The rotator collapse field coupled mechanism of LENR

(LENR: low energy nuclear reactions)

J.Wyttenbach independent researcher; juerg@datamart.ch

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Uploaded version: This is an extract out of three different papers and contains the most relevant findings. Deeper details on Ni-Li-H LENR are not given in this paper. This is not a final version.

We explain why and how H* is responsible for LENR point 4.4.2. We explain which basic effect is responsible for LENR.
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Introduction

LENR (first called "cold fusion" [1]), in 1989 was the "unbelievable", that contradicted every knowledge, trained old school intuition. If confirmed, such a cold fusion could easily destroy the ivory tower - the huge pile of nuclear theory - of the century long consent among Physicists. Even worse, it would immediately stop projects like ITER.

Now it's time to solve the puzzle. The field has completed an uncountable number of experiments and there is enough evidence and data available to draw a first conclusion. We here do not mention the other so called "theories or speculations" how LENR could work. We will focus on the "physical environment" that enables and defines the outcome of the LENR effect.

This work is entirely based on public available research. Thus thanks go to J.Rothwell for maintaining lenr-canar.org, JCF, JCMNS, arXif, .., and finally google for the countless searches.

About this paper

We try here, to give an answer about what has been overlooked, - or not yet combined, within the vast field of Physics- , to give a reasonable explanation about the mechanism of LENR-like reactions. Thus the aim of the paper is first, to structure the field and second, to point the researchers to the most promising paths one should follow.

What you possibly will learn from this paper is:

- What is covered by the field named LENR
- Which type of nuclear reactions are happening in LENR (the important ones)
- Which are the structural parameters of the LENR reactions
- How the input energy of a LENR reaction gets modulated
- Which structures support the input energy storage and modulation

- The RCFC reaction overview
- The physics needed for the RCFC reaction
- Stability discussion of the RCFC rotator
- The steps from Orbit collapse to general transmutations
- Why, at the large, we see muonic physics patterns

In the first part we leave some questions unanswered denominated by a **Q(number)** to motivate the reader to start thinking.

Terms used: a_0: The usual hydrogen Bohr-radius;

1 Defining the field (of LENR)

1.1 The term LENR

What are we talking about? -

As in all new evolving research fields, early adapters try to state/define their view of the matter, with a “single” easy memorable term. *Cold fusion* was the first phenomenological term used to describe, what was seen in a milestone experiment[1]. The term *Cold fusion* correctly describes, what happened in the Pons & Fleischmann experiment. They were able to fuse deuterium nuclei at room (cold) temperature.
In fact, the term *Cold fusion,* was a mind blower for the physics community, that directly lead to 'patho-sceptical' allergy reactions. The second term to name the field, *LENR - low energy nuclear reaction(s) - ,* was invented later (around 2005), to avoid further precognitive immune reactions, when talking about “unbelievable phenomenas”.
In the mean time many other words appeared, - following Göthes logic in Faust -, which meant to set a different focus on the various aspects of the emerging field of LENR. But most of the other terms will certainly disappear as fast as they were invented.

1.1.1 What are the potential benefits of the emerging field of LENR reactions?

- Cheap, decentralized energy production.
- Nuclear reactions with a very low level of problematic waste output.
- Nuclear reactions with low radiation levels.
- Nuclear waste treatment - solving the nuclear waste crisis.

What are the potential risks of the emerging field of LENR reactions?

- Unknown amount of “new” particles radiation. (In fact muons ..)
- Unknown radiation of new EM field pattern.
- Proliferation of critical isotopes.
- Revival of old style fission in a new framework.
- “Burning off” strategic elements (Li, Pd, Ti etc ...)

1.2 Transmutations

Introduction

The term transmutation or TNR (Transmutation Nuclear Reactions) is very generic, as it describes the core behavior of all**1 known LENR reactions and also of most classical high energy nuclear fusion reactions. In a LENR/TNR reaction there are always at least two source/inputing nuclei involved, - contrary to fission, where usually a neutron is the trigger for the decay of a single nucleus. (Purist could argue that a neutron is a condensed Hydrogen atom...)

The end product of a LENR/TNR reaction is usually a nucleus with a larger mass (^{A}N) or a follow-up nucleus with at least one added proton equivalent charge. Thus the most simple reaction looks like:

$^{A1}N + {}^{A2}M \rightarrow {}^{(A1+x)}N' + {}^{(A2-x)}M' + E_{nergy}$; where M' is an optional outcome and $_{Z}N' >= {}_{Z}N$ and $_{Z}M >= {}_{Z}M'$ and Energy may be any form of radiation including particle like electron/protons positrons.

N, M, N', M' usually denote different elements of the two dimensional periodic table of nucleotides. A is the total nuclear charge, that is allowed for the isotope/element number Z the effective charge.

**1 There is well founded reason to assume that hydrogen can exist in a stable toroidal[2] low orbit form. This outcome of a LENR reaction is not a transmutation!

1.2.1 Basic symmetric type of TNR reaction

The first known, simple and best documented LENR reaction is D+D → ^{4}He! Where indeed true ("cold") fusion happens. This was also the starting reaction of the field[1].

$^{A1}N + {}^{A2}M \rightarrow {}^{(A1+x)}N'$ in this case is effectively: $2\ {}^{A1}N \rightarrow {}^{A1+A1}M$

Here the general LENR D-D Fusion core pattern of a closed D-D reaction scheme.

S1:
1) $d + d \rightarrow {}^{3}He(0.82\ MeV) + n(2.45\ MeV)$
2) $d + p \rightarrow {}^{3}He + gamma\ (5.5\ MeV)$
3) $d + d \rightarrow p(3.02\ MeV) + {}^{3}H(1.01\ MeV)$
4) $d + {}^{3}H \rightarrow n(14.01\ MeV) + {}^{4}He(3.5\ MeV)$
5) $d + d \rightarrow {}^{4}He + gamma\ (23.84\ MeV)$; fragmentation levels at ~ 20.6 and ~ 19.8 MeV.
6) $d + d \rightarrow {}^{4}He + E +$ kinetic particles not yet documented...

In the best documented LENR reaction - D-D sono-fusion [3] - **Reaction 5)** highly dominates. No neutrons, above background could be detected.

Q1: Why is reaction five preferred in LENR?

1.2.2 Basic asymmetric type of TNR reaction

An other reaction, well known to field, is the Ni(Li)H complex. In this reaction one or two hydrogen-equivalents of nuclear charge get added to Ni.

The main reactions, known from ash analysis of NiLiH-LENR experiments look as following:

S2:

1 : $^{2}H^{*} + {}^{A}Ni \rightarrow {}^{A+2}Ni$

2 : $^{7}Li + H \rightarrow {}^{6}Li + {}^{2}H^{*}$!

Which results in the following main reaction path:

3 : $^{Z}Ni + {}^{7}Li + H \rightarrow {}^{6}Li + {}^{2}H^{*}$ .. $^{2}H^{*} + {}^{A}Ni \rightarrow {}^{A+2}Ni + {}^{6}Li$

The side reactions are:

4a) : $H + {}^{64}Ni \rightarrow {}^{65}Cu$. 4b) : $H + {}^{62}Ni \rightarrow {}^{63}Cu$ 4c) : $H + {}^{60}Ni \rightarrow {}^{61}Ni$ 4d) : $H + {}^{61}Ni \rightarrow {}^{62}Ni$

Q2: The main question is: What is $^{2}H^{*}$?

Q3: Why does Ni follow an z=Z+2 rule? An easy answer is: Only ^{61}Ni is stable...

1.2.3 General transmutation nuclear reactions (TNR)

The D-D fusion was only the starting point of the "LENR" story. So far many more strange "reactions" have been found, which show a more complex, general behavior like:

$\prod n_i {}^{Ai}A_i \rightarrow n_j {}^{Ai+k}A'_{i'} + m\, {}^{Aj}Bj + E \quad i,j\ \varepsilon\{1,..,n\}\ k\ \varepsilon\{-1,..,A_{i,} + 1,..,\sum A_i\}$

S4: A complex proposed sample of a TNR reaction proposed by Uruzkov[4]:

$$2 \cdot {}^{49}_{22}Ti + 4 \cdot {}^{1}_{1}H \rightarrow 4 \cdot {}^{4}_{2}He + {}^{40}_{19}K + {}^{46}_{22}Ti + e + o(1kev)$$

The energy balance (+1keV) in the above sample, does not account for the input activation energy! This type of TNR reaction, we will call **nuclear charge redistribution or "charge redistribution transmutation"**!

Q4: Why and how do large nuclear charge exchanges happen?

1.3 The activation energy

Historically the "L" in LENR originated from the fact, that a chemist noticed that, a low, quasi chemical level *energy input* was leading to a "*high energy output* physical reaction". The later was in sharp contrast to a century long lasting knowledge, that the induction of a **sustained** fusion reaction usually needs some 10keV of kinetic (particle) energy or, equivalently, temperatures well above 100 Million degrees.
As a fact, the first LENR D-D fusion process did run at room temperature or slightly above, what was in sharp contrast to common knowledge. At that time (1989) the only, so far agreed, well known "low energy" fusion reaction was the muon catalyzed fusion, which once was heavily examined for a positive COP. An overview of muon physics can be found in [5].

As temperature and energy are not synonyms, but usually are related via complex mathematical formulas, like the Plank radiation law or the Bolzmann statistics, the term "Low Energy" is misleading or only partly describing the phenomena of the general LENR Transmutation Nuclear Reactions (TNR).

A Transmutation Nuclear Reactions (TNR) may be a LENR reaction if and only if the activation energy and the energy input to **sustain** the reaction are below a given reaction specific threshold.

1.3.1 The TNR (LENR) activation energy:

To merge/fuse two or more nuclei a certain amount of energy is needed to align them close enough in a zone where the strong force finally overtakes. According to current theory some LENR fusion reactions are depending on the weak interaction forces. This has a severe consequence, because the interaction time for a successful fusion event must be much longer, than given by strong force rules.

Classically the amount of energy (in chemistry) to start a reaction is called the activation energy, which is minimally needed to overcome the classical Coulomb barrier.

Historically physicists (and most still today) think about nuclear physics in the beam/target scheme. This old style experiments have the big advantage, that we can measure the two critical parameters of a fusion event, namely: **Probability**, **minimum energy** needed for a statistical relevant (significant) amount of events to happen.

Definitions:
X1: In a classical TNR reaction we define the activation energy to be the amount of energy to start a single TNR merge/exchange reaction.

X2: In a LENR process the **activation energy** (delivered as T,I,U,ΔP, eV) is the minimum energy input needed to start a collective reaction of TNR processes.
X3: In a continuous LENR processes the **stimulation energy** is the energy (delivered as T,I,U, ΔP, eV) needed to **sustain** the LENR reaction.
X4: The LENR COP (as usual) is the total energy output divided by the sum of the activation and stimulation energy. (We should not account for external energies that are used for e.g. mechanically propel a coolant etc.. For this purpose a second COP, called system COP, should be defined!)

E.g.: If you need 1 million times 0.3 eV to start a LENR reaction, then the ignition threshold is much higher than in a kinetic TNR reaction! But the overall effort to sustain a continuous reaction may be much lower!

2 The vanishing coulomb barrier

It is well known that the famous Gamow theory sometimes is very close to the experimental behavior of the physical reality, but also can be awfully off by factors as large as 10000!

Recently an other classical concept, that of the existence of a "simple" Coulomb barrier has been blown off. An old style physics experiment (proton beam on target[6], lowest impact energy of 100eV showed the highest Q factor!) did show LENR behavior, with a "claimed" target incident energy of less than 100eV! How was that possible? How can we overcome a Coulomb barrier with a proton carrying a kinetic energy of as low as 100eV?
Of course Li has a weak electron coulomb barrier – 122.5 eV deepest orbit, which is one more argument, that a positive charged nucleus cannot acquire much additional momentum from the negative charge. Thus, at this point, physics is challenged to find the real model of condensed nuclear matter. Currently, using main-steam physics, there exists no acceptable explanation how a nuclear coulomb barrier of more than 500'000 eV can be overcome with about 100eV (as shown in [1], point 261) kinetic energy. This is no surprise, because there currently exists no **exact & complete** theory for any measured parameter regarding nuclear reactions...

(In fact if you study [10] Mills GUT-CP, then you will find part of the answer!)

Known Facts to think about:
1 The Coulomb barrier is not a symmetric closed homogenous sphere. The classical screening potential is not of spherical symmetry and may effectively vary by a factor of more than 1000! (In fact, we know from nuclear quadrupole momentums, that a nucleus is inhomogeneous)
2 Obviously the Coulomb barrier is structured (**can be made structured!**) and allows so called "sweet spot" resonances, where e.g. an incoming charged particle like a proton (cheap to produce!), is quasi guided (close enough) to the nucleus.
3 A well structured, polarized surface (in the above sample liquid or charge polarized Lithium) can present the incoming particle (at a well defined angle) an Achilles heel.
4 In fact there is a neglected effect, we will explain later that helps to overcome the main obstacles in kinetic fusion.

a) When two spheres meet, in all cases, except with a probability of 10^{-x} (x very very large..), we will see scattering! Scattering implies that the mechanical input and output momentum vectors will **not be aligned**!
b) Any unaligned fusion will excite the nucleus asymmetrically – including rotational momentums! - and can cause complex excitation/decay patterns.

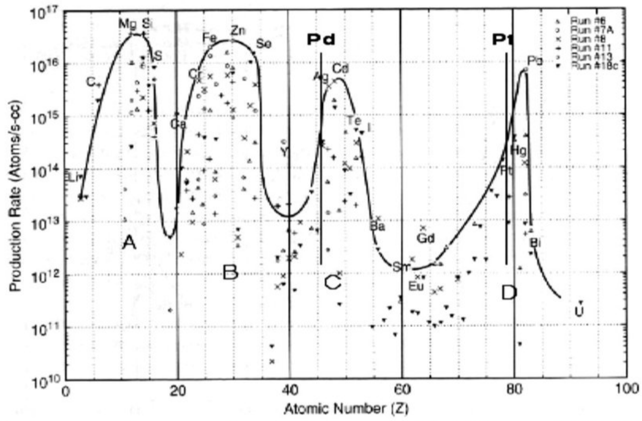
2.1 The transmutation patterns

Thousands of experiments have shown that LENR reactions generate some typical patterns among the resulting transmuted nuclei.

- Masses increase/decrease following certain rules
- There is usually not much radiation
- Mass (nuclear charge) can be redistributed!
- Potentially all, more or less stable!!, nucleotides will be generated in certain LENR nuclear charge redistribution reactions.

2.1.1 *What drives complex transmutations?*

There is one strong hint: We present an old graph (top figure) from LENR experiments compiled by Miley[14] and compare it with the experimentally measured muon capture probability of metallic oxides! [13] bottom figure.



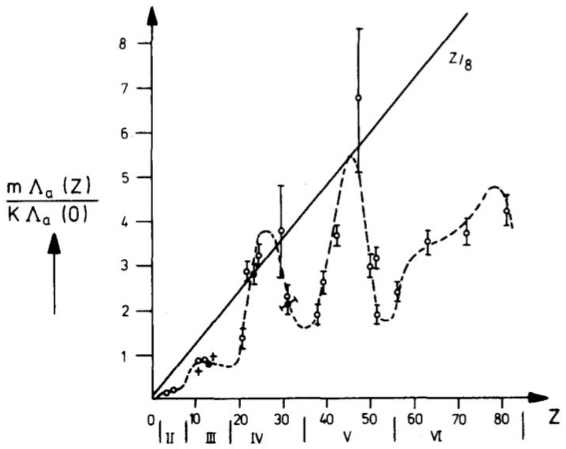


Fig. 2.2. Periodicity of the relative atomic capture probability $m\Lambda_a(Z)/K\Lambda_a(0)$ in the metallic oxides Z_KO_m. Numerals II, . . . , VI represent the groups in the periodic table to which the metallic atoms belong. The expectation of the Fermi–Teller law is represented by the straight line. Experimental data are from Zinov et al. [24a].

Both graphs show peeks for Z between 8-12, Z=28 and Z=48, also the peak around 80 is no common surprise. Additionally the graphs have more or less the same basic shape.

This is a strong hint, that a good chunk of the general LENR transmutations (**nuclear charge redistributions**) follows the same laws as **muon capture physics**. Muon capture is a two step process. First the nucleus undergoes coulomb contraction, then the muon gets eventually captured. I just recommend to study the Fermi-Teller law of muon capture first presented in phys rev. 72

1949, 399

2.1.2 The classical view of the LENR phenomena

As already mentioned, in the classical TNR experiments we shoot nucleus A onto a target consisting of nuclei B. That implies that at least one partner of the reaction has a complete (X,t) (3D+t) freedom. The target structure usually is inhomogeneous and we mostly see a full space angle of scattering reactions, involving both particles in producing new particles & radiation.

If a classical TNR event happens, then the outcome is always at least a three-body result-pattern. The main reason for this complication is the kinetic energy, delivered by the beam momentum, which must be correctly redistributed. Thus in the classical D-D fusion ^{3}H (Tritium) or ^{3}He are the dominant outcomes, because at least one proton/neutron must be expelled to balance the momenta. Under rare circumstances the momentum/excess energy could also be carried off by a Gamma quantum or by a neutrino.

In reality classical scattering is much more complex. Two nuclei meet on a vector that is the result of the momentum plane intersection. Thus at least 4 (independent) momentum vectors change. In addition each nucleus is free to rotate around 2 stable axes giving 4 (independent)angular momenta, that interact with each other over a common force exchange vector. If we add stretching oscillations, then the degree of freedom in classical two body scattering is 10, way to much for a closed mathematical solution.

2.1.3 The current LENR view of TNR reactions.

Most reported LENR reactions run at temperatures well below 2000C, thus the incident momenta of the involved reaction partners are small. If a LENR reaction creates a third body then its inherited kinetic energy will be very low (some eV).
A low incident momentum also implies a low relative velocity (large De Broglie wavelength), of the reacting nuclei, what implies that the timeframe of a reaction can be very large.
Thus the kinetic behavior of the TNR reaction product is usually entirely defined by the mass reduction energy balance of

$$E_m = (m_{in}-m_{out})c^2.$$

Q5: Why do classically educated physicists believe, that they can judge the outcome of LENR reactions by using results of high energy scattering experiments, when LENR kinetic impact energies are in the range of 1eV? (at most some some 100 eV!)

There are exceptions to the rule: As we will discuss later, if a reaction produces an intermediate state with a follow up high energy Beta-particle produced, followed by a fast decay as seen in:

$^{7}Li + H^{*} \rightarrow {}^{8}Li$ + 17.347 MeV (1.25MeV to ^{8}Li) $\rightarrow \beta^{-}$ 625. keV (790 keV Lipinski!) $\rightarrow {}^{8}Be$ + 16.508 MeV
In such a case we, see a highly kinetic (pseudo) three momentum structure. In reality first ^{8}Be gets

accelerated (by the beta electron emission) then it will split in a two momentum decay that eventually is perturbed by an additional gamma emission momenta.

2.1.4 Physical implications – kinetic pattern - of quasi “gravitational” fusion

How does the scattering result of a lattice enabled LENR reaction look like?

We could argue, that in the case of “no input momentum” we will have no scattering. But this is wrong. In a LENR fusion event there is always an initial phase dominated by a large acceleration force, that is active over a very short (typically close to $a_{0/30}$) path. The current consensus is that a below 2pm minimal inter nuclear distance is needed to trigger nuclear fusion. Finally two highly accelerated particles clash together and the resulting amount of matter is either “stable” - oscillating – or asymmetrically wobbling and possibly will decay.
If the decay is happening with a single body ejected, then usually the scattering angle is +- 180 degrees. If two bodies (including radiation) are ejected, then the process follows the general rules.

The main difference between beam-target fusion and LENR fusion is the fact, that the input/meeting angle is not following a complete random (statistical) distribution. In condensed matter the nuclei have an awful lot of time to place themselves in an optimal position for a successful fusion event. Just one example: Two Deuterium nuclei will follow their nuclear Van der Waals momenta and perfectly arrange in a tetrahedral formation, what guarantees, that a highly symmetric reaction will happen.

2.1.5 LE(NR) TNR scattering result patterns

The result pattern strongly depends on the position, where the center of the LE-TNR reaction is located.

a) LE(NR) TNR happening inside a lattice:

Optimal alignment is possible. We usually see a radial - one dimensional - point symmetry of the reaction, which can be modulated by the surrounding Coulomb cloud. (Closed cavity reactions.)

b) Close to surface:

The alignment still can be optimal, but the coulomb cloud of the reaction output, at least at one side, can be highly asymmetric, leading to a directed kinetic outcome. Up to half of ΔE_m can be carried away as new kinetic particle momentum, the other half (or more) is absorbed or scattered by the lattice.
The physical description will be a superposition of a) point symmetry and a linear behavior.
This pattern is the standard one in sono-fusion.

c) On surface

Classical case with no input momentum. The internal reaction kinetics of the fusion products will dominate the observed pattern. The degree of freedom is maximal with a lower bound given by case

d) Electron/proton beam reactions

Astonishingly report both highly reliable sites (Lipinski Proton and R.Mills Electron) that they see no harmful radiation and reaction byproducts. Thus we can conclude that the high pinch fields lead to a quasi solid-state reaction, by confining the reactants in a quasi one dimensional cylinder shaped filament.
But both experiments were not conducted with a three dimensional particle detection unit. Both assume a homogenous (isotropic) space angle of particle/radiation emission, what is highly unlikely.

2.1.6 The energy transfer of quasi "gravitational" fusion reactions

The optimal case, as we will see, of a LENR-TNR reaction is a quasi one dimensional pattern. In such a case the nucleus will undergo quasi stable oscillations.

The nature of the LENR *reaction heat dissipation* (mass loss $e=mc^2$) is still one of the "mystery questions" we must solve. Dozens of proposals have been made, which can be explained by the currently unstructured nature of the field. Basically we know from open D-D Fusion, that it leaves behind, in a average, about 10 MeV (the total momentum, under total symmetric conditions, must be split equally in two parts) of single particle kinetic energy which, in the LENR case, must be handled by a new theory. But this is only true in kinetic fusion events!

Lets make a simple thought experiment: The most basic law of physics is momentum conservation. How should two Deuteriums at rest induce a kinetic carry away of about 20MeV? Which force, if we assume a symmetric collapse (like the ^{4}D fusion proposed by Takahashi) should accelerate the resulting ^{4}He nucleus?

a) If 2 Deuterium are "LENR" collapsing to form ^{4}He, then, during a symmetric merge process, the generated nucleus has no contact to adjacent nuclei and a scattering momentum distribution other than at an 180 degrees axis is not possible. Thus, during the first merge phase it is impossible to "mechanically" (by condensed matter) carry away the momentum because a second and third body are missing.
We must therefore assume that the resulting nucleus is heavily but highly symmetric perturbed.

b) In the classical (beam target) case one (only one incoming) deuterium would hit a deuterium nucleus, that is more ore less at rest, Most likely the incoming Deuterium will be scattered and split. In most cases one of the D-D is split into two protons, where of one merges with the other "intact" Deuterium. The energy surplus (mass reduction-energy) momentum is attached to the resulting nuclei or, additionally released as gamma photons.
This can easily be explained: If you add two unaligned momentums, then the outcome (after mass redistribution) is always at least two other unaligned momentums. But .. if the two spheres do not hit in a plane (formed by the input momentum vectors an the nuclear-nuclear contact vector) then two additional momentum are created depending of the second scattering angle. Thus the output will be a 4 vector momentum that depends on a complex mass redistribution process!

c) Because ^{4}He as a result of a one dimensional LENR fusion event is not able to kinetically carry away excess energy as momentum -there are always only two symmetric input momenta!,- the only classical solution would be, to release a part of the energy surplus as a set of gamma photons or a whole range of EMF. The release of a gamma photon is very likely and will also give a neighboring Deuterium a momentum. But this should only happen if the fusion process is heavily perturbed!

Unluckily we cannot use the current accumulated knowledge about the ^4He decay spectrum, because all information we collected so far, is based on classical kinetic impact measurements. A second point is the fact, that ^4He is a perfect nucleus regarding symmetries. Thus the nucleus itself has no internal structure that will cause highly asymmetric reaction behavior.
For a classical discussion of the effect look into [20].

d) Conclusion: What happens if the merged D-D nucleus is unable to radiate and just starts to oscillate? Will this D-D* compound nucleus look like two entangled D-D's? Will the resulting strong force field show a completely new shape which attracts additional D nuclei which are pushed, by the left behind coulomb forces, in direction of the resulting cavity of the lattice?

Q6: Open questions: How will the resulting symmetrically collapsing 4He nucleus oscillate? Will we see high energetic quadrupole EM waves? (two oscillating core centers two electrons!) If we assume that the D-D meet in a perfect tetrahedral alignment?
Q7: What happens, if the impact is not perfectly tetrahedral? When exactly (meeting points) do two times two nucleons mutually hit?

Hint: For a short period of time a left behind deuterium could feel two additional electrons which will cause an acceleration towards the merging nuclei.

2.1.7 Possible way out

At a first glance the Takahashi [7][8] model of the 4D /3D collapse gives us the needed kinetic partner to carry away the surplus energy. But how realistic is it to believe that 4 deuterium nuclei can merge in a common 3D center of mass?

a) Probability
4 nuclei means 4 times the charge, which results in about 3 times the repulsive forces, which prevent the event! Further on (using current thinking about how a nucleus looks like..) there is only one solution, where we can more or less guarantees the needed symmetry. It's the sono-fusion situation, where 4 Deuterium meet axially aligned in one row and finally one deuterium, on each side of the reaction, takes over half of the kinetic momentum!
Just one simple thought is enough, to more or less invalidate such a 4D [7][8] 3D-collapse model. Nuclear processes happen in 10^{20} or shorter time frame. How likely is it, that one Deuterium out of four get's somehow delayed (by about 0.05 a_0, just vibrating at a slightly higher frequency than the others..) when it should met two other D's?. A “3-dimensional” symmetric 4D collapse is just wish-full thinking.
Nevertheless the idea that a nearby nucleus is damping the **oscillation** of a D-D fusion event, which will happen after a gravitational collapse is crucial.
Thus the focus of the so called 4D collapse – TSC model, should be shifted to a linear model and laid on the energy dissipation phase.

b) Acceleration = (given by) delta mass?

A simple calculation shows that – under the assumption acceleration = nuclear force/delta mass –

the reaction partners (D-D) can be accelerated to a speed close to 0.11c!
Q8: What shape has a nucleon under such a strong acceleration?

3 The RCFC-Reaction

What we have so far:

1 Experiments show, that well defined LENR reactions are of linear scattering type!

2 A key experiment[6] shows that in a special linear configuration the coulomb barrier vanishes!

(In fact a resonance condition occurs, which leads to a new type fusion reaction.)

3 Many LENR experiments show that nuclei seem to prefer to exchange two nucleons at the time.

4 About 100 eV "seems to be" more than enough for a "proton" to fuse with Lithium!

3.1 The rotator collapse

Lets go back to mechanics. Assume we have a hollow cylinder rotating around a stable axes. The angular momentum is given by mr^2 and the energy by $mr^2\omega^2/2$.
If such a rotator contracts $r \rightarrow r/2$ then the rotator must speed up to conserve the energy.
$mr^2\omega^2/2 = mr^2\omega'^2/8 \rightarrow \omega'^2/\omega^2 = 4 \rightarrow \omega' = 2\omega$.

This is college physics. Now we add a stable, localized charge to the rotator. Lets assume we initially have 100 revolutions/second and a charge of 0.01 coulomb, finally resulting in a circular current of 1A.

What will we see before and after the $r \rightarrow r/2$ contraction? Nothing special, the current doubles to two 2 ampere because after contraction we have 200 revolutions, with the same stable localized charge.

But what happens just after the famous rotation 1313 when a sudden event deforms the rotating hollow cylinder form going from $r \rightarrow r/2$?
Lets assume the collapse lasts one resolution. It takes less than 1/100 second to complete because during rotation 1313 a speedup happens. For simplicity we linearize the problem and note that in 1/150 second the current increases from 1A to 2A and thus we get an average dI/dt = 150!

Thus in average for 1/150 seconds a current of 150 Amperes is generated, that in addition will ramp up a strong magnetic field.

This effect only happens if charge (stable localized) is quasi mechanically force to flow faster. If you ramp up the current in an inductivity or in condensed matter (grid), then the induced fields always delay the ramp up of the current.

The RC-effect is well know in physics, but most of the time different configurations are used to generate such high pinch currents or pinching fields.

To draw a first conclusion: What will we see, if we can construct a mechanically stable charged molecular rotator with ω (f) > 10^{13} Hz ? What will be the physical outcome?
.dt = 10^{-13} dI = 10^{-5}A ? → dI/dt = 10^{8}.

We must notice that in such a configuration an ultra high current densities can exist for about 10^{-12} seconds. In addition a B field is dependent on 1/r, r being typically less than 10^{-9} m! What is leading to ultra high B-fields.

3.2 The field coupling (FC) - effect

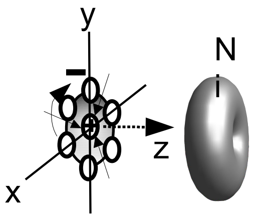


Fig. 13.1 Field coupling between molecular rotator and a Ni nucleus.

A charged molecular rotator spinning in the x,y plane produces a H field in the Z direction.

Under 3.1 we have shown that a molecular rotator carrying charge during a radial collapse can produce a very high H-field pulse, which is able to strongly distort the orbits of a neighboring nucleus. The field that causes the distortion is working long before the collapsing event has happened. Already a “small” (ring) current of e.g. 10^{-5} Amperes is strong enough to produce a significant field (H ~10^{4}) within atomic dimensions of 10^{-10} m!

In some cases, ramp-up of a rotator at lower temperature, we should also count in, that nickel, as the most interesting environment for high power LENR has a high magnetic permeability, what increases the B-fields by a factor of (at least) 100. But this amplification only works up to the Curie temperature!

Thus already in the “steady” state, before the collapse is happening, we can notice some preluding effects:

- A ring current generates an axial symmetric field.

- The superposition of an axial field with the coulomb field leads to a toroidal flow of charge because electrons are partially forced into (x,y) cyclotron orbits.

- Any nuclear orbit that is of cyclotron nature, will induce an additional magnetic moment in the core, which causes the nuclear spin axes to align with the external field.

- **If the degree of freedom of an adjacent nucleus – just below the rotator – is high enough, then the rotator axes will finally be in line with the nuclear (spin) and average orbital electron “spinning” - axes.** (This is the fields coupling – FC - effect.)

Final statement:

The RCFC rotator collapse-field coupled effect produces a nuclear environment that is optimal for a linear – one-dimensional fusion event.

Depending on the strength of the rotator collapse the final toroidal distortion can be very high, especially, when the rotator couples to a nucleus with a low z like Lithium.

3.3 The physical rotator

In Ni-Li-H LENR a rotator can only consist of Hydrogen which may be available in the following configurations: H ; H^-; H_2; H_2^+ and H_3^+. Such rotators have been found by Holmlid [11] and were discussed by Winterberg [12].
The only interesting charged hydrogen compound that is long time stable is H_3^+. Thus H_3^+ is the smallest stable molecular rotator we can build. In [9] extensive work has been done determining the recombination rates of the various forms (ortho, para) of H_3^+. At room temperature and lower pressure the recombination rate is many days. This was measured by free electron – H_3^+collisions. People always think that charge must recombine. But as soon as you reach plasma state this is no longer true. Recombination of charge obeys the same laws as photon absorption. The kinetic speed of an electron must match the orbital speed of a resonant orbit [10]. Further on if a particle has a higher J (>2) state then experiments show that such particles are more or less chemically passivated!

Removing charge – in the case of the $H3^+$ ion - leads to an interesting effect. In average the central force get's only slightly weaker! [10]. (Binding – H-H bond - energies : $H_3^+ = 4.371eV$ $H_2 = 4.478eV$; difference about 0.1 eV.). Adding the free electron to H $\rightarrow$ H^- frees about .75eV, what tells, that the overall disproportion reaction $2H_2 \rightarrow H^- + H_3^+$ is exothermic!

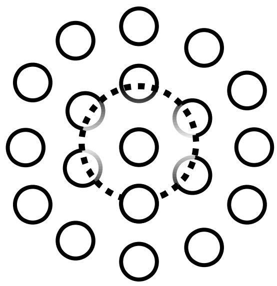
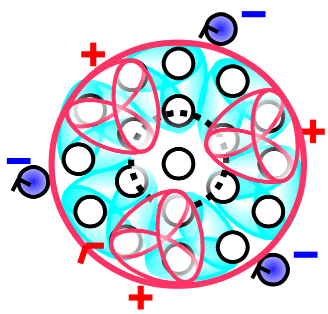
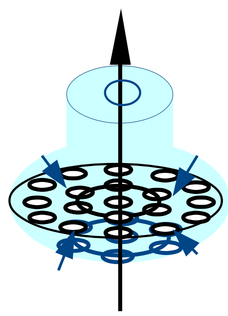




Fig. 14.a Simplified H19 Rotator 14.b H19 charged Rotator Fig: 14.c bomb shape cavity.

The most interesting complex rotator is the conjugate charged H19 compound, Fig 14.b. The stability is limited by internal resonances given by bond oscillations. If in the center sits a negative charge the H_3^+ compound will be radially stabilized by coulomb forces. But more important the maintenance of a stable radial flow around a common center.
The most interesting point of resonance is the H_2 (H-H) bond vibration mode, which is at 1.3725 E14 Hz.
Any excitation of this mode can lead to uncontrolled ramp up/ decay of the rotator.
Thus we only calculate base value energies below this point. We also to not account for the center hydrogen and will not add multiple rotators!
The following rotator kinetic energies are given at resonance frequency: H_3^+ : 22.7 eV; H7 (not shown) charged conjugate: 328eV; $H19^{3+}$: 1313eV!

Such a rotator stays/spins inside a cavity, which is providing enough stability for avoiding rotator tilt. A cavity shape (bomb shaped) that supports rotators by suppressing tilt is shown in Fig. 14.c. Thus the goal is to speed-up the rotator up to the H-H bond (inter nuclear) resonance. Any higher speed will potentially lead to high losses or (un-?) wanted instabilities.

3.4 The macroscopic rotator collapse

We assume that either a central positive or negative charge is causing the final collapse. (this is just one of many possible scenarios) The picture Figures 15a/b looks similar, if a central negative charge is causing the breakup.

a) Initially Fig.14.b we have a stable, charged H19 rotator spinning at a critical energy > 640 eV.
b) Conjugate break Fig.15.a. Liquid like curls occur → charge is no longer allocated (orbital) stable.
c) H_2-H_3^+ conjugates decay into H_3^+ and single H_2. This decay is accompanied by an orbital blow-up phase which generates additional pressure on the remaining $H3^+$ conjugate.

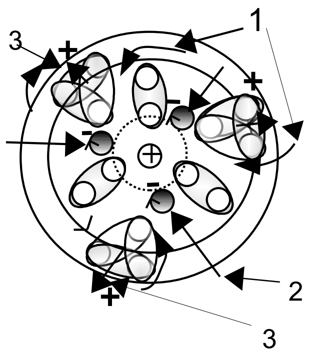


Fig 15.a

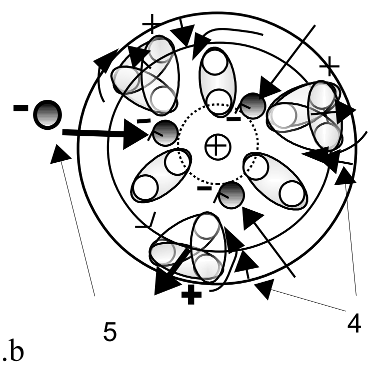


Fig 15.b

For Fig 15.a/b:
1:Local rotations start 2: Inwards forces 3: Outward forces 4: Inwards reflected forces 5: Charge forced inwards. Outer black circle is the stable cavity wall

d) Charge either moves inwards (external charge) or outwards (internal charge) given by the actual polarity of the rotator center.
e) The outer part of the H19 rotator consisting of a H12 ring (outer 12 circles of Fig. 14.a) in average moves radially outwards and gets reflected (4) by the cavity wall.
f) The forces (4,5) from the reflected momentums are finally provided inwards.

g) At the very same moment charge is either moving in or outwards. If the rotator polarity changes, then a sudden field change caused by a strong new current (opposite to the positive charge flow in the H19 rotator) will occur.
The same effects, as shown above, happens if the "positive charge flow" inside the H19 rotator is slightly moving inwards. If a molecular fragment carrying a charge is forced inwards it has to conserve its momentum. Thus it starts to macroscopically rotate faster.
h) The charge (+3) of a H19 rotator spinning at about 10^{14} Hz corresponds to a ring current of about 0.00005Amperes.
i) If a massive disproportion of the rotator happens within one (or a few) rotations, then the change in current, dI/dt, is about $5*10^9$ (in case the radius shrinks by a factor 2 or charges change place). If the charge carrying radius shrinks only by 10%, then then the change in current, dI/dt, is still $.5*10^9$! A10% radial change is not much and smaller than a factor given by a transformation of an electron orbit by $H_2^+ + e^-$ to from H_2 or caused by the proton ejection shown below.

If the rotating charges just change their places, then we don't even need a change in the rotator radius for a large dI/dt!

Such a huge change in current density will generate a very strong field, that is aligned (parallel to)

with the rotator axes. This effect will only last for a very short time frame (e.g. $10^{-12}..10^{-14}$ seconds) given by the time it takes the charge(s) to move inwards or change places. (Plus secondary effects like B field relaxation).
An other interesting path would be to look only at the H_3^+. If they loose the central force and have to keep their angular momentum, then they must speed up their rotation by a huge factor! Thus the high field can be produced in many ways.

3.5 Proton or H* ejection

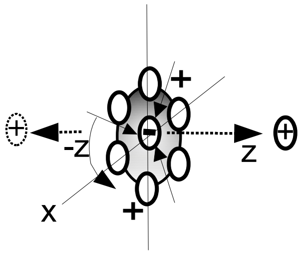


Fig 16.a

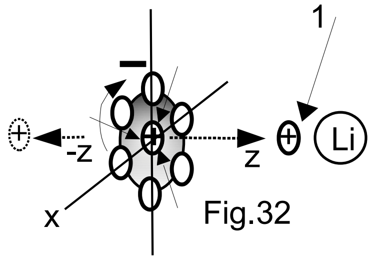


Fig 16.b

Fig 16.a: The inward forces are focused on the center of the rotator. The center hydrogen finally gets expelled.
Fig 16.b: The expelled hydrogen (proton) moving in direction (1) of an adjacent Lithium nucleus.

The next step in the rotator collapse event is the ejection of the central hydrogen. A H19 rotator maximally carries up to 1300eV of kinetic energy, which in the first collapse phase, will be partially delivered radially outside in direction of the cavity wall, where it gets reflected. (In an optimal tight cavity!) Finally, after reflection, about 40% of the total rotator kinetic energy is delivered radially inwards, which will force a radial compression. In the best case about 500eV can be delivered to the rotator center, what, at the end, will propel the ejected center hydrogen(s). We can assume that in average about 250eV is delivered as single particle (1 hydrogen atom/proton) momentum.

3.6 Finally Fusion happens

We know from the Lipinski experiment, that "any" proton moving in axial direction onto a Li-nucleus can potentially cause a fusion event. More in chapt.4

3.6.1 The possible picture

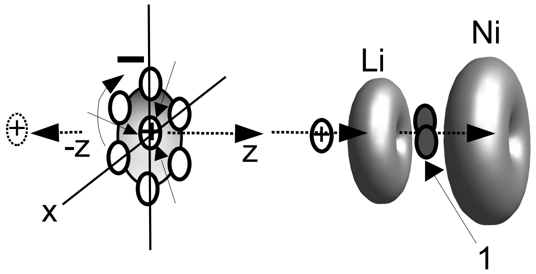


Fig 16.a

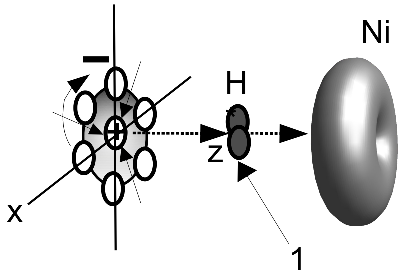


Fig 16.b

Because of the high H field induced by the rotator collapse, the adjacent nuclei's coulomb-barrier are highly toroidally distorted. Further on do in average all forces try to align the reacting partners - rotator nuclei – in the axial dimension. A charged particle like H+ will additionally be confined by the H-field and "fly" in direction of the coupled nucleus center.
An uncharge particle like H* or H_2 will be axially focussed by the mutual coulomb forces (see below) interacting with the toroidal field, as long as it stays inside the torus ring of maximal charge!

From the resulting ashes of Ni-Li-H LENR the two reactions given in 16.a,16.b can not be distinguished. Both seem to run in parallel. Only out of the relation between $^7Li \rightarrow {}^6Li$ depletion and $^zNi \rightarrow {}^{z+2}Ni$ produced, we can estimate which path is more frequently happening.

4 Reevaluation of the Lipinski Experiment

The Lipinski experiment presented in [6] (a patent) is a milestone LENR experiment. Lipinski (in fact S. Lipinski, & H. Lipinski) investigated, in countless experiments, under high standards the fusion reaction between various mixtures & states of Lithium, under the influence of a varying proton beam. For us the experiments, where Lithium is provides as a thin disk, is the most comparable with the NiLiH case.
Originally Lipinski in [6] (reposted under [19])developed their own theory about the high reaction rate seen in various Li H+ fusion events. They too overlooked the current driven RCFC-effect, which is finally responsible, to align the proton momentum with the Lithium axes.
According to R.Mills [10] the Lithium nuclear axis is (precision) rotating at an angle of 60 degrees Fig: 17.2. Exactly this 60 degrees have been found by [6] to be the optimum angle for the proton impact on a Lithium surface.
Just remember that chemical bonds go over the outer most electron and therefor the inner two electrons and the core are to a certain extent flexible.

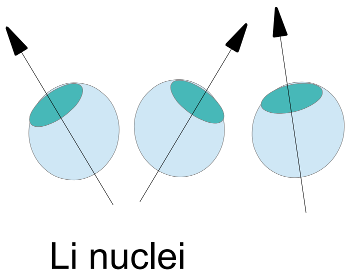


Fig: 17.1

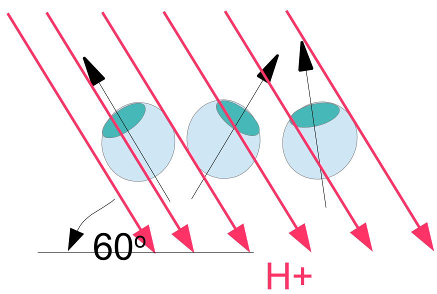


Fig: 17.2

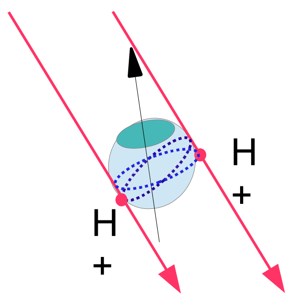


Fig: 17.3

How does the effect work in the Lipinski experiment?

Lipinski used a thin Lithium disk surface Fig: 17.1 that was exposed to a steady beam of protons. Initially the surface (and some layers below)Lithium atoms are free to align there spin axes at the fixed angle seen from plane surface.
A proton beam Fig: 17.2 is equivalent to a current flow of positive charges. Positive charge flows along the Li nucleus and has the same effect as a central E field. It is obvious that the (+) current (+ charge) density is highest in the equatorial region Fig: 17.3 (red dot), because most charges have to flow along a circle (in z – axial/beam direction) finally "meet" at the equator.
Such a positive charge radially compensates negative charge and causes nuclear bound electrons to move (in average) away from the axial "center" to the outside Fig: 17.3. The superposition of the

new orbits Fig: 18.4 to Fig: 18.5 (final state) leads (ideally) in average to a new circular current that flows perpendicular to the proton beam.

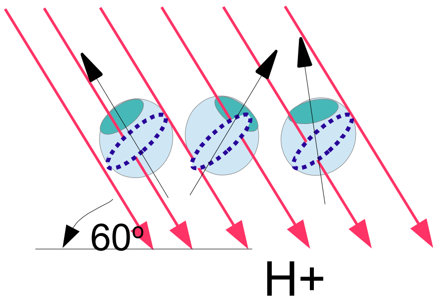


Fig: 18.4

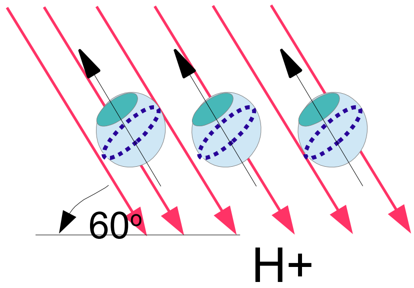


Fig: 18.5

The self induced field caused by the moving Li-orbital charges (s_1 electrons), partially moving in a cyclotron like orbit, forces the uncoordinated Fig: 17.3 Lithium nuclear axes to position in line Fig: 18.4 with the proton current and perpendicular to the induced orbital current.

Thus any following proton hitting a Lithium nucleus, will do this under close to optimal conditions! **A perfect hit in line with the spinning axes generates a scattering result that is free of angular momentum exchange and thus significantly reduces the freedom of the resulting nucleus to go into an unstable excitation.**
Further on: The coulomb barrier in spinning axes direction seems to be at least **10^5 times weaker** than in radial (orthogonal to spinning axes) direction. This can only be explained by a new nuclear model, or with a charge distribution as calculated by R.Mills [10].

4.1 The scattering picture

There are fundamental differences in scattering between equal and opposite charges. First the situation for equal (negative = blue) charges:

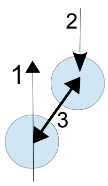


Fig: 18.1

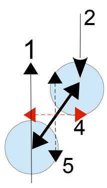


Fig: 18.2

In all drawings the forces pointing inside/outside the paper are not shown, but are analogous to (4) etc.. Spin is neglected too! Forces are shown relative to the common center of mass only.

Fig: 18.1 The axes of the nucleus is depicted by (1), the momentum vector (2) of the moving particle parallel to axes (1). (3) the force vectors of charge/momentum interaction. (4) the scattering forces, (5) repulsing forces.
Now we show a proton (red dot) that moves in direction of a Lithium (negative) coulomb-barrier. For slow protons it is enough to look at the “orbital electron” interaction.

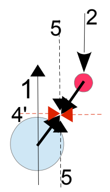


Fig: 19.3

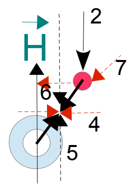


Fig: 19.4

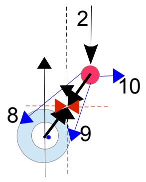


Fig: 19.5

Now, in Fig: 19.3 we see that the scattering forces get inverted and becomes attractive. The same is true for the repulsive forces. Overall opposite charge shows a focusing behavior.
In the case of Lithium that is pre-polarized by the constant proton beam, we see two additional forces. The H field Fig: 19.4, co-linear to the axes may compensate any drift Fig: 19.4.(7) in a plane perpendicular to the axes. This is a stabilizing force.
If the Lithium nucleus is heavily distorted by the H-field, then the center of charge, as seen by the proton, will move slightly in direction of Fig: 19.5.(9) the momentum axes(2) of the incoming proton. This looks like a defocussing force Fig: 19.5.(10), because the averaged sum of the forces (8) & (9) is pointing to the displaced center of charge. Such a net force(averaged sum of the forces 8 & 9) can also cause an unwanted tilt of the Lithium axes.

4.2 The pinch wave

The polarization of the Lithium nucleus is only of temporal nature unless the frequency of the incoming protons does not provide a resonance condition. If the distance (passing time interval) between two following protons is too long or the proton is passing to fast, then the polarization of the Li-orbit will relax again. Depending on the relaxing constant, we will see the same behavior as in the RCFC effect because in average charge is moving radially inwards.
This pinch effect starts, when the proton leaves the equator of the Li-nucleus and the charge (in average) flows back. The question that arises is whether the pinch effect will propagate to the nucleus behind and how deep (below lithium disk surface) such an effect will be effective.

Thus a stable current of protons induces the same effect as a rotator in a Ni-(Li)-H cavity. In fact the Lithium atom itself becomes a rotator.

In realty the story is somewhat more complex as we will discuss in chapt. 5.

From the Lipinski experiment, we can deduce, that the lower the proton energy (the slower the proton) is, the higher the overall nuclear reaction Q factor gets! Thus there must be an optimal frequency, where the close to surface Li nuclei all get polarized in the wanted, optimal fashion! This will greatly enhance the probability that a proton meets a Li nucleus at an optimal (180° axial) angle.

This effect of axial "vanishing of the coulomb barrier" has been overlooked (really??) by most current experimenters. Further on this effect, in condensed matter, can (strong enough) only be produced by a stream of positive charges (protons or other nuclear charge), that hits a nucleus with flexible orbits. Luckily both Lithium and Nickel are excellent candidates!

4.3 The full rotator collapse field coupled (RCFC-) effect

If the collapsing rotator is inline with a neighboring nucleus, then the short-time occurring high energy-density magnetic field will toroidally distort (see Fig. 20 below) the outer electron shell of a neighboring Ni/Li nucleus. This effect is due an overlay of a cyclotron radius with the orbital wave-function. For a concrete calculation in case of Hydrogen see [2].

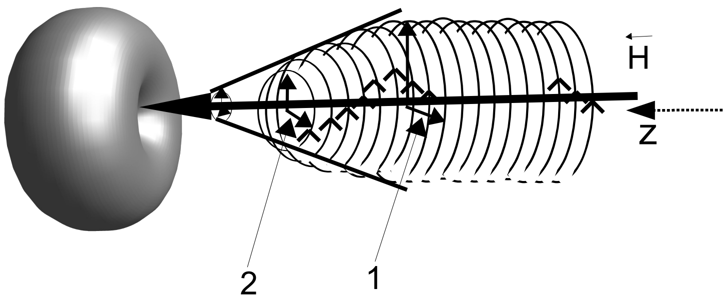


Fig. 20. The radial collapse of rotator bound charges will induce a strong short-time H-field, caused by the angular momentum conservation induced rotation speed-up, when moving inwards. Further on as the radius collapses from (1) to (2) the magnetic flux density increases quadratically with the reduced radius.
In the Lipinski case we expect that the homogenous flow of protons causes an oscillating Z pinch field. The follow proton meeting (hitting) the nucleus should arrive, when the first proton(s) caused the strongest H-pinch effect.

In the Lipinski case, neighbor (top, bottom) nuclei can be responsible for the strong pinch field, which can for a very short moment completely distort the whole Lithium electron coulomb barrier.

4.3.1 Effects of toroidally polarized nuclear orbits

A toroidal electron configuration of a nucleus is responsible for two important effects.

a) There will be no spherical scattering because there is no longer a homogenous charge (electron coulomb orbits) with a single center. In the extreme toroidal case the “center of negative charge” is a circle!
The probability for a fusion event is dependent on the meeting angle, which defines how much energy is delivered for overcoming the nuclear coulomb barrier.

If two spheres (spherical charge distributions) meet, then there will always be scattering. There are no forces that enhance the probability for a 180º degree (momentum) meeting point

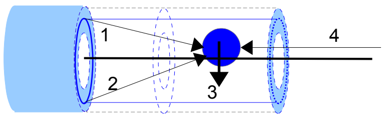


Fig: 21.1 showing a particle of same charge moving (4) axially inside the circle (toroid radius) of maximal charge density. The repulsive forces (1) and (2) sum up to a net force (3) which moves the particle in the direction of Torus axes! This works also for "neutral" particles like Hydrogen because in the near field the charges to no cancel!

b)
1) A toroidal electron configuration will try to align with the (externally) generated field, because the polarized electrons – going into cyclotron like orbits - issues a force on the center of mass.
2) A proton moving in direction of a nucleus with a (partial is enough) toroidal electron configuration, **will be guided by the field and slightly defocused** on the center of the nucleus, if it is moving inside the circle of the charge center. The trajectory will look like an spiral with a slightly decreasing radius around the common axes.
3) A normal hydrogen or H* moving (axially) in direction of a nucleus with a (partial is enough) toroidal electron configuration, **will be focused to the center of the toroidal cap**!!

4.4 The crucial final Li + H+/* question

What did Lipinski(s) see?

Correcting a minor error:
Citation from patent [6]:
[0092] The HLFD creates low energy proton-lithium fusion reactions that release helium ion fusion byproducts with the indicated kinetic energies. The average output energy per fusion event for standard metallic lithium (Li-6: Li-7) = (7.5%: 92.5%) is about 16.21 MeV. p + Li-6 ⟶ He-3 (2.3 MeV) + He-4 (1.7 MeV)

p + Li-7 → He-4 (8.6 MeV) + He-4 (8.6 MeV)

[0262] The measured particle peak energies that exceed 8.6 MeV are believed to result from "double counting" that occurs when two or more helium ions are measured concurrently.

If ^{7}Li fuses with hydrogen (not a proton) then exactly 17346824 eV of mass defect (excess-) energy are produced, that is maximally delivered (if equally then 8.67 MeV) to two ^{4}He nuclei. The peak width is 108keV thus higher energies are OK. The mass-equivalent of an electron of 511 keV must be subtracted in case a proton fusion would happen! Then in fact higher peeks could not easily be explained.

4.4.1 Most likely reactions

The most likely reactions of ^{7}Li + $H^{+/*}$ have Beryllium as an intermediate step: ^{8}Be has a resonance at 16.626 MeV (-108keV peak width) which together with average 625 keV β− energy of ^{8}Li is very close to the above 17.35 mass excess for ^{7}Li + H* → ^{8}Li fusion

Thus the reaction is either :

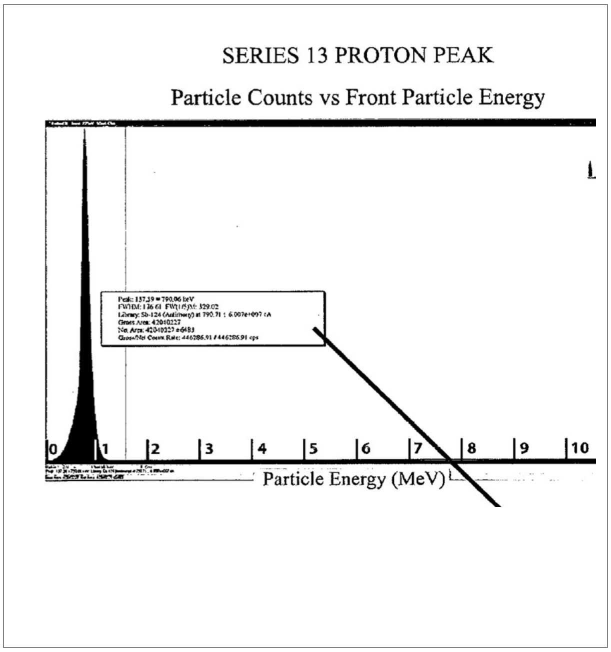
1:) $^{7}Li + H^* \rightarrow {}^{8}Li$ + 17.347 MeV → β− 625 keV (790keV peak intensity Lipinski) → ^{8}Be + 16.508 MeV → ? not known state or:

2:) $^{7}Li + H^+ \rightarrow {}^{8}Be$ +16.836 MeV → 2 ^{4}He (2 α 8.313 MeV average) + (2* ?) 108keV peak width – well known transition.

There are only two explanations for what happened in the Lipinski experiments.

1) The Lithium toroidal electron configuration allows H* (most likely stable toroidal Hydrogen see[2]) to get close enough in contact with Lithium and finally fuses – leaving the electron behind. ^{8}Li is known to emit a β− electron (with 839.9ms half time) and going to ^{8}Be, but if this electron is just left behind then the reaction switches to 2)!

Toroidal Hydrogen may be produced because a slow proton, on then flight may resonantly pick up a collapsed s_1 electron orbital staying in front of Lithium.
2) The Lithium coulomb-barrier in exact (spin) axial direction is "virtually inexistent" = very low.



Citation[6]:
[6]FIG. 8 shows the front proton!.. backscatter counts per second (CPS) peak for proton gun energy about 225 eV, bias voltage about negative 222.6 volts, and reaction chamber vacuum pressure about 3>< 10"4 Torr in series #13 of experimental tests.

Fig. 22.1 out of [22]

4.4.2 Li-H(+) fusion conclusion

If we look at Fig. 22.1 (figure 8 of [22]), then we see, that Lipinskis show a perfect Beta spectrum (exact cut-off) for a 1.25 MeV mass excess of the $^{7}Li + H^* \rightarrow {}^{8}Li$ reaction! **As a result of an $^{7}Li + H^+$ fusion such a signal would never occur!** There is a known ^{8}Li gamma line at 980.8 keV with t ½ 8.2fs, which may be responsible for the asymmetry of the measured peak, what further confirms the hypothesis.

Thus we can conclude that the ^{7}Li-H fusion reaction in fact runs over H* which is coupling with ^{7}Li to form intermediate ^{8}Li! This is also confirmed by the fact that Lipinskis measured the spectrum in direction of the proton beam. We assume that only 180° scattering is possible due to momentum conservation.

Short summary of $^7Li + H^* \rightarrow {}^8Li \rightarrow {}^8Be$ reaction energies:

Excess-energy : $^7Li + H^* \rightarrow {}^8Li$ = 1'250'447.9eV
$^7Li + H^* \rightarrow {}^8Li \rightarrow {}^8Be$ 16'004'536.6eV
$^7Li + H^* \rightarrow {}^8Li \rightarrow {}^8Be \rightarrow 2\ {}^4He$ 17346824 eV.

Known Alpha/Gamma levels of ^8Be: 16.922Mev; 16.626 MeV 3030MeV all at J^n =2

Lipinskis measure a peak at 790keV. => 17'346'824 -790'060 = 16'556'764 what is very close to the known ^8Be alpha decay radiation level (16.626 MeV) which has a peek width of 108keV! What well includes the above measured value.

Lipinski (in Fig.8) only reference $^{209}At(85)$ which in fact has a relative intense line at 790.2 keV at an excess energy of 2.323MeV. But then they should also see the intense follow-up 195keV,781keV signals and finally the strongest (90.9%) signal at 545keV!
Thus simply: Lipinskis cannot explain the measured signal.

There is also a second measurement of the fusion reaction signal (^8Be alpha decay) which is independent of the proton beam.

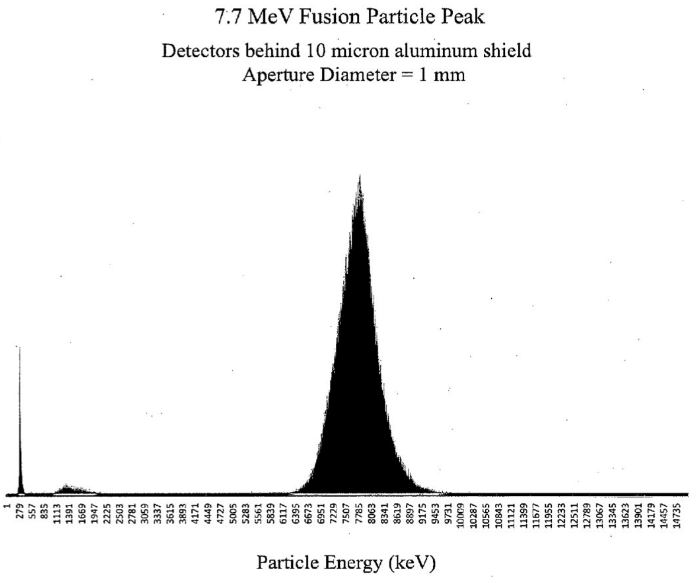


Fig. 23.1 Fig. 14 of [19] ^8Be decay radiation

Energy calculations: Maximal excess energy 17346824 eV Max. ^8Li excess 1.25MeV. Electron rest mass 0.511MeV. (electron is missing in ^8Be after ^8Li beta decay!)
Effective mass excess energy available in MeV: 17.346824 – 0.511 - 1.25 = 15.585824 = 2 * 7.79 MeV as seen in the spectrum.

H* is toroidally distorted Hydrogen equivalent to a orbital (electron) "J" quantum number > 2 . H* is electrically neutral and has a large excess negative charge aligned in axial direction. (see 5.1.2) In the extreme, the polar charge density is going to zero. Further on the proton inside the quasi-cylinder shaped electron orbit is free to move. In the Lipinski experiment the reacting Lithium nucleus is practically unshielded because his electrons, to a great extent follow a cyclotron radial distribution.
If the nuclear charge obeys the same rules as orbital charge, then the internal and external H field

will lead to a dilution of the polar charge density, what explains – to a great extent - the reduced coulomb barrier. Classical experiments that investigate such an effect on a more deep level can be found in [24].
Further on the squeezed electron orbit will slightly accelerate both nuclei towards their common center of mass, because the center of charge is flexible. (The nuclear repulsion will somewhat delay the proton.)
What we must elaborate is how strong can a toroidal H* field screen the nuclear (proton) charge and to what extent do the ultra strong fields polarize (polar charge dilution) the Lithium nuclear charge.
Just remember, that a normal hydrogen electron configuration is not able to significantly screen the proton, because the electron simply will switch to the Lithium ion! Thus one key question that must be solved is: How deep a_O/x can a toroidal electron configuration be stable in front of nucleus if the orbit is stabilized by a strong H-field?

4.4.3 What else interesting did the Lipinskis find?

There was one series of experiments with an alternating (800,..,1600Hz) bias field and varying bias voltage. Applying a positive bias to the lithium disk will mobilize the surface layer lithium. It can therefore adapt much faster to the field of the incoming proton current. The particle count (number of fusion events) increased with the bias frequency and with lower bias voltages!
This is what we would expect from our model. Higher (+) bias voltages would lead to evaporation of Lithium what destroys any coupled field effect (has been shown by experiment) . Higher frequencies shortens the relaxing interval of the polarized nuclei, what implies they in average stay longer in the polarized mode (has been shown by experiment).
An other Lipinski experiment (0251)[6] shows that below a critical (+) proton current the particle count significantly decreases until a the low voltage effect again takes over. But the nature of the measured low energy particles has not been disclosed. Most likely the reaction happened deeper inside the lattice..

Series 25 (0275)[6] tests shows that the particle count has a complex dependency in regard of the bias voltage. This points again to a resonance between current and particle speed, that are responsible for the polarization

The output power calculation (0278)[6] is critical. In our model with an 180º fusion angle, we expect particles initially to fly in a very constraint angle. Thus Q-factors of up 7000 seem to be a very optimistic assumption, unless proven by calorimetry. Further on, we have no detailed explanation (type of particles) how a current of 10mA = $6 * 10^{16}$ charges can produce the calculated $5.22\ 10^{16}$ particles...

4.4.4 What is to do ?

The Lipinski setup is a very interesting testbed for the RCFC (and other effects too!) effect. The above mentioned parameters obviously show convergent behavior and a systematic experiment, knowing the physical reality, will bring more clarification. Of course such a setup must include particle measurement with varying angles!

The explanations given for the Lipinski setup can also be used (with some added details) to explain most liquid and plasma arc-electrolysis reactions, including the SUN-CELL.

4.4.5 Summary of the low energy (100-400eV impact) RCFC reaction

The following steps are needed to induce a low energy LENR reaction.

In the Ni-LiH case:

RC-only LENR

- A stable rotator must build up and couple to Lithium.
- Enough energy must be stored in the rotator.
- The collapse of the rotator must deliver enough energy to a center Hydrogen.
- Lithium must be present in the direction of ejected hydrogen (proton or H*).

RCFC-enhanced LENR

- Rotator charges flow inwards and get accelerated or
- Rotator charge changes polarity
- A short time very strong H-field builds up
- The collapse of the rotator must deliver enough energy to a center Hydrogen.
- Lithium or Nickel must be present in the direction of ejected hydrogen (proton).
- The rotator field nuclear coulomb-interaction will enhance the probability for a successful 180^o meeting of the nuclei.

RCFC Li-proton case

- Hydrogen is provided by a beam (not by a collapsing rotator)
- The (pulsing) field is built up by polarized electron orbits of Li, which play the role of the rotator!
- The self-alignment of Li spin axes, driven by toroidal outer Li orbit, with the incoming proton beam is key for an optimal delivery of the "incoming protons" momentum to Li.
- A nucleus inside a toroidal electron cloud has a large z-axes freedom [2], which can be used for a harmonic excitation. It is very likely that the alternating bias frequency (e.g1600 Hz.) leads to an acceleration of the nucleus, which easily can double/multiply the impact energy!

5 Possible high energy rotator collapse

The transmutation picture of some Ni-Li-H experiments show, that an other class of reactions is possible. We must notice that, as said in 1.2.2, Nickel undergoes transmutations, with adding nuclear charge in steps of 2H equivalents! Further on we see, that a wide range of elements, roughly covering half of the period table can be generated, thus elements that have lower or higher charge (A,z) than Ni.

Thereof it is obvious that the Ni-Li-H reaction must look as following:

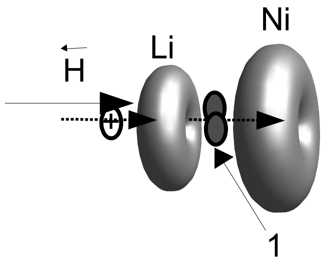


Fig.26.1: The first proton/H* hitting a ^{7}Li nucleus causes Li into the more stable ^{6}Li configuration by ejecting ^{2}H* in direction of Ni.

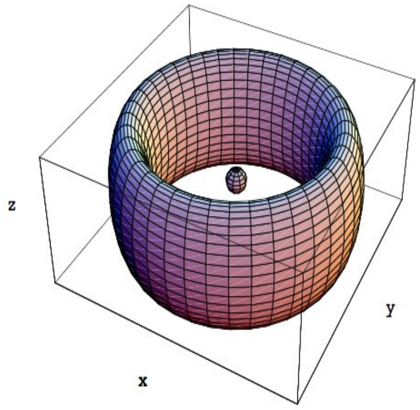
Such a reaction as given in Fig.26.1 above certainly needs more input energy as a low energy RC collapse can deliver. It will also be better supported, if the neighboring Ni nucleus gets aligned with the momentum delivered to Li.
In fact do classical experiments show, that excited ^{8}Li has many levels of Neutron ejection, but the excess energy (1.25MeV) of the built ^{8}Li nucleus is to low for such an explanation. The only fact that we must note is that the ^{8}Li state is highly stable in time dimensions (T1/2 = 840ms) of a nuclear reaction!

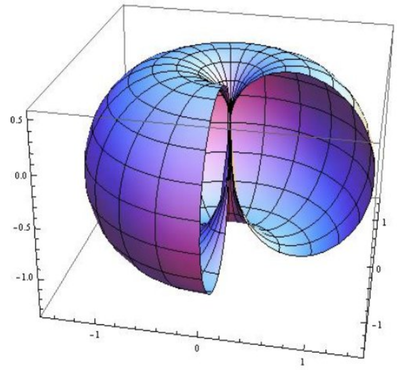
Thus we need a new explanation

5.1.1 Prerequisites for a strong coupling

Since about 30 years there are intense discussions in what form, if ever, a collapsing hydrogen orbit can deliver a part of it's sub-Bohr potential energy to a physical process.
One effect rarely accounted for in the overall discussion is the mixture of quantum/orbital effects with “mechanical” effects. Many chemical reactions are not orbital like energy flows. Higher bond energies must be mediated by kinetic momentum exchanges. The so called hydrino resonances delivering kinetic momentums are based on sound experimental evidence. The stability of the hydrino state is an other discussion, we will no dig in.
Thus, in a first conclusion, we can assume that such disproportion reactions as described by R.Mills and measured by others too, can be a short time source of additional freed input energy, that can be used to drive a rotator based LENR reaction.
If a rotator collapse can produce a very strong field, e.g. by undergoing an r → r/5 collapse the resulting field energy density is increased by at least a factor of 125.

5.1.2 Proposed higher sub-Bohr orbits





Pic.4 The chart of function $\left|P_l^m \cos(\theta)\right|^2 \sin(\theta)$ at $l=-\frac{1}{2}$ and $m=0, \theta\in[0,\pi], \varphi\in[0,2\pi]$

Fig.: 27.1 Argingazin [2], p22 fig.8 Fig 27.2 Danghyan [15] p.6

In 27.1 above, the exact potential C(z) for toroidal hydrogen is plotted, at B >= B0 = $2.4 \cdot 10^9$ Gauss

Argingazin [2] did his work as follow up work and conclusion of Santillis experiments with high currents running through water and hydro-carbons. Santilli produced Hydrogen gas with a higher density (about 10%) than normal. He also produces other hydrocarbons with interesting features. He is the only person that officially sells “hydrino like” hydrogen that is magnetically bound to other molecules.
Santillis' (a top physicist!) work has been suppressed like most other findings in the field.
Argingazins toroidal hydrogen is a physical fact, as you are free to buy it at the “magnegas company”. A field of 10^9 Gauss is typical for atomic distances along a conductor carrying a high current (10^4 A). Further on additional (potential) energy can be extracted because the toroidal hydrogen corresponds to a sub-Bohr level. The orbital current of toroidal hydrogen corresponds to about 0.6 Amperes!

5.1.3 What experiments tell

Luckily enough we have plenty of experiments, what in real live physics always has proven to be more important than any theory! Deeper sub Bohr level radiation has been measured many times and such deep-orbit intermediate states are thus experimentally confirmed.

Danghyans approach Fig 27.2, which is based on a slight modification of QM, delivers a first sub Bohr level potential of -52.8705*eV*! This is close to Mills short-cut approach of two times -27.2eV= -54.4 => H(1/2). Thus from an experimental point of view, it would be very difficult to distinguish the two different XUV break up point.
In fact, if you look at picture at p.47 of Mills XUV measurements in[16], then you may note that the calculated cutoff of 23.45nm (**using Danghyans** value) for mechanically induced XUV breaking radiation is exactly in line with the situation measured in this experiment – that means, fits better

than Mills calculation.

Higher sub-Bohr resonances have been shown in [22][23]. [25] Shows that in electrical arc discharges also higher (multi keV) hydrino like resonances can occur. Va'vra's experiment has been carefully designed to exclude all other physical probabilities for high energy X-ray production.

The fact is: Sub Bohr level orbits (also in QM approaches) exist in chemical bonds and lead to certain unexplainable destructive effects (in solid catalysts), which can only be explained by mechanical thrust! Like it occurs in the H-O-H building reaction.

5.1.4 First Conclusion

In the following we will assume that in the Ni-Li-H case, any ignition of a strong RCFC-LENR reaction leads over a follow up orbit collapse (hydrino like disproportion reaction) of the atomic rotator shell. Depending on the resonance level of the rotator, up to 1.3keV can initially be harvested. (In fact this can be much higher if rotators run stacked - in parallel)

What is needed for toroidal polarization of Hydrogen? We can simply compare the energy levels. Complete toroidal configurations of the Hydrogen start at QM -337eV orbits (1360 eV Landau level!) – we see radial collapses of up to a factor of ten. The classical calculation deliver 340eV (kinetic energy) for orbits at a radius of 2pm. (Epot ? -680eV) Thus about 340 eV must be delivered to equalize the orbital momentum, what finally produces an additional 340 eV of excess energy in the Mills case. (In the case of [2] the energy to produce the field is not given, thus a balance cannot be made)

Further on these collapses are amplified by the Z-pinch effect of the dying field. (SUN-Cell – collapsing current- evaporating outer ring!) In the Ni case further pressure is delivered by the increasing radius of the surrounding Hydrogen due to heat dissipation. In the Lipinski case we see a standing (Alfen/sheer?) wave of toroidally oscillating inner electron shells.

5.1.5 Second collapsing phase

At the point where the first higher "hydrino-like resonance" occurs, more additional kinetic energy – in average corresponding to half of the potential energy lost during the radius contraction - is pumped into the cavity. As the rotating hydrogen is at high momentum there is only a low degree of mechanical freedom (assuming a bomb-shape like cavity!). The mean maximal free path is maximally enlarge by the amount of the shrunken radius. Thus more or less instantly higher hydrino resonance will happen because of follow-up events, until the collapsing radius goes down to the critical below 2pm range, where the nuclear force takes over - if this (r <= 2pm) phase lasts long enough.
During this phase a part of the hydrogen in the cavity will kinetically be heated up to a plasma state and there will be enough free carriers for sustaining and amplifying the ring current.

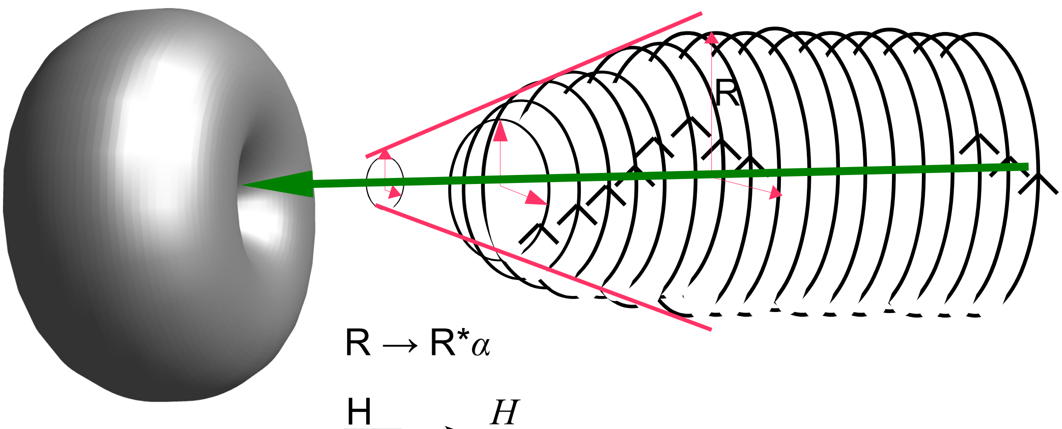
To make it clear: The Mills' proposed higher hydrino resonances can physically only occur, if we allow multi-body collisions (there exists no continuous two-body statistics > H(1/5) because of the summation of n^2 terms), what under the dense cavity regime should be possible. But contrary to Mills postulation that a photon-based force is delivering a charge like force, we assume that in our case the increasing, external short-time H-field (induced nuclear H field?) provides the additional

force to keep the electron at a the lower orbit.
In such a chaotic reaction mode, during the first disproportion phase, maximally involving the outer 12 Hydrogen nuclei, each can deliver up to 52..54 eV the input energy radially inside. That way the commensurable rotator energy can be more or less doubled by the added freed orbital potentials. This is finally enough to promote up to 2 hydrogen molecules to a ready to fuse (below 2pm radius) state.
If the collapse stops at H*1/5) or toroidal Hydrogen [2], then the static amplification of the magnetic field created by the rotator ring current is a factor of 5*5*5. The peak current effect dI/dt is boosted by the 1/time =(up to 10^{12}) that it needs for completing this state.

5.1.6 Coordinate collapse

If the internal molecular coupling of the rotator is tense enough and also the coupling of the rotator to the circular current, we can assume that, with a high degree of confidence, for further explanations, the equivalence principle can be applied.
We can assume that the strong H field and the high local current (seen from the rotators frame) will allow the rotator to behave as a complete entangled object.

Thus at the very short moment, where a first instability occurs, **any lost potential energy of electron orbits is instantaneously ramping up the "external" H field due to faster rotation of the inner part of the rotator. (There are no other degrees of freedom).**
In a coordinated collapse the outer H12 ring surrounding the H7 ring can only short distance move radially outward, just by expanding the orbits and mediating energy/momentums with the cavity wall, while the inner H7 ring undergoes a "complete" collapse.
At the point where the radius goes down from from 52.9pm to 2 pm the H field energy density is increased by a factor of about 625! further on the momentum conservation dictates that the speed of rotation increases by the same factor (25), which gives the inner rotator the impression that the ring current is amplified by the same factor. Because these effects can be multiplicative (assuming a stable situation) long range toroidal distortion may happen.



$$R \rightarrow R^*\alpha$$

$$\frac{H}{\pi R^2} \longrightarrow \frac{H}{\pi R^2 \alpha^2}$$

$$I \rightarrow I/\alpha$$

Max amplification: $\rightarrow 1/\alpha^3$

Fig. 29.1

This (Fig. 29.1) is the general picture of an strong RCFC LENR reaction. In the final stage, a spiral like ring current is radially collapsing and delivers a high energy-density (green arrow) H field in direction of the spinning axes. An adjacent nucleus will be toroidally distorted and in the center, the electron coulomb-barrier is strongly weakened. Thus also a partially charged nuclear compound like $^{2}H^{*+}$ will have no problem to penetrate a Ni nucleus. (*α <= 84! at maximum)*
You will see the same picture in the plasma case (Mills SUN-CELL reaction) to!

5.1.7 Which field strengths can we expect?

The magnetic field inside a closed circle around a long wire with radius r.

B= μ0*I/r= 1.256637061* 10^{-6}/r

The magnetic field inside a close circle around a long solenoid with N windings/meter, if we have stacked rotators

B= μ0*I*N= 1.256637061* 10^{-6}*I*N (inside) outside as above.

We only give the formulas and make no speculations, as we cannot tell how much charge is generated during the disproportion reaction. Further on any collapse below 1pm radius may be of terminal nature due to a follow up event. Due to physical (mathematical) reasons any collapse below a H*(1/84 electron De Broglie Radius)) can be excluded, because of relativistic energy constraints.
Also the environment will play a crucial role as the permitivity (at lower temperature) of any surrounding material will influence the ramp of of the field.

Along a single H19 rotator at most 6 charge do circulate at a proposed frequency of of to up to 10^{14} Hz. This will give a maximal macroscopic current equivalent of 0.0001A. Thus the influence of the B field at steady state is small. But already the combined current of two toroidally distorted hydrogen atoms is > 1 Ampere!
In the SUN-CELL reaction we have a complete different starting picture: There we have an initial (during five ms!) current of 10^4 A (Due to charge disproportion this current can be doubled) and due to rotation, we a have a very large number N of windings, which lead to a strong central field. In the SUN-CELL already after ignition macroscopic fields of some 10 Tesla will be built up!

5.1.8 Summary of orbital collapse

If we assume that a tangential current, along the outer circle of the H19 rotator was present and the rotator radius is shrinking, then the current induced H-field will be amplified two fold. First the frequency of the moving charge increases more or less linearly with the shrinking radius of the inner part (assume current density – amount of moving charge – constant and charge strongly coupled to inward moving rotator). Second: The area of the field flux is reduced by $1/r^2$

Many experimenters report EM-pulses during excess energy phases. It is obvious that a quantum physical system only can get rid of energy by emitting EM-radiation. In a densely packed cavity there is no room for instantaneously delivering a mechanical momentum to external (to the rotator) third bodies, especially if the collapse is happening faster than the sound speed of the medium. We only see mechanical forces that point in radial direction & tangential to the rotator. Only after the first collapse phase followed by possibly asymmetric momentum reflections, scattering will yield significant forces in the Z direction.

The only disturbance we can expect to happen during the very first initial phase is an immediate H-H (1/x) disproportion reactions that may lead to kinetic energy transfer. Here only experiments can show the extent of this process.
If we assume that the LENR reaction partners (rotator, Lithium, Nickel) are close enough, then the overall process may happen on a purely orbital level, where the resonances just point to intermediate steps and possible results of slight asymmetries.

5.1.9 The steps of the collapse

1: Rotator forced to (partially) stop
2: Mechanical energy converted to H-field energy → increasing H field density
3: Electrons or H^3 bound (+) charges forced closer to nucleus → current ramps up & potential energy is released, which leads a compensation in tangential direction (electron needs higher speed or lower!! mass in deeper orbit)
4: This process "stops" as soon as two H-H meet at a distance below two pm. Or enough hydrogen transforms into the toroidal form.
5: Center hydrogen gets expelled or will get under the influence of a strong field.

6 The strong RCFC effect

In this chapter we quickly complete the Ni-Li-H picture and then we discuss the general strong RCFC effect due to orbital resonances.

Remaining open Questions:

- What is the final outcome of the HH orbital collapse?
- Will there be "cold" sub Bohr-radius Hydrogen hanging around?
- How many H undergo the final collapse?
- How will the individual fields of the involved (H) evolve?
- What happens in the Lipinski – plasma like case?

6.1.1 The possible Ni-Li-H picture

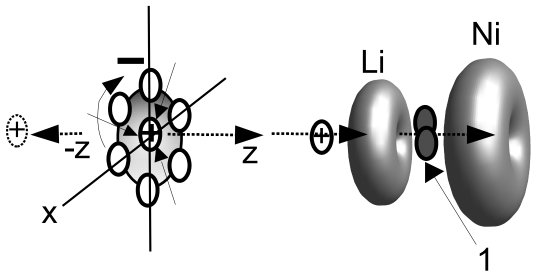


Fig 32.1

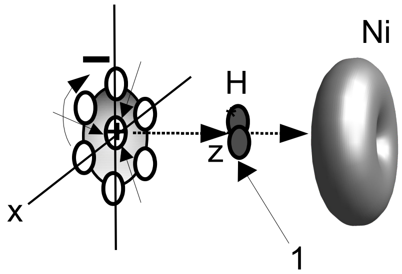


Fig 32.2

From the resulting ashes of Ni-Li-H LENR the two reactions given in Fig 32.1 (Li-Ni mediating 2H*) and Fig 32.2 (2H* directly fusing with Ni) can not be distinguished. Both seem to run in parallel. Only out of the relation between ^{7}Li → ^{6}Li depletion and ^{z}Ni → $^{z+2}$Ni produced, we can estimate, which path is more frequently happening – when knowing the material used to build the cavities.

6.2 What causes higher order transmutations

Until now our model can logically explain most effects seen in Ni-H LENR except more complex transmutation patterns. Lets look at the last sentence above.

What is the outcome of the "possibility of a field only reaction including direct interaction with Ni!"? Field only means, no full conversion of the collapsing field energy into momentum(s). Just think about the probability that a second Ni nucleus is sitting highly aligned with impact momentum/EM field just behind the reacting Ni nucleus? What will happen?

The usual reaction of a highly symmetric body following a symmetric impact effect is just a mirroring of the impact side to the backside of the nucleus. There is good reason to believe that a non fully kinetic impact, that is prepared by a running ahead field, issues some forces that try to bring the target nucleus in line with the expanding field axes.
First the *coulomb can opener* field is propagated/mirrored to the backs side of the nucleus and after one or more protons impact the first Ni nucleus, this nucleus starts to oscillate along the axis.
What happens if such a line of virtually chained Ni nuclei is coupling to the collapsing rotator field? And is the energy gained by adding nuclear charge to the first Ni (Li?) nucleus finally added to the field? And, finally a whole chain of Ni starts to get entangled?

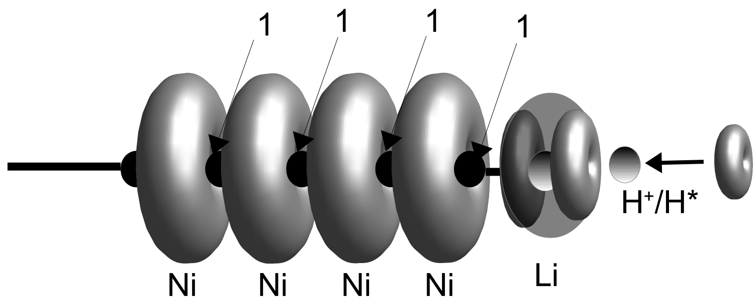


Fig: 32.3: (1) Nuclear charge is mediated between Ni-Ni inside a toroidal electron cloud

In the entangled case the box of the Pandora is open: Everything is possible up to muon level energy will be freed under certain conditions. The outcome of a distributed nuclear charge realignment just depends on all possible minimal condition of possible element redistributions. In our first chapter we mentioned the paper of Urutskov [ur1] which makes some proposals for a distribution transmutation reaction based on experimental data. It's now up to the experimenters and modeling cracks to draw the complete picture!
Just to stop further speculations. **Higher order transmutations** are not the primary product of Ni-H LENR fusion but, as in common fission, we have to find reaction parameters which, if needed, allow to avoid them. **Higher order transmutations** may produce no additional energy or unwanted by products.
As noted above in the lithium case. ^{8}Li has a long living intermediate state, which will certainly enable/trigger follow-up “chain LENR reactions”!

6.3 Plasma like Lithium fusion

We already explained that in the case of Li-H fusion the lithium nucleus and the two inner electrons take over the role of the rotator. We told that Lipinski could show that a 100eV “high current” proton beam leads to the largest Q factor. (produced energy/ reactions input energy)

The ionization energy of the two inner Lithium electrons are according Mills[10] is 122.45 ($2^+ \rightarrow 3^{+)}$ and 75.64($1^+ \rightarrow 2^+$).***** This is in average well in line with the measured proton energy (the two electrons are spin paired and react as an ensemble) . In fact the proton beam has an energy between 50 and 150 eV. 100eV(98), is just the average. (Before a ionization happens the two inner electrons are indistinguishable.)

***** It is needless to mention that the “simple” Mills-GUT-CP[10] calculations of the Lithium electron binding energies (e.g table 7.1) are two magnitudes more exact than the most elaborate QM methods...

The outer s_2 electron of Lithium has a low ionization energy and will be “taken away” (goes into higher orbits) as soon as the proton beam hits the surface of the lithium disk. Thus any proton in the range of 75.64 .. 122.45 is potentially able to merge (take away) an inner Lithium electron. At least such an electron will go into a resonance condition.
For the RCFC effect to happen the complete take-away of an inner electron is much less efficient. What we need is an electron that is as much as possible pulled away form the center axes and on the way back produces the field effect. Thus 100eV is close to the average (98eV) ionization value of the inner two Lithium electron orbits. But the proton orbits and the average electron orbits, have a low probability to be in sync. The proton speed at 100eV and the Lithium orbit speed differ by a factor of about 50. Thus potentially an electron(2) meets the proton maximally about 100 times.

Such a series of resonant meetings between an inner lithium electron and a proton can in average pump up to 100 eV into the Lithium orbit and finally into the afterwards produced pulsed H-field!

The difference between inner and outer radius(Li s1,s2 electron) is a factor of 8, the difference in orbit speed according to Mills[10] is 400! This is the maximal amplification factor for the current driving the H-field. But as soon a series of RC events occurs the electron can no longer fall back to its original orbit because the H-field, which will couple with the aligned Lithium nuclei, will prevent this. The fall back will “stop” at the proper cyclotron orbit given by the induced field that

must be folded with the orbital function. Classically spoken the orbits inside the cyclotron radius become much less likely!
Because initially the proton speed and the Li electron speed differ by a factor of 27 the phase of distortion lasts much longer, than the follow-up relaxing takes

Thus the evolution of the Li-Plasma like fusion will look as following

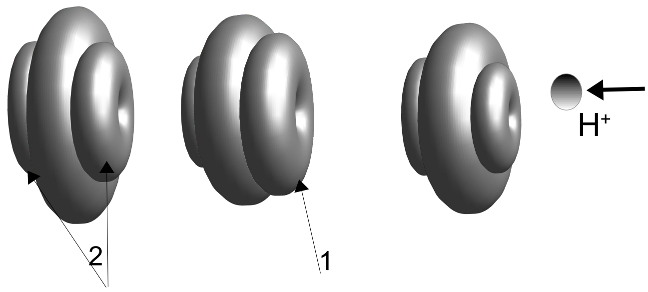


Fig.34.1: Evolution of the Li orbit

On the right a proton is arriving at Li s1 orbit energy and couples with one electron (1). The orbit will blow up. In the second step the energy is mediated to the other electron, that is forced into a partial cyclotron orbit by the fall back H field of the first electron.

6.3.1 Cascading resonance

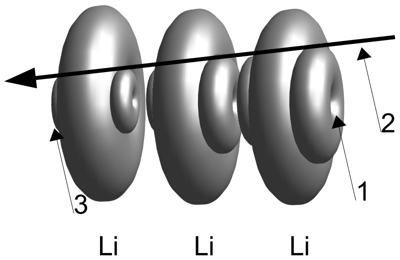


Fig.34.2 Three cascading Lithium

The field effect is transported to adjacent nuclei in line with the spin/torus axes. In the ramp-up phase distant orbits will usually have a smaller radius(3). Fields decay with 1/r, but as soon as a neighbor nuclei is stimulated by the field forces or a follow up proton, they will in average sum up.

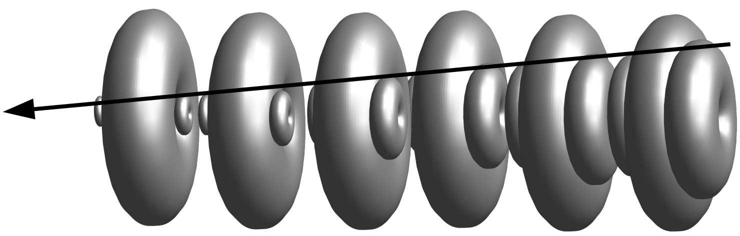


Fig.34.3 Longer chain of cascading Lithium

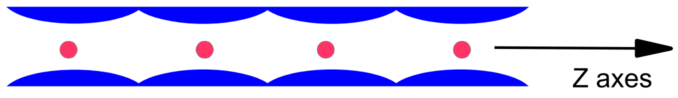


Fig. 35.1: Idealized section view along Z-axes; "inside-out view" of charge density (blue), nucleus (red), according [2] under symmetric toroidal conditions.

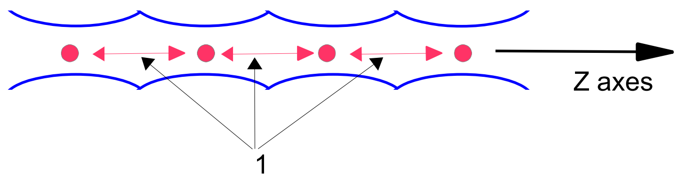


Fig. 35.2: Section view along Z-axes according [2] the (nuclear) charges are free to move (1) along z-axes

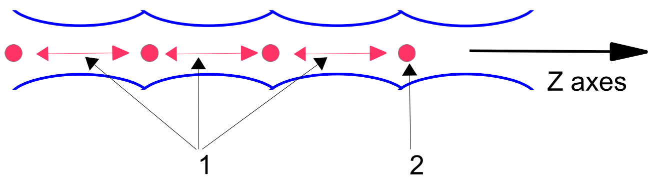


Fig. 35.3: large displacements are possible following external forces

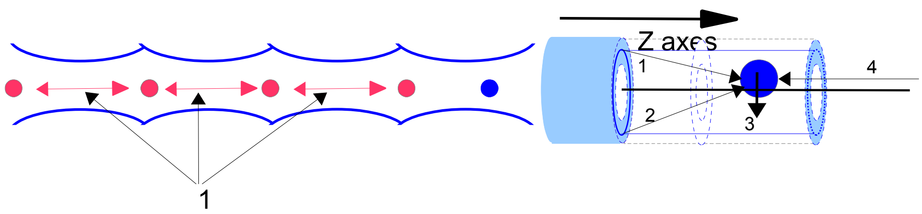


Fig. 35.4: As explained above neutral Hydrogen(4) H* will be center focussed by forces (1,2 → 3) into the toroidal channel.

For a chained reaction situation to happen, a section of toroidal connected Li nuclei must be present.

In the above case Fig. 35.4 a proton (100eV) that picked up an electron (now being H*) is propelled inside the torus. If such a proton can pickup a part of the energy of the orbit (13.6 up to 340eV if complete toroidal) potential then it gets an extra momentum. If the stimulated field collapses (3) Fig. 36.1: then the proton(Hydrogen) can inherit at most additional 198eV from the two Li orbits left behind

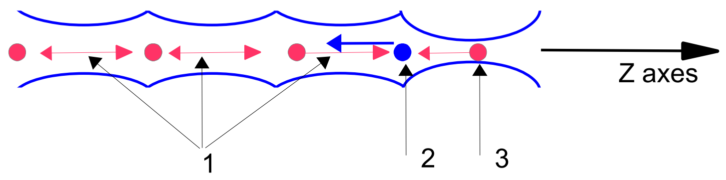


Fig. 36.1: As explained the charges (1) are free to move in Z direction. If a proton is able to the enter the torus with 100eV it can maximally acquire an additional 200 eV from the collapsing (3) orbit of one Li nucleus. The same holds for any Li-nucleus inside the torus if we see no higher resonances.

Thus the maximum expected collision energy for a linear Li-H (+) event is 500eV. (two Li momentums + own momentum. 800eV if H* orbit is toroidal and acquired its collapsing energy potential)

6.3.2 The Alfen condition

$$V_{Alfen} = \frac{|\vec{B}|}{\sqrt{\mu_0 \cdot \rho}}$$

From the pictures above it is obvious, that the situation is very similar to the one in a plasma. In fact we see some very interesting effects. The initial current of positive charges in the high power Lipinski experiment is 0.0106 Ampere. This is measured at the proton gun.
Due to a slow down during the penetration into the Lithium disk, we will locally see a strong increase of the current density, which is proportional to the slow down of the protons. Finally, if the proton have an average speed of about 5eV, then they will mediate with the s_2 electron of the lower Lithium atoms and stop their movement into the beam direction.
This current "slow down" (100eV → 5 eV) must be compensated by a counter current of electrons that is delivered from Lithium below the reaction zone. Such a counter current could be responsible for the stimulation of a neighboring torus, because negative charge will issue pressure on expanded orbits.

If we look at the Alfen formula then we may note, that the Alven speed in the Lipinski experiment is modulated over a broad range. If the current density ρ goes up then the Alven speed reduces and the same happens if the field breaks down. (and vice versa) In fact do the Lipinski experiments show strong resonant behavior. The occurrence of an Alven sheer wave condition, that helps to stabilize the toroidally distorted Li electron orbits is highly likely. If a higher order resonance occurs, then the momenta of the involved nuclei (H*, ^{7}Li) can be a multiple of the above linear maxima of about 500eV. This effect is caused by the Alven sheer wave energy transport mechanism.
In fig. 3.18 of [21] Yang Zhang shows the proof, that resonant sheer Alven waves (produced in the lab) can in fact accelerate ion in the direction of flight. Even more interesting, is Zhang[21] uses

Lithium ions for his experiments, what directly proves our assumption, that Li ions inside a toroidally distorted electron cloud, can – under an Alven resonance condition - get much higher energies than originally provided by the bias voltage generating the beam.
But there is also a down side. The path of flight, for such an acceleration, in the here presented Lipinski case – an initially solid disk, is short and the energy transfer per radian is in the single eV range. But for the SUN-CELL situation and the Lipinski gas phase experiments it looks very promising!

6.4 Nuclear charge mediation

In our modeled case, we assume that Li-$H^{+/*}$ fusion happens due to the optimal meeting angle along the spin axes, where the coulomb field seems to be much weaker. That the charge density along the rotation axes is in fact weaker can be seen by looking at Mills [10] eq. 6.8 calculations for an electron orbit of Hydrogen or for photon cavities (l=1 case!). In fact Mills models the electron density with a radial delta function, which more ore less vanishes around a pole (not so in the ground state!). Further on we assume that the nuclear charge obeys the same laws and will additionally be distorted by a ultra high H field!

The follow up calculations of nuclear energies made by Mills are entirely based the this orbital charge model. The agreement of Mills calculation with measured physical parameters is outstanding. As a consequence we must state, that the orbital charge distribution calculated by Mills are closer to physical facts than QM like models!

To produce and/or to follow a magnetic moment, source charge must rotate around the spin axes, such a rotating charge will have a higher density away from the axes than along the axes (poles). Whether – to what extent – charge inside the nucleus follows the same rules must be proven. By looking at the relative high precision Mills quark/neutron mass calculations, we can follow that the picture inside the nucleus will be the more or less the same as Mills uses for the electron shell current model.

6.4.1 Follow up events

In [17] Carl-Oscar Gullström discusses the potential of nucleus-nucleus interaction involving a long range Yukawa potential. This is the same idea we mentioned in [18] and did show in figure 31.1 above. The interactions Gullström is discussing can only happen under very high excitation around or greater 1MeV and we too believe, that for chained transmutations, following an initial LENR reaction, such an exchange of nuclear charge/mass is the core reason of the effect. By looking at the Lipinski spectrum [6]Fig.8 the resulting combined nucleus ^{7}Li and H* will very likely form a compound state with a $J^{\pi} = +2$ nuclear momentum. This state is long living (>800ms) and the excess energy is well within the needed dimensions.

6.4.1.1 What we discussed so far

The discussion up to point 5.3 above show, that the input energies for a primary Li-H LENR reaction are to low (some few 100eV) for a nuclear charge mediation to happen. In fact the input energy would also be far to low for any kinetic fusion not in line with the rotation axes.

In the Nickel LENR case the ignition happens over an intermediate Li fusion step, that is easy attainable. Even low speed rotators can deliver enough energy for an axial H*-Li fusion event.

For a direct proton/H* Nickel fusion ignition, a novel hydrogen disproportion effect discovered by Mills must be use for delivering enough input momentum. Whether such an effect can be forced is, to a higher extent, speculative. But experimentally there are Ni-H events happening. It's just a matter of carefully designed experiments to prove under what conditions direct Ni-H fusion can be attained.

If an Ni nucleus enters a higher J state then we could use the same arguments as give with ^{7}Li. Current physics has no compelling model to describe the nuclear coulomb charge and its distribution.

In the Lipinski experiment with high proton current, the optimal Q-factor is reached at 100eV (average energy) and highest bias frequency, what we identified to be optimal for resonant energy transfer between electrons of Li and the proton.

6.4.2 Potential ^{7}Li → ^{6}Li(He) depletion

The main reason to come back to this experiment is the reported, unusually high particle count during the Lipinski high current experiment. In fact each proton produces one high energy result particle. From the given reaction we expect 3 high energy particles two alphas and one beta electron. Of course breaking radiation of the alphas can multiply the particle count. Unluckily Lipinski's did not document the exact composition of the particles.

In contrast to the Nickel LENR reaction, Lithium alone has only one possible path for a chained reaction, because below & above Lithium Helium is a dead end. Only the complete fusion of two lithium(^{6}Li) nuclei would bring us back into stable regions, what is highly unlikely to happen.

What is known from Ni-Li-H ashes is the partial ^{7}Li → ^{6}Li depletion. This effect can only happen if ^{7}Li is able to mediate one proton/neutron with a neighboring nuclei. As discussed in [17] the environment we present is ideal for the proposed effect. Further on the fusion event between ^{7}Li and Hydrogen is slow in regards to the decay of the resulting ^{8}Li → ^{8}Be nucleus. No immediate long range perturbation will be seen except a longitudinally oscillating Fig. 38.1 (1) nucleus. The excess-energy of the final ^{8}Be is over 16MeV, far more than needed for starting a nuclear charge mediation reaction.

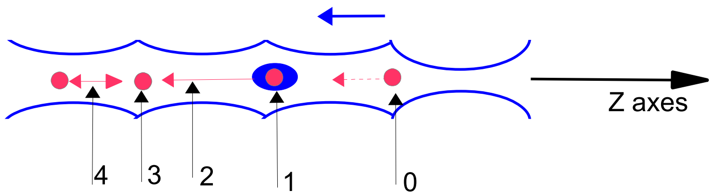


Fig. 38.1 Momentum propagation

The original proton (0) fuses with Li (1) and forms a highly axial perturbed unstable ^{8}Li (1) nucleus.

(In fact there are two oscillation amplitudes.) the other is laying in the x,y plane. The maximal oscillating power is potentially half of 16MeV. This will also move (accelerate) a part of the internal nuclear charge (3(4)+) which will cause a steep acceleration of (3) an unshielded neighboring ^{7}Li nuclei. Under such a followup meeting (4) (Li pushed -pushed back) the exchange of nuclear mass is possible.

Such a process ^{7}Li "+" ^{7}Li → ^{6}Li + ^{8}Li is highly exothermic and can possibly explain the huge excess in the particle count, because one proton would ignite two (or more chained) fusion reactions.

7 Conclusions

LENR reactions run under much tighter conditions, than any classical fusion reactions. We did show (in fact the Lipinski experiment!), that under LENR conditions the probability for an optimal fusion event, at 180 degree impact angle, is drastically increased. Under such a point of view, the classical fusion model must be questioned, whether it really reflects the same physics as the LENR case shows. Further on the classical fusion experiments have a singularity problem as the 180 degree axial meeting condition in reality never will occur. Thus any measured **probability** of a classical TNR reactions is not applicable for LENR reactions.

We also could show that contrary to classical scattering, where equal charges lead to a severe downgrade (two fold scattering - angles) of the fusion condition, we see a focussing behavior if a high local H field (toroidally) distorts the target nucleus electron coulomb-barrier. This new type of scattering is virtually undocumented and certainly needs more experimental clarification!

LENR fusion mostly is of "gravitational type", what means that the only relevant kinetic active force is the nuclear force. As a consequence very few energy is provided for rotation energies, unless the nuclei themselves are in a higher J state. The outcome are thus highly stable nuclei.

We could identify that LENR fusion runs over H* a condensed form of Hydrogen, which due to high screening can deeply penetrate the nuclear coulomb-barrier. This can be verified by looking at [6]fig.8 (given as Fig. 22.1) which shows that the Lithium proton-fusion in fact is a lithium-hydrogen (H*) fusion!

The importance of H* for LENR fusion was not recognized so far, because the focussing effect of a toroidal electron cloud has been neglected. The process of accelerating H* has been explained throughout this paper. The rotator collapse is an universal mean to provide an axial momentum. Such a collapse can be seen in all known LENR reactions. The rotator collapse has two crucial effects: 1) It provides a short time ultra high H-field, either through radial charge exchange (u.a. In SUN-CELL!) or rotating charge – radial compression (most cases). 2) The radial inside forces generate an axial momentum, which can strongly accelerate particles. The same effect (Li-H plasma fusion) can be explained with Alven sheer wave resonances. In fact in a solid, that is partially in a plasma state – as seen in the high current Lipinski Lithium Disk experiment – we most likely see a combination of the two effects.

To our understanding the general starting and supporting conditions for LENR reactions are now understood. Now we have to evaluate the details!

There are still open questions: After a gravitational fusion of two Deuