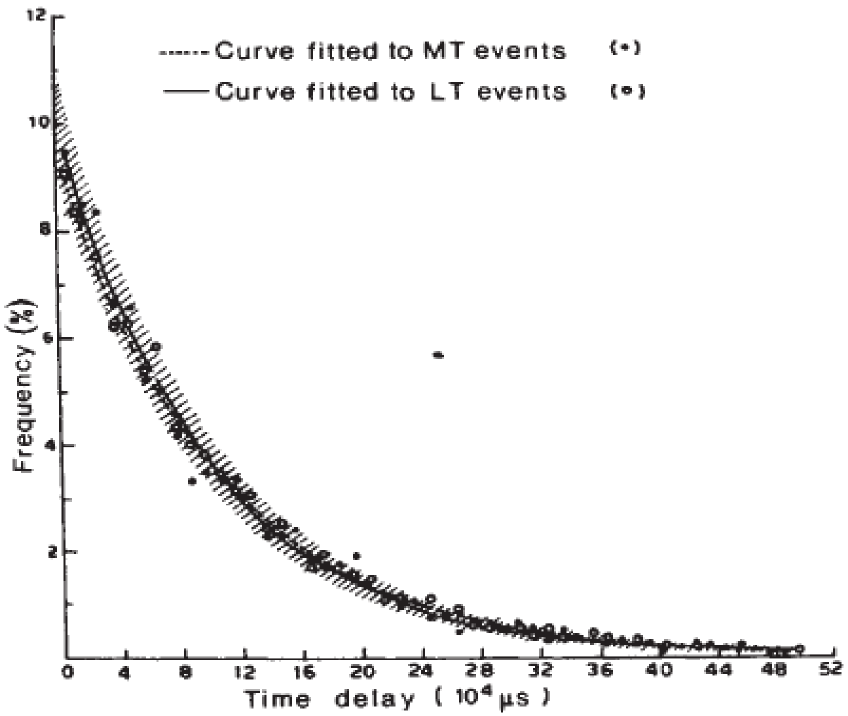
Lightning

NATURE VOL. 313 28 FEBRUARY 1985 LETTERS TO NATURE 773

Neutron generation in lightning bolts

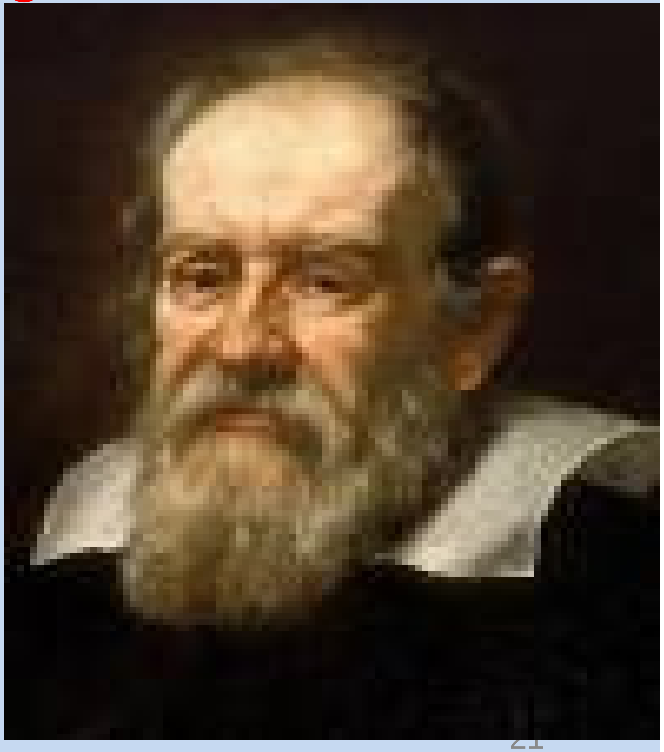
G. N. Shah, H. Razdan, C. L. Bhat* & Q. M. Ali

Bhabha Atomic Research Centre, Nuclear Research Laboratory, Zakura, Naseem Bagh, Srinagar-19006, Kashmir, India

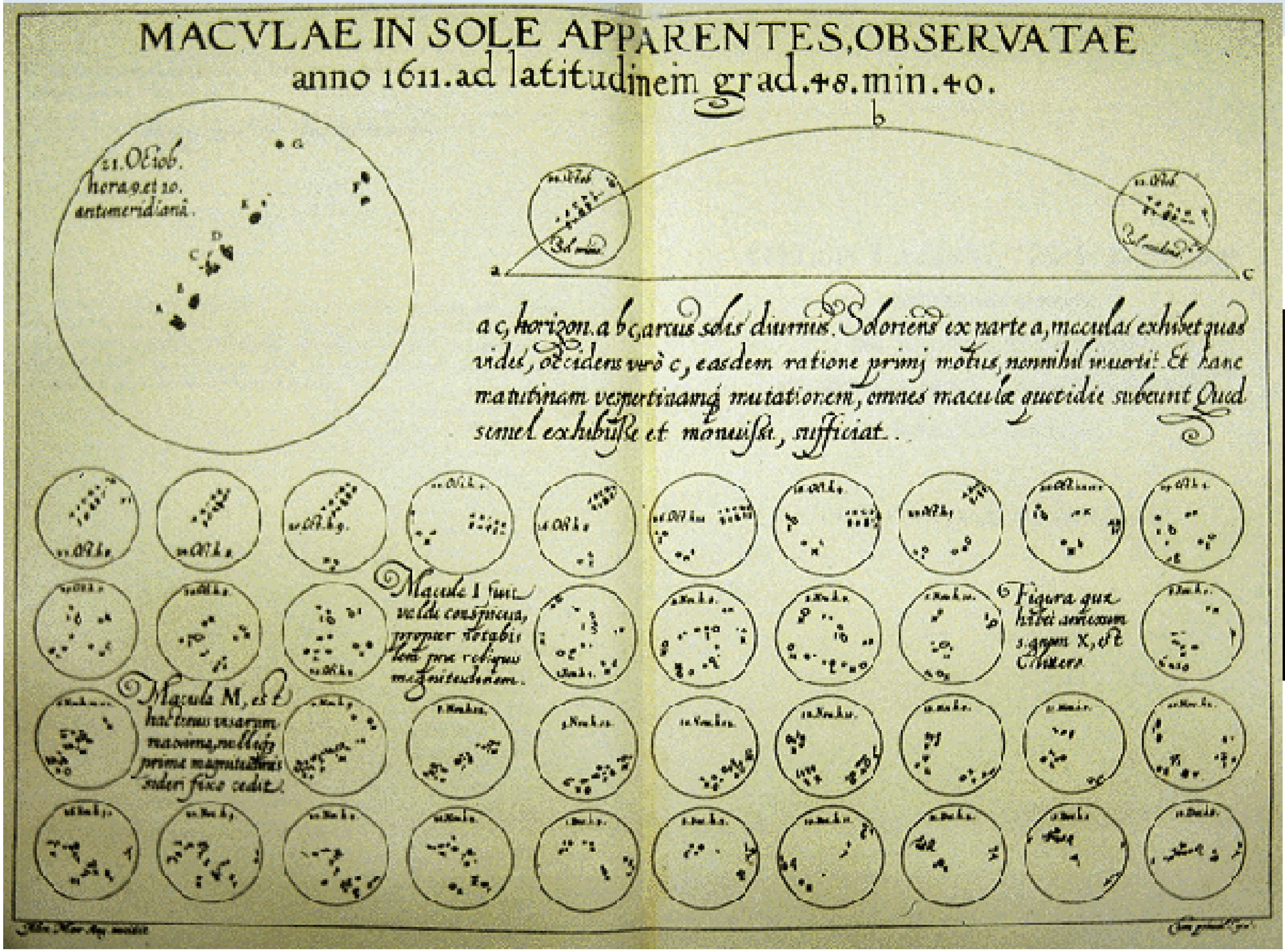


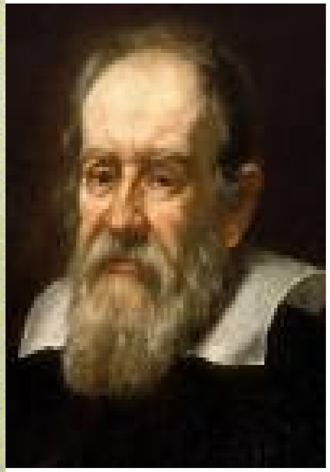
Galilean Sun Spots

There now exist magnificent pictures showing that at the surface of the Sun, high magnetic flux tubes jump out of one of Galileo's sunspots to dive into another sunspot. Once in a while these magnetic flux tubes break and lead to Solar flares.

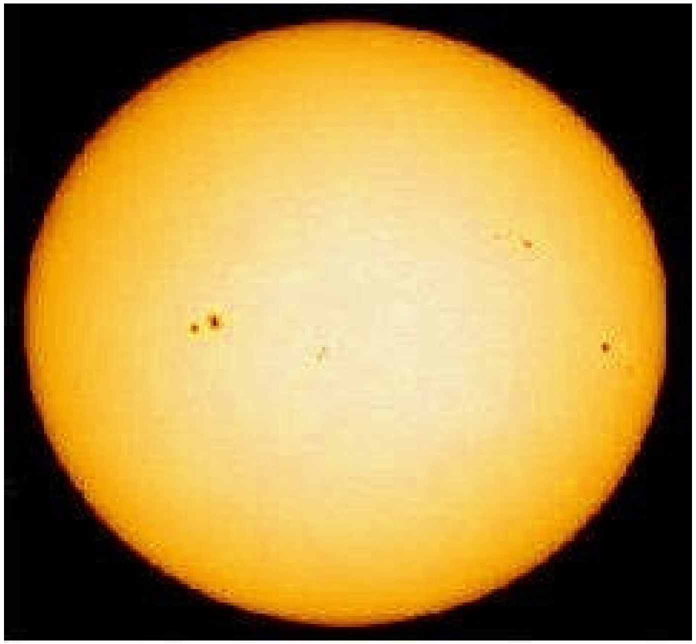


Galileo and his Sun spots



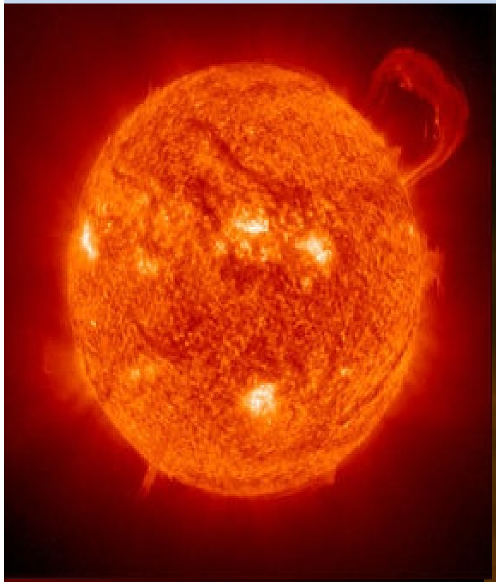


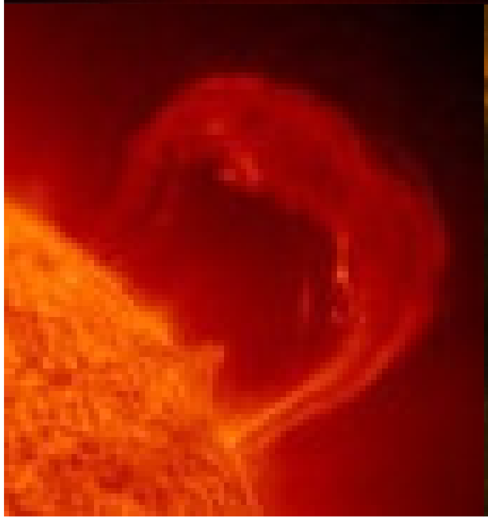
Galilean Solar Sun Spots

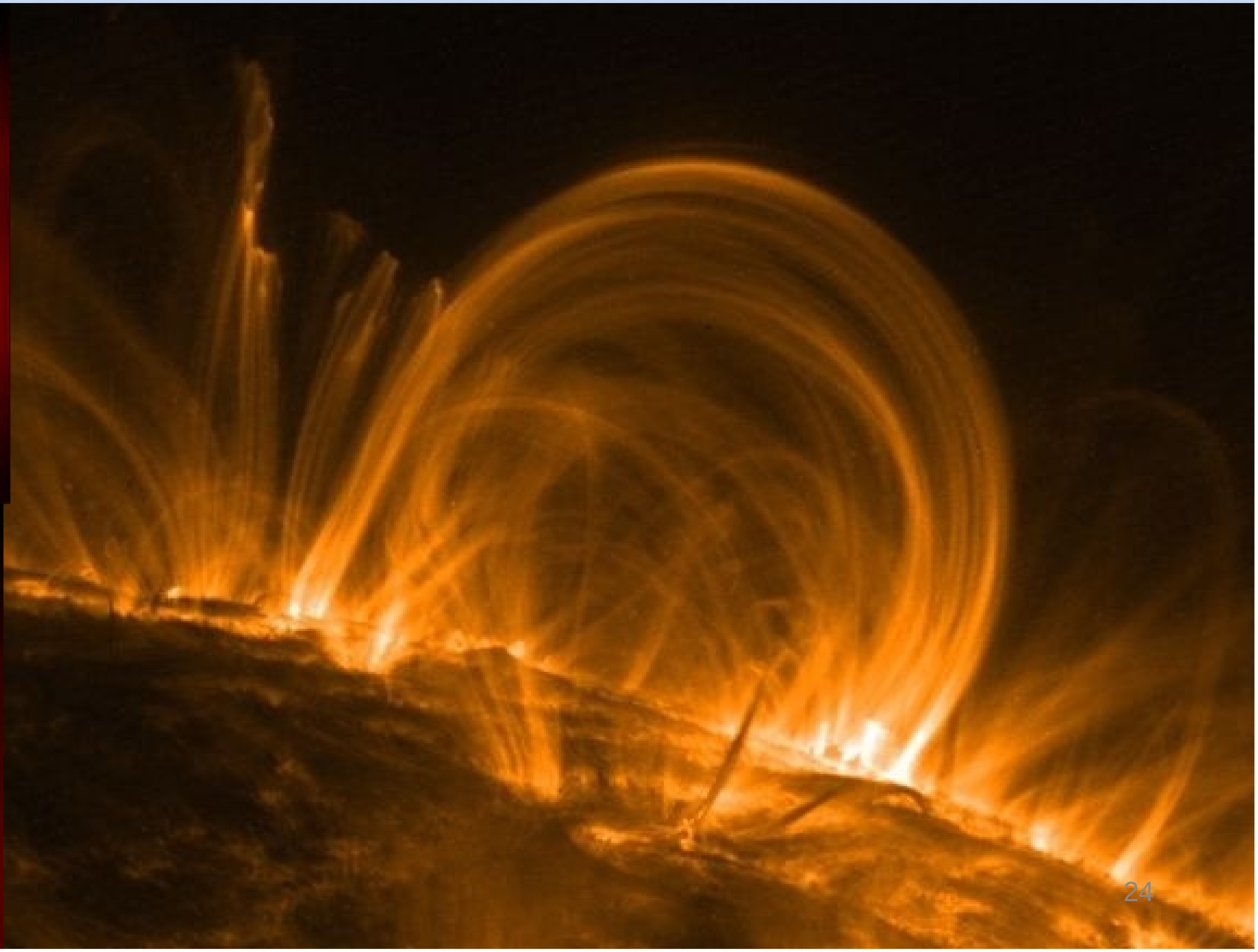


Picture of the sun taken with an optical camera. There is little surface structure beyond a few dark Galilean sunspots

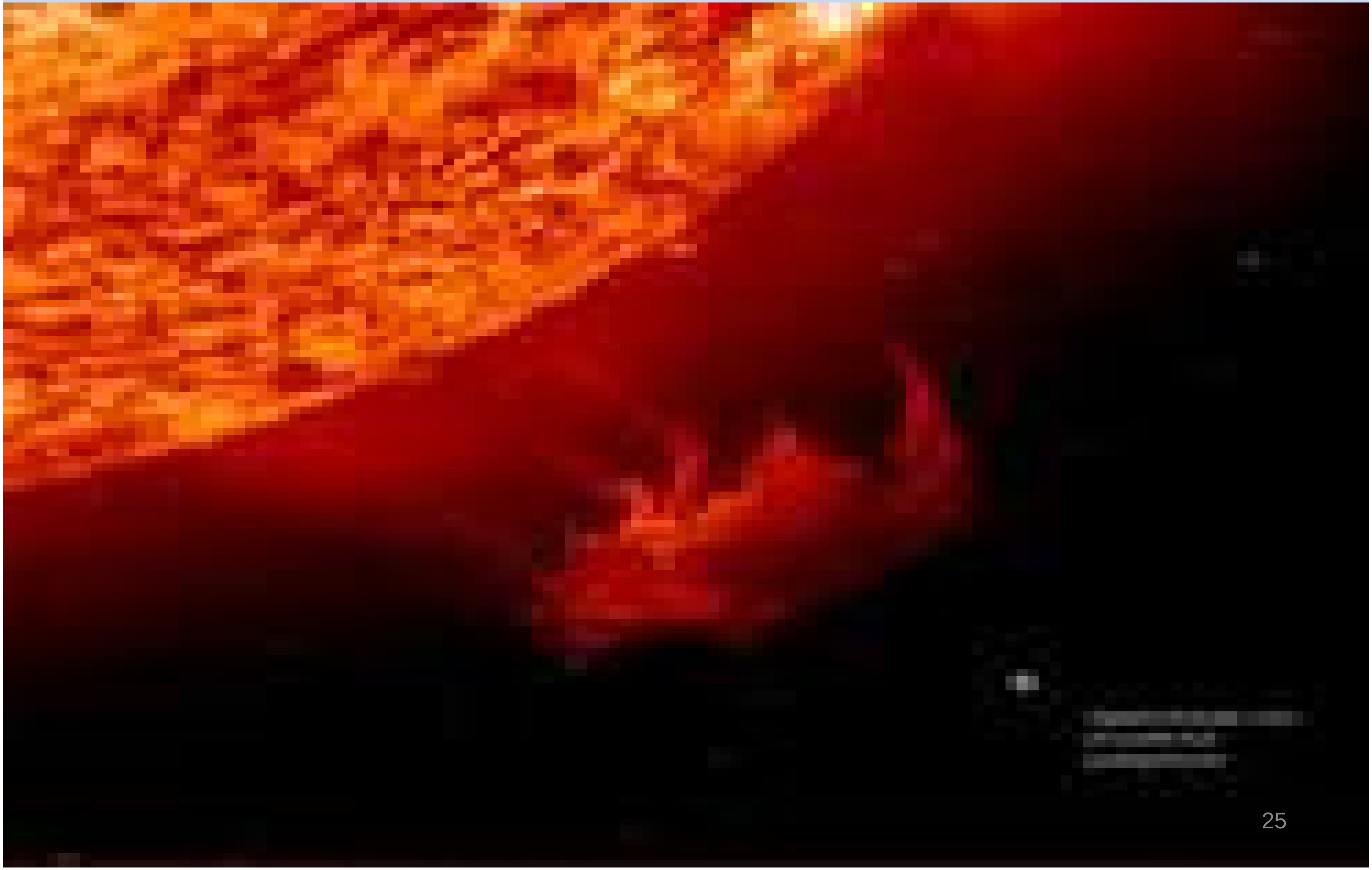
Magnetic Flux Tubes out of one Sun spot into another





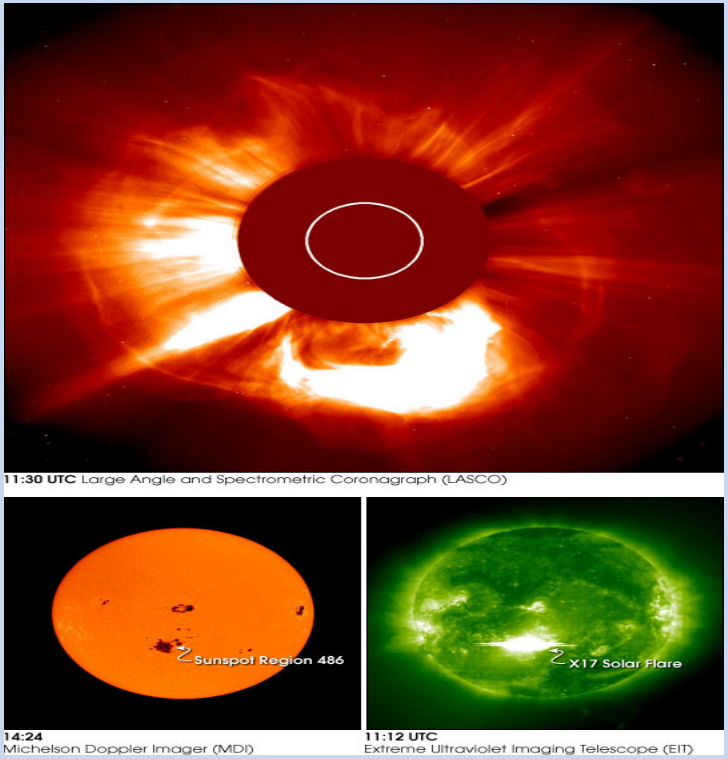


Giant Solar Flares



Some giant Solar flares accelerate electrons and protons to energies higher than the highest accelerators designed on Earth .

In 2003, debries and shocks from a great Solar flare reached close enough to the Earth to disrupt all radio, wireless and satellite communications



Design for a small (or a large) device

Based on well established scientifically confirmed results

1. Electric impulses are used first to create conditions suitable for causing what is called a weak interaction (the mechanism behind radioactivity and the theory for which was first provided by Fermi)
2. Through this weak interaction, electrons and protons on the surface of the internal part of the device produce a slow neutron and a neutrino.
3. The neutrino escapes [neutrinos do not cause any damage to a living system: through a small fraction of radioactive calcium in our body, we produce about 50 neutrinos per second and none of us ever notice it

Left over neutron

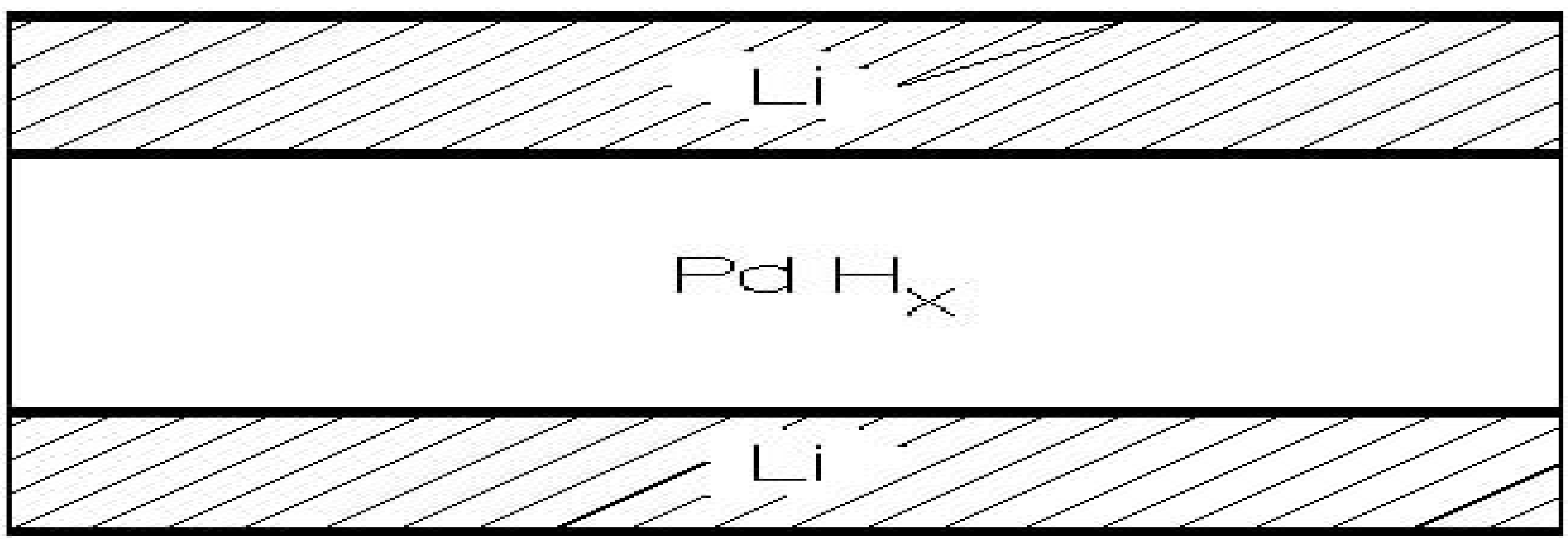
The left over neutron passes to the outer layer causing nuclear transmutations and produces

controllable, clean, green energy, without any nuclear waste or other harmful products.

Lithium Palladium Nuclear Device

- The neutron flux emerging from the core rod can enter into a region in which the nuclear fuel resides. The lithium is packed around but insulated from the palladium hydride core rod and the neutrons produced in that rod flow into the lithium fuel cylindrical region.
- The nuclear burning takes place within the lithium.

Shown is a lithium cylinder wrapped around but insulated from a palladium hydride current carrying rod



Demonstrated in our published papers and discussed in seminars around the world

Boston MASS USA

DOE in Washington DC

La Sapienza, Roma I

Roma III

INFN, Laboratorio Nazionale di Frascati

Gran Sasso National Laboratories

Napoli

U. di Perugia

U. di Milano

ST Milano

Indian Universities Accelerator Center in New Delhi,

etc. etc

Efficiency of such a device

The power inherent in 1 gram of appropriate material

if successfully transformed

-say in one hour-

is truly gigantic:

equivalent to over a billion Megawatts of power.

Versatility of device: big, medium or small

consists in its scalability from making Giga Joule nuclear power plants to a hand held million Volt battery

Imagine a telephone cell charging device which lasts for a year instead of the present charging devices which only last over a few day period

Intermediate size can be used to power the needs of a remote village without building a surrounding complex power grid.

We can imagine its use in myriads of ways

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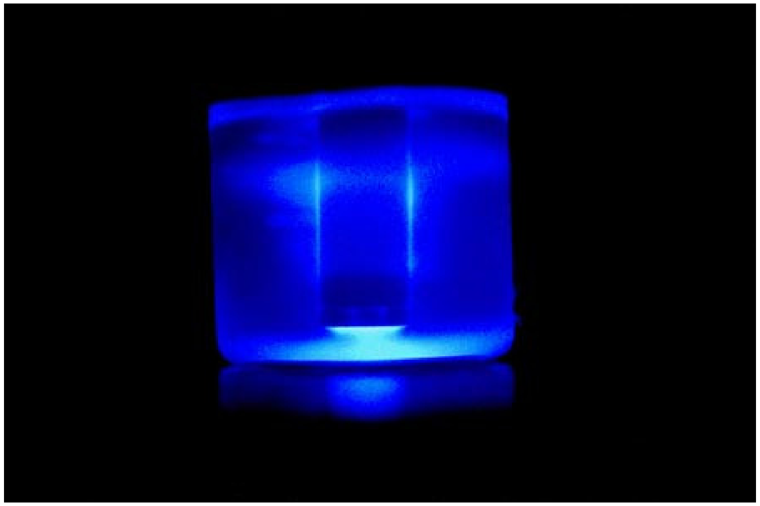


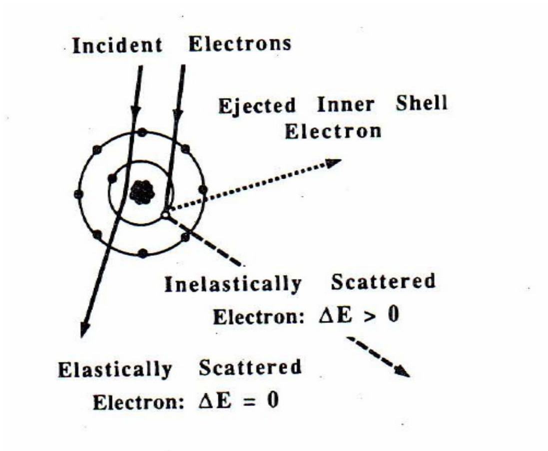
Nuclear Cold Fusion Power I

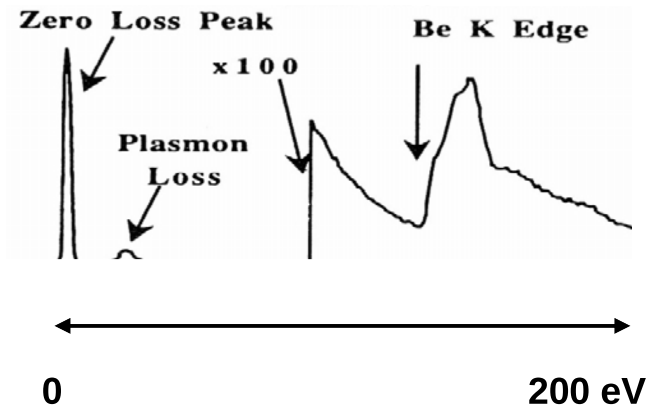
In deuterium saturated palladium, it was conjectured by Martin Fleischmann that experimental "excess heat" measurements occurred because of the reaction

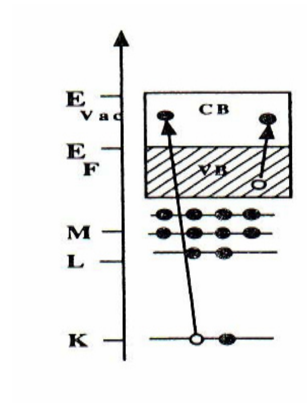
d+d $\rightarrow$ +(heat).

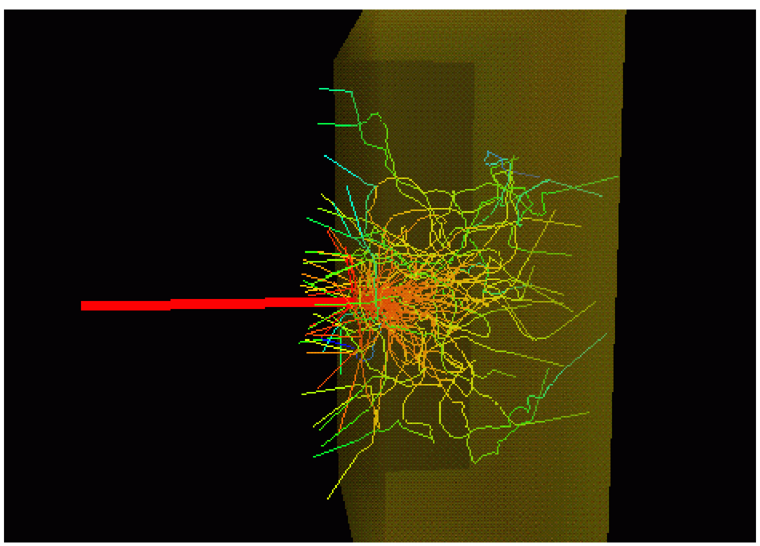
Further excess heat experiments (*without deuterium*) by Stanley Pons rendered this hypothesis unlikely, but Preparata and Del Giudice still investigated how such a miracle might possibly occur.

Nuclear Cold Fusion Power II







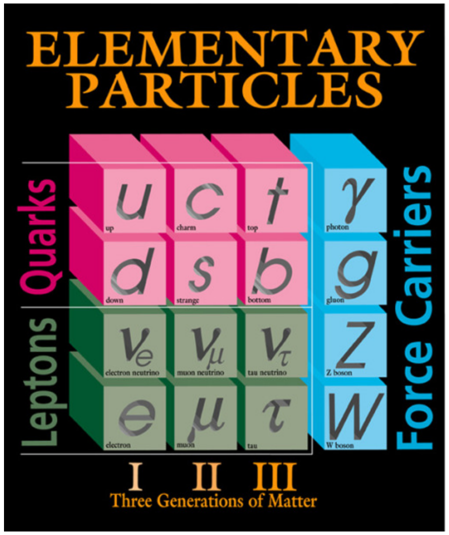


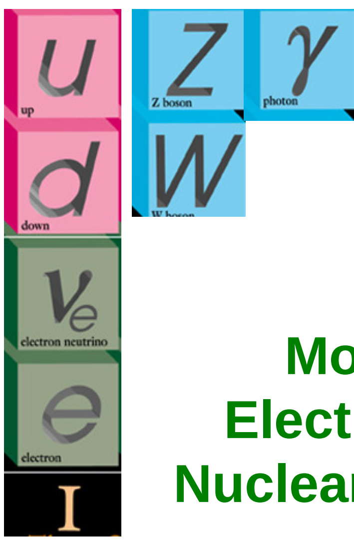
The collective bulk frequency plasma oscillation

$$\Omega^2 = 4\ e^2n/m$$

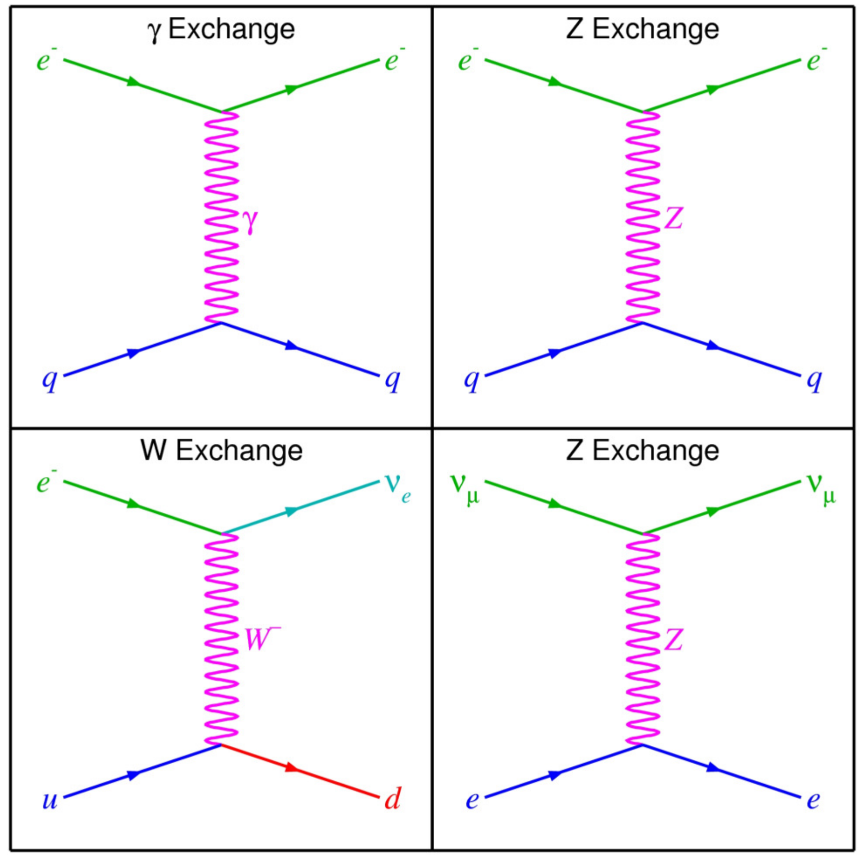
Coherent bulk plasma oscillations supply energy to fusion barrier.

Weak Interactions I

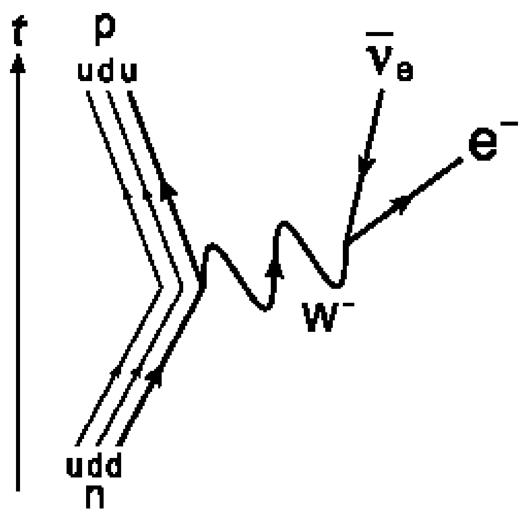




Most of Electroweak Nuclear Physics



Weak Interactions II



$$n \rightarrow p^{+} + e^{-} + \bar{\ }_{e}$$

Weak Decay of the Neutron

$$n + {}^{A}_{Z}X \rightarrow {}^{A+1}_{Z}X +$$

Strong Nuclear Transmutation

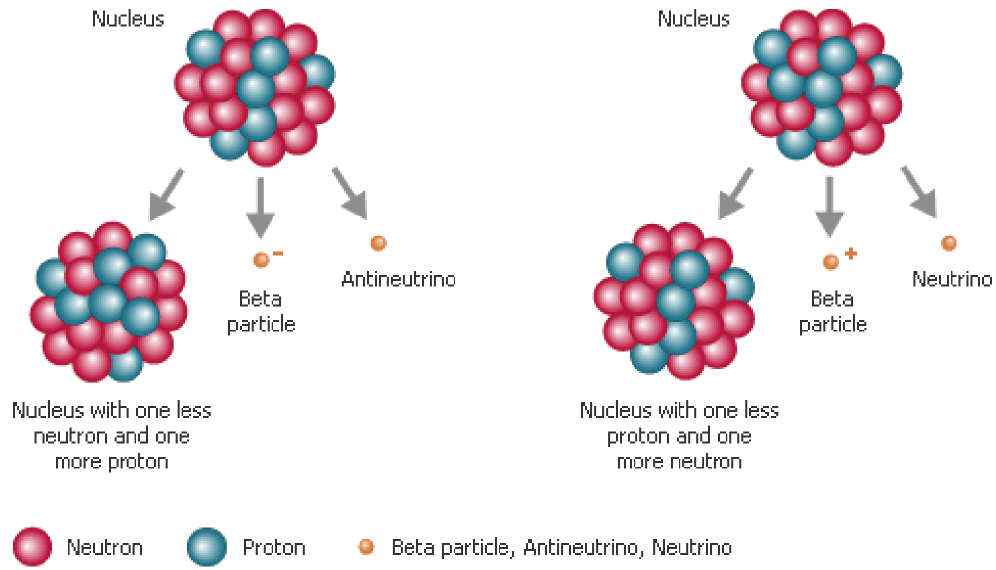
$$e^{-} + p^{+} \rightarrow n + \ _{e}$$

Weak Production of the Neutron

***Z*=Charge Number**

***A*=Baryon Number**

Weak Interactions III



$$^{A}_{Z}X \rightarrow {}^{A}_{Z+1}X + e^{-} + \overline{}_{e}$$

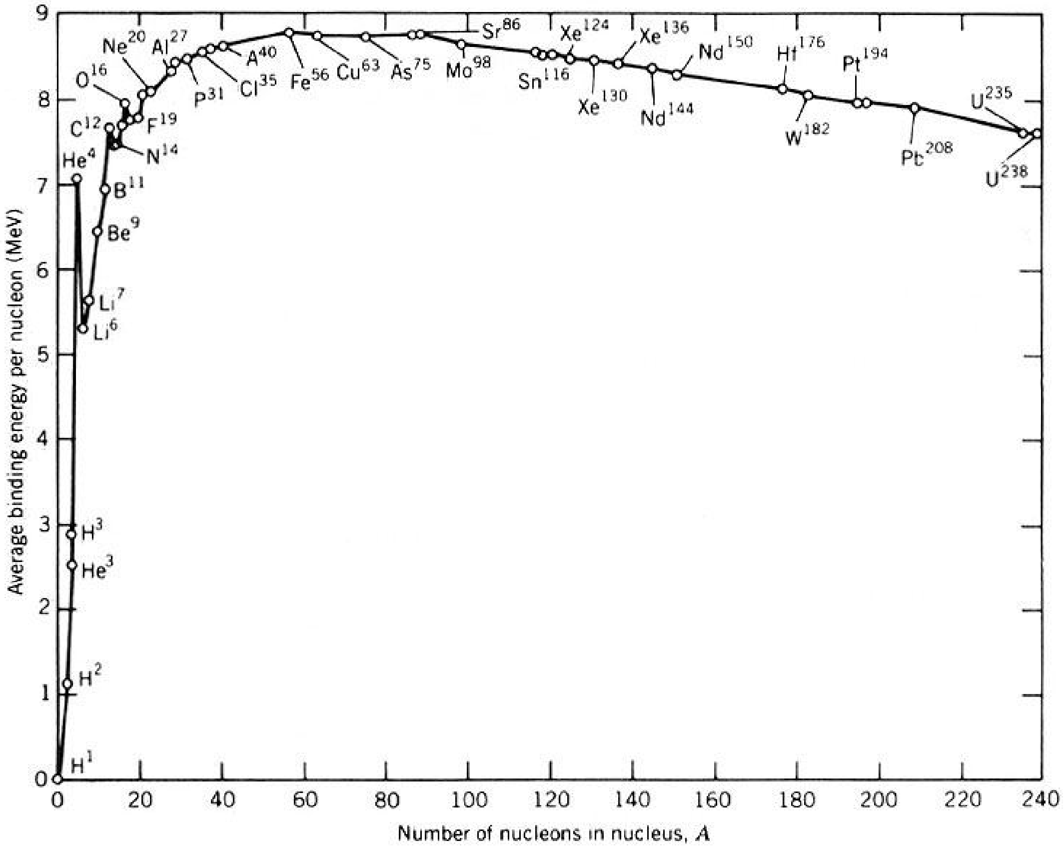
$$^{A}_{Z}X \rightarrow {}^{A}_{Z-1}X + e^{+} + _{e}$$

$$e^{-} + {}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}X + _{e}$$

Weak Nuclear Transmutations

Weak Interactions IV

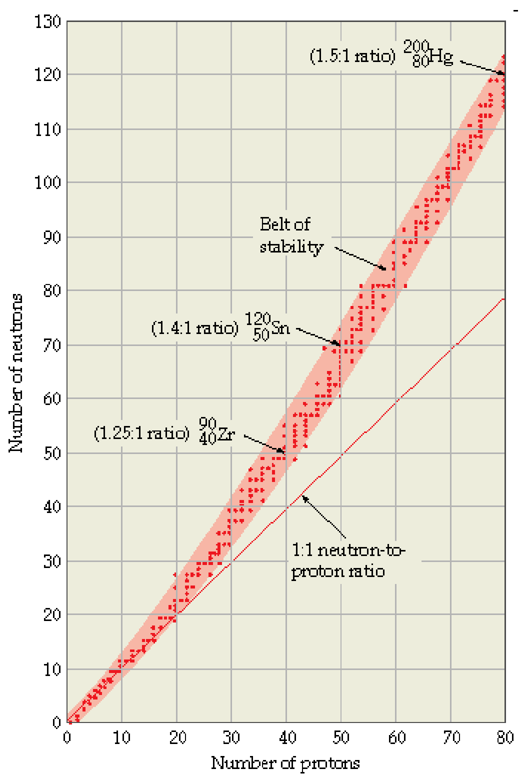
B/A



A

$$M(Z,A)c^2 = AM_n c^2 + Z(M_p - M_n)c^2 - B(Z,A)$$

Weak Interactions V



$$M(Z,A)c^2 = AM_n c^2 + Z(M_p - M_n)c^2 - B(Z,A)$$

$$-B(Z,A) = -\ _1 A + \ _2 A^{2/3} + \ _3\left(\frac{Z^2}{A^{1/3}}\right) + \ _4 \frac{(A-2Z)^2}{A} + \ _5 \frac{}{A^{3/4}}$$

$$_1 = 15.75 \text{ MeV} \qquad _2 = 17.8 \text{ MeV} \qquad _3 = 0.71 \text{ MeV}$$

$$_4 = 23.7 \text{ MeV} \qquad _5 = 34 \text{ MeV}$$

$$= +1 \quad \text{if} \quad \text{odd} - \text{odd}$$

$$= 0 \quad \text{if} \quad \text{odd} - \text{even}$$

$$= -1 \quad \text{if} \quad \text{even} - \text{even}$$

The nuclear voltage is Φ(Z,A).

$$e\Phi(Z,A) = c^2 \frac{\partial M(Z,A)}{\partial Z}$$

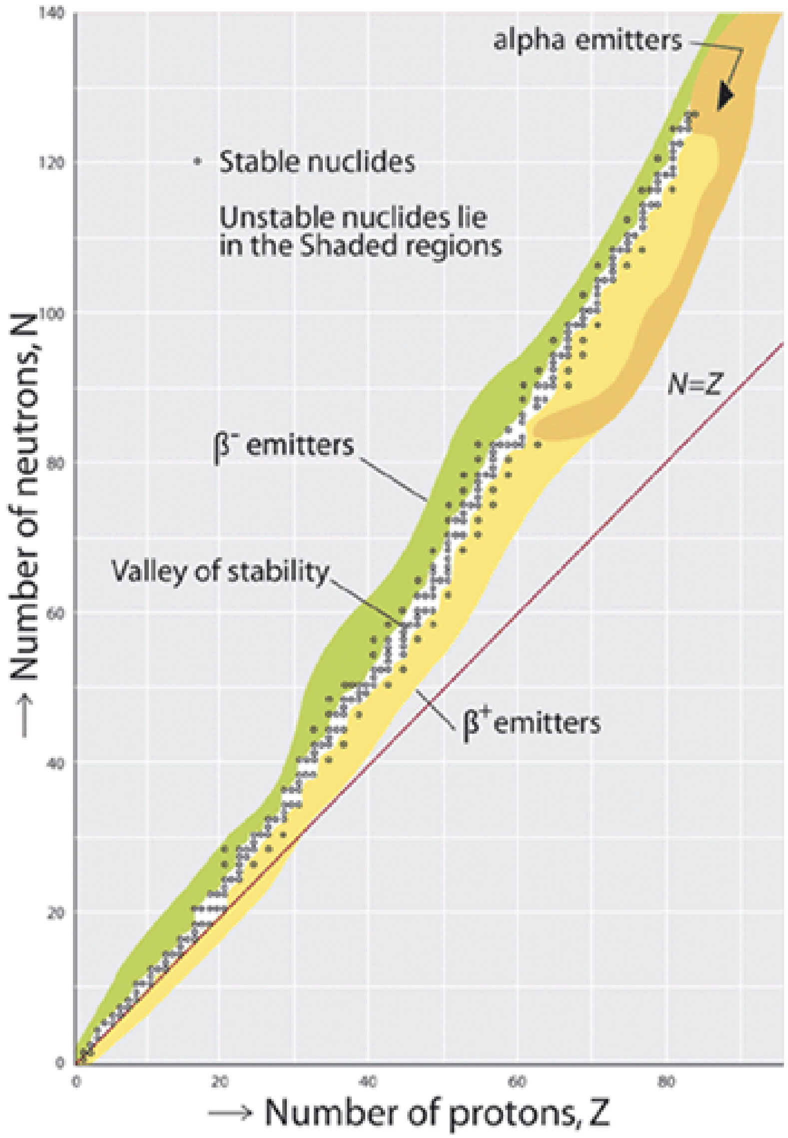
$$\Phi(Z^*,A) = 0$$

$$Z^* = \frac{A}{2 + (\ _3/2\ _4)A^{2/3}} \approx \frac{A}{2 + 0.015A^{2/3}}$$

The stable nuclei lie on a plot of

N*=A-Z* vs Z*.

Weak Interactions VI

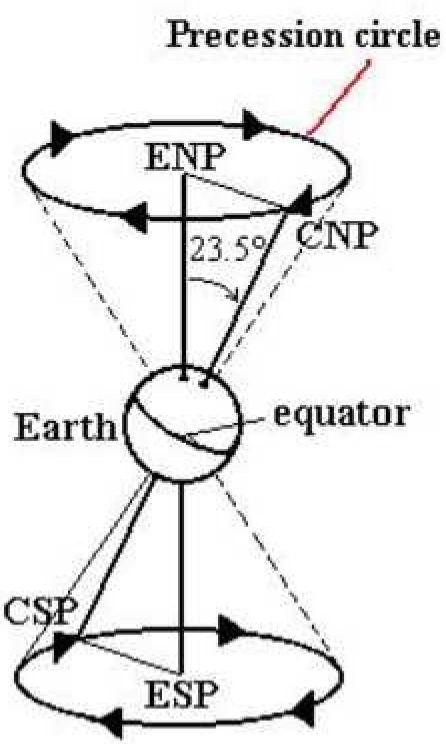


The stable nuclei for $Z<50$ arise from $^-$ decay from the neutron rich unstable nuclei and arise from $^+$ decay from the proton rich unstable nuclei.

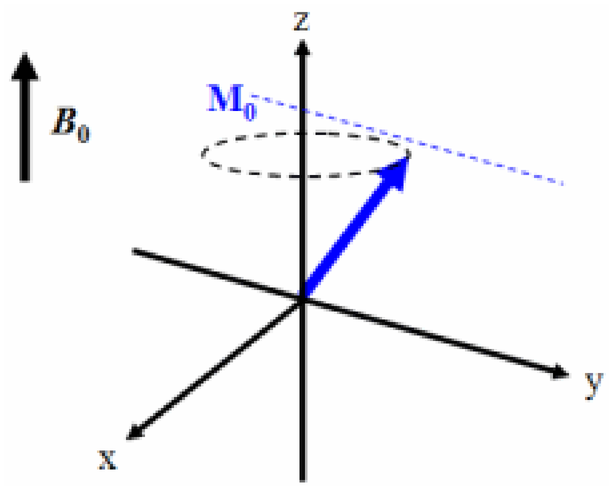
Low (negative) voltage Φ^- yields $^-$ decay.

High (positive) voltage Φ^+ yields $^+$ decay.

Weak Interactions VII

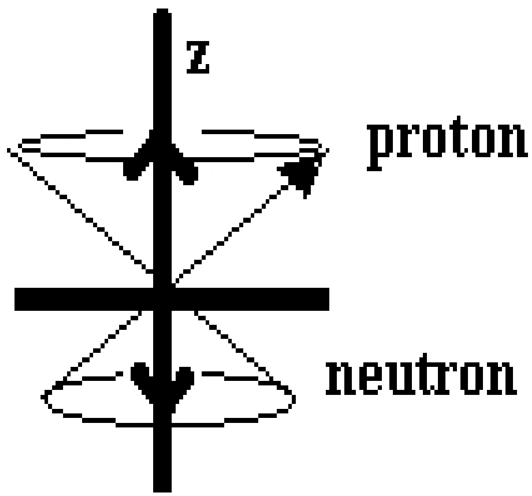


The earth magnetic moment exhibits a precession



The electronic magnetic moments exhibit a precession.

Weak Interactions VIII



$$\mathrm{T} = (T_1, T_2, T_3)$$

$$[T_a, T_b] = i \quad _{abc} T_c$$

$$\mathrm{T} \cdot \mathrm{T} = T_1^{\,2} + T_2^{\,2} + T_3^{\,2} = T(T+1)$$

$$T_3 = \frac{1}{2}(Z - N) = Z - \frac{1}{2}A$$

Simple Model Precession

The nuclear isobaric spin exhibits a weak interaction precession due to the nuclear voltage Φ.

$$\frac{d\mathrm{T}}{d} = \frac{i}{\ }\left[c^2 M(Z, A), \mathrm{T}\right] = \boldsymbol{\omega} \times \mathrm{T}$$

$$\boldsymbol{\omega} = (0, 0, e\Phi)$$

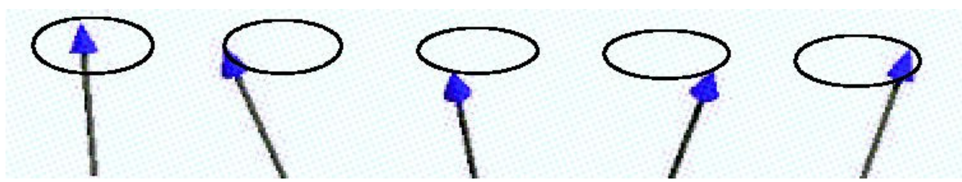
$$\Omega = \frac{e\Phi}{\ } \quad \text{(precession frequency)}$$

$$T_{\pm} = T_1 \pm iT_2 \quad \Rightarrow \quad T_{\pm}(\ ) = T_{\pm}(0)e^{\pm i\Omega}$$

Weak Interactions IX

The isobaric spin precession is a description of “virtual” W particles which decay into electron and neutrino excitations.

$\boldsymbol{T}_{\pm}$ yields $\boldsymbol{W} \rightarrow \quad + \quad ^{\pm}$ wherein $^{+} \equiv \bar{\ }$ and $^{-} \equiv$



The isobaric spin wave excitations can be induced by long ranged electrodynamics.

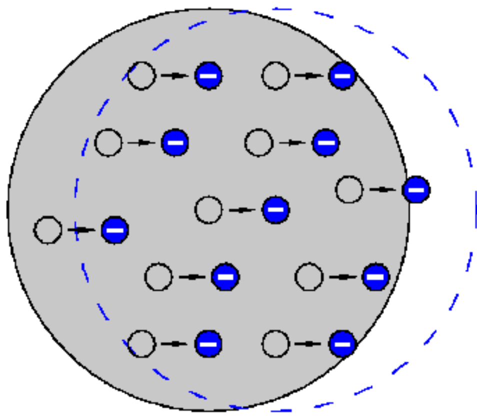
Weak Interactions X

$$\overline{\Phi}_a = e\left\langle \sum_{b\neq a} \frac{Z_b}{|\mathbf{R}_a - \mathbf{R}_b|} - \sum_j \frac{1}{|\mathbf{R}_a - \mathbf{r}_j|} \right\rangle$$

$$- e\left(\frac{\mathbf{v}_a}{2c^2}\right) \cdot \left\langle \sum_{b\neq a} \frac{Z_b(1+\mathbf{n}_{ab}\mathbf{n}_{ab}) \cdot \mathbf{V}_b}{|\mathbf{R}_a - \mathbf{R}_b|} - \sum_j \frac{(1+\mathbf{n}_{aj}\mathbf{n}_{aj}) \cdot \mathbf{v}_j}{|\mathbf{R}_a - \mathbf{r}_j|} \right\rangle$$

Coupling Between Isobaric Spin Wave Charge

Surface Plasma Waves I



$$-\nabla^2 \varPhi(\mathbf{r}) = 0$$

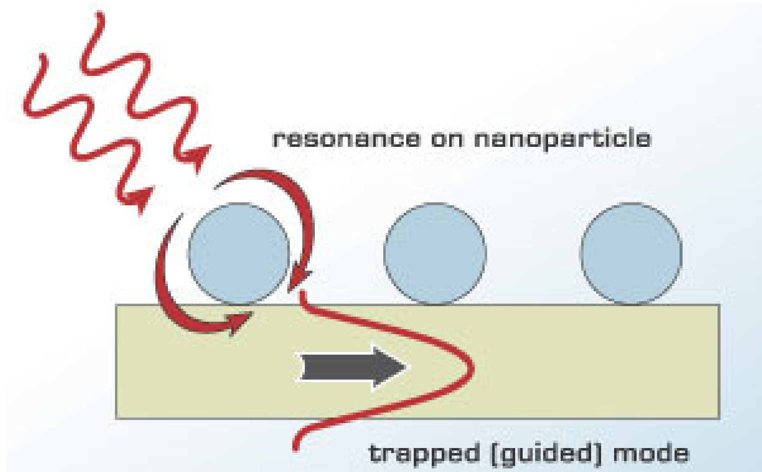
$$\varPhi(x, z) = A e^{ikz} e^{-k|z|}$$

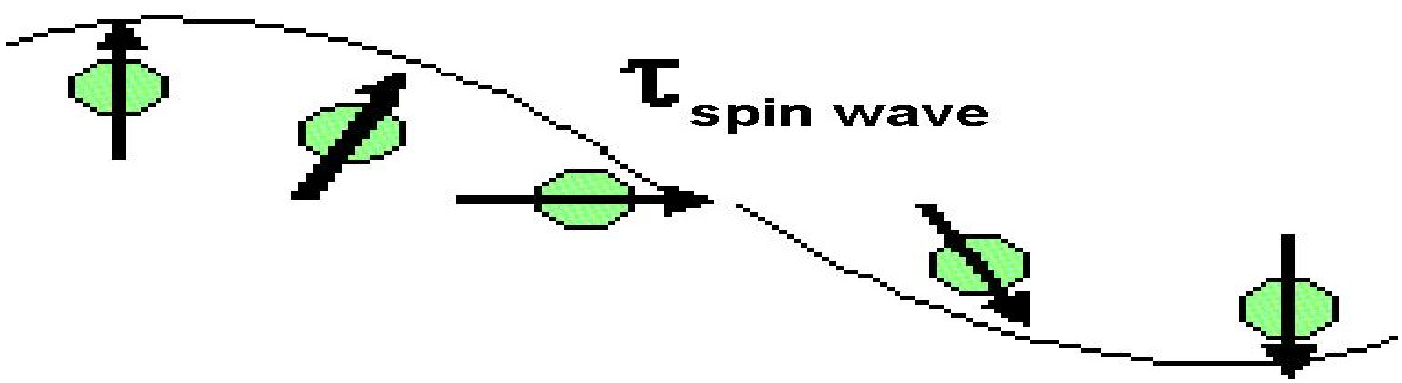
$$\frac{\partial}{\partial z}\varPhi(x, z = 0^-) = \frac{\partial}{\partial z}\varPhi(x, z = 0^+)$$

$$2 + \quad (\varOmega) = 0 = 2 + \frac{1}{\Omega^2 - \varOmega^2}$$

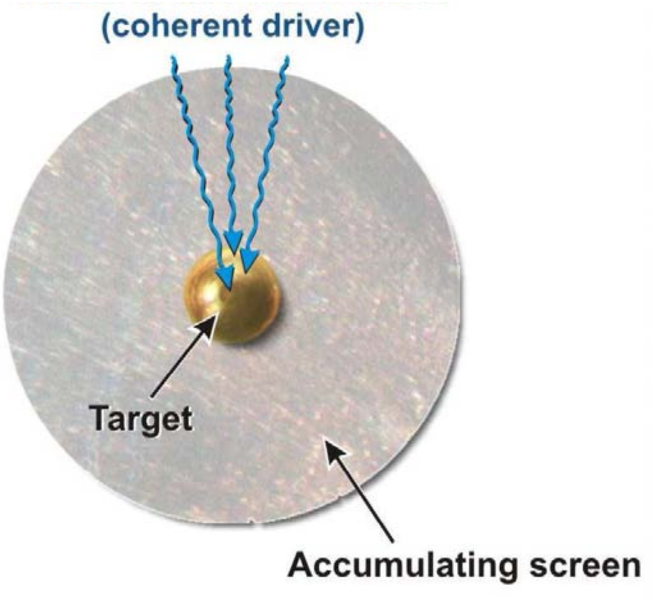
$$\Omega^2 = \frac{4\ \ ne^2}{m} \quad \text{(bulk)} \qquad \varOmega = \frac{\Omega}{\sqrt{2}} \quad \text{(surface)}$$

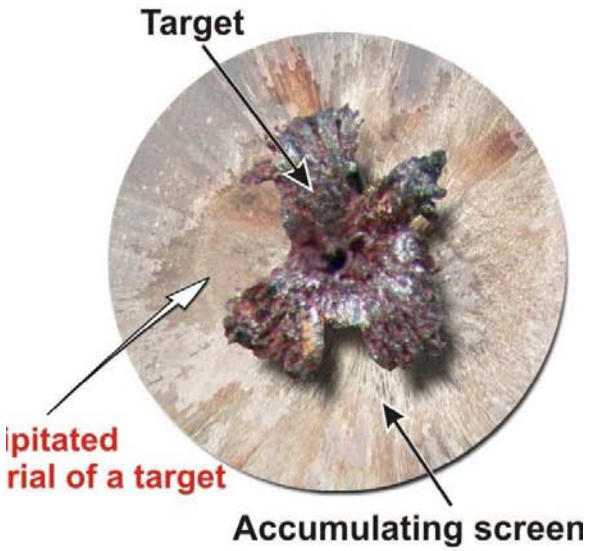
Surface Plasma Waves II





Weak Interaction Sources I

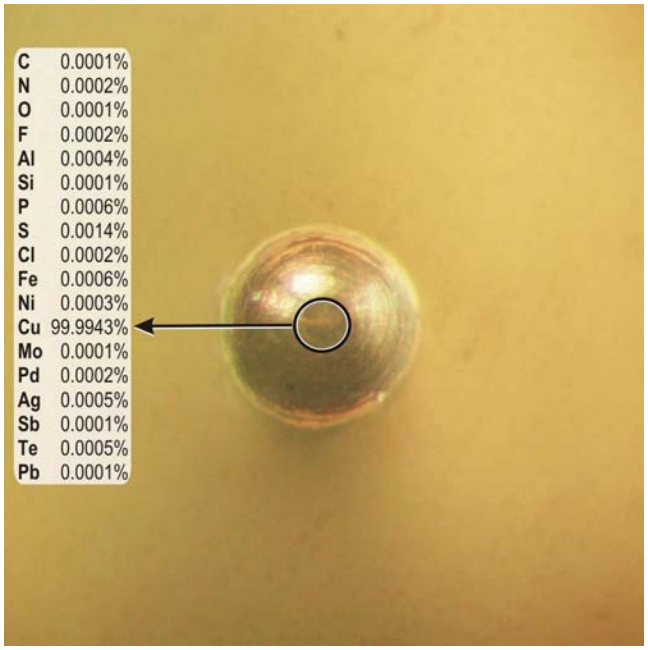


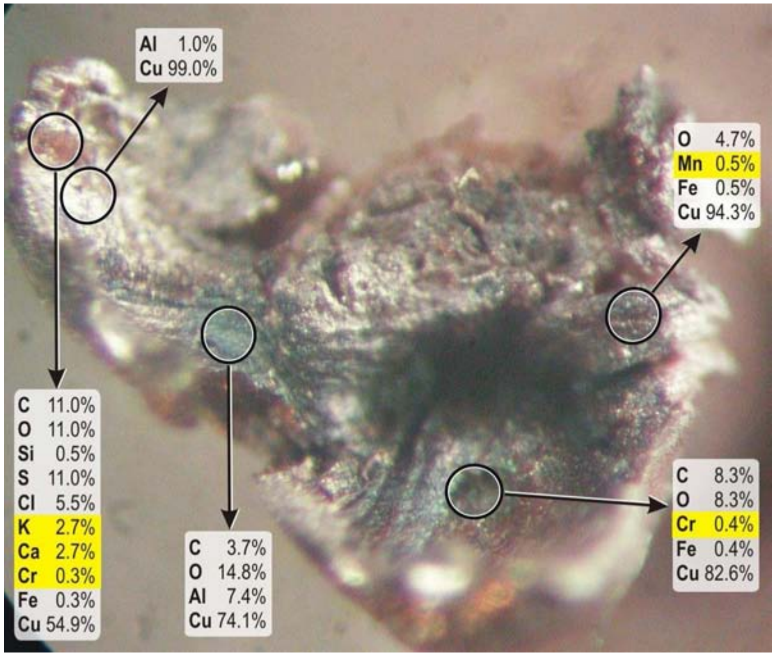


Proton21 Electron Beam is sent into a very pure Copper on the Screen Target

Proton21 After the pulse one looks for Nuclear Transmutation Products in the Remains

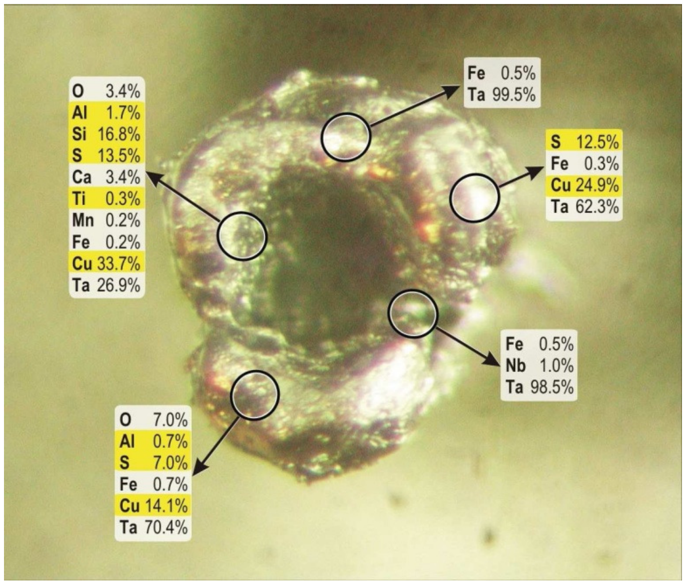
Weak Interaction Sources II

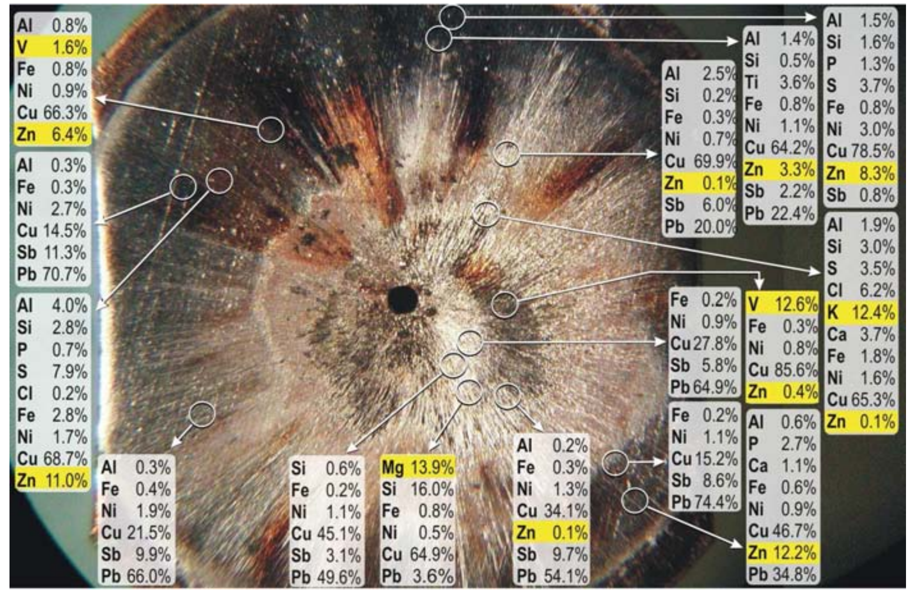




Proton21 Chemical Composition Before and After Electron Pulse

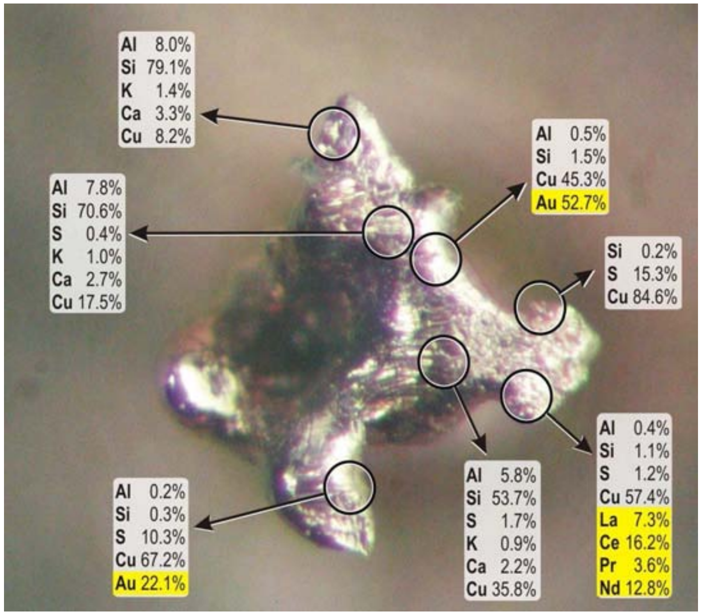
Weak Interaction Sources III

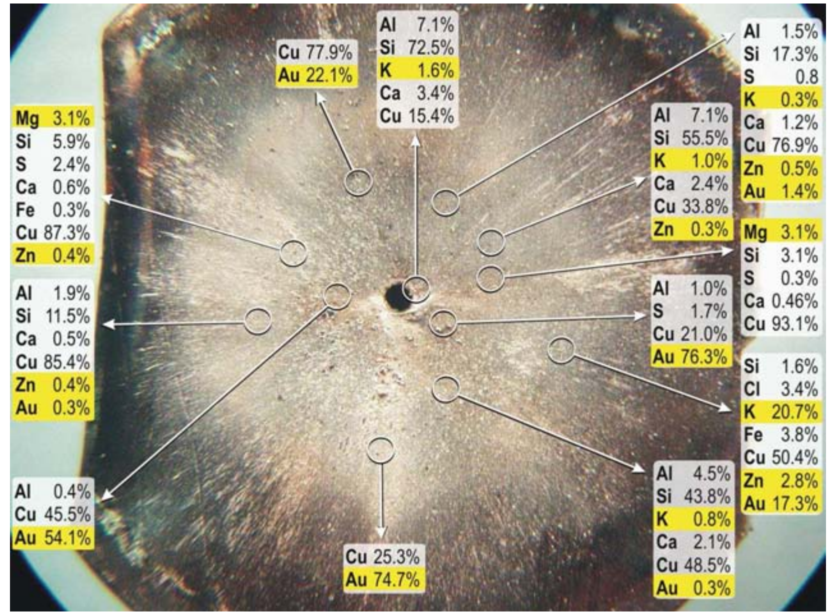




Proton21 Chemical Composition on Different Samples within the Sample Remains and on the Detection Screen

Weak Interaction Sources IV

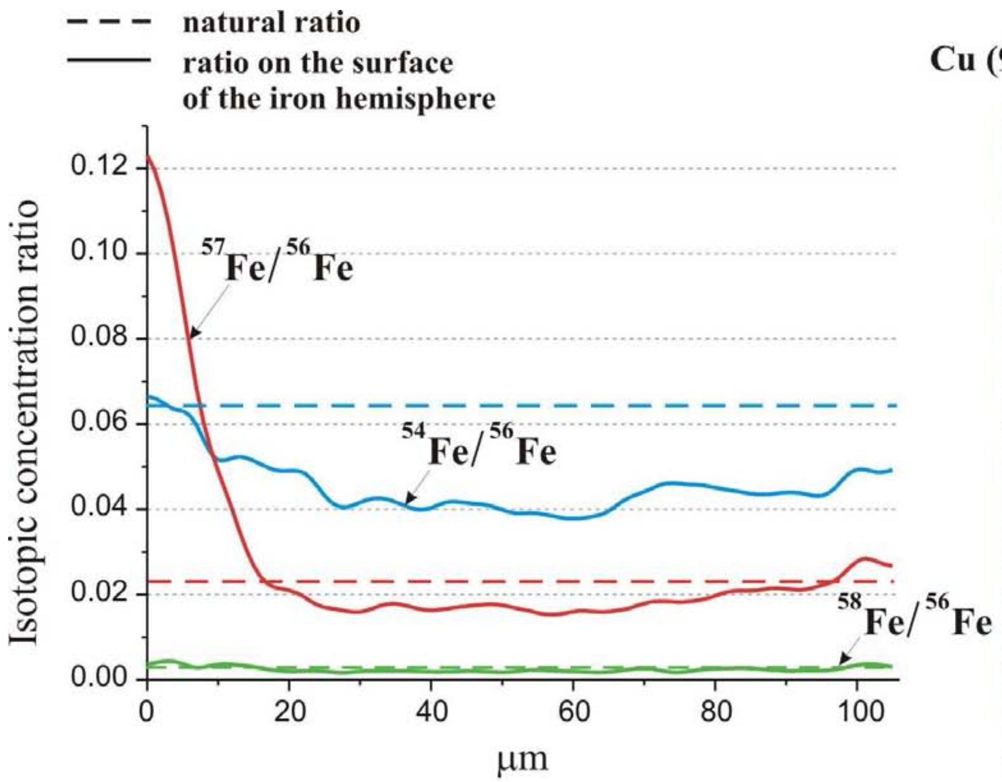


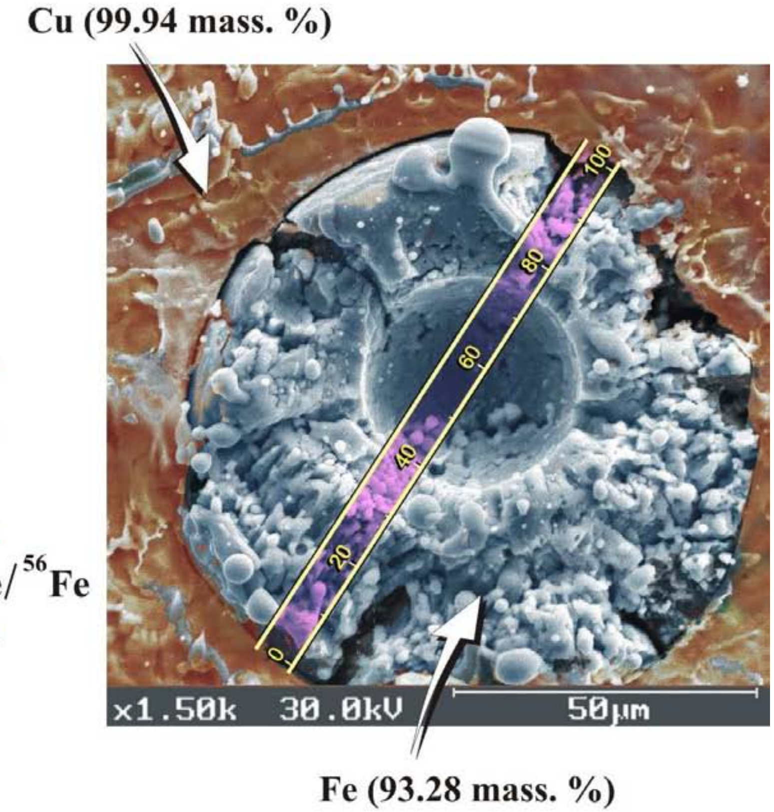


On this sample one transmutes copper into gold.

"Once you do transmute lead into gold, you'll find the market for it is very speculative."

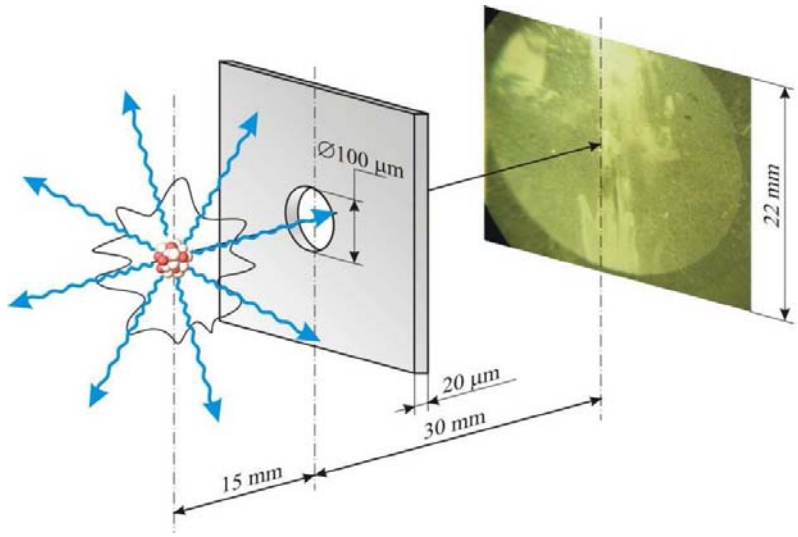
Weak Interaction Sources IV





Nuclear Transmuted Isotope Distribution does not Match the Natural Distribution of Isotopes

Weak Interaction Sources V



Astrophysical Object Producing Radiation	Energy Range in KeV	Correlation
Quasar 3C273	10-4000	0.94
Crab Nebular Cluster	10-4000	0.92
Gamma Burst	20-800	0.99
Supernova CH1987A	10-700	-0.23
Sun	200-5000	-0.9 6
Deceleration Emission	20-500	0.24

Measured Picture of the Plasma Flash. The plasma radiations distributions are very similar to those observed being emitted by astrophysical objects

"Of course the elements are earth, water, fire and air. But what about chromium? Surely you can't ignore chromium."

Conclusions

1. **Strong Interaction fission works well but for Z > 30 has badly behaved end products**
2. **Strong hot fusion has products with low Z < 30, but has hard confinement problems.**
3. **LASER induced fusion has not yet passed a large enough fusion production.**
4. **Weak Interaction LENR effects show the best prospects with the nuclear burning of Ni proved possible with signifiant heating outputs.**
5. **Clear nuclear fuels have promising future prospects.**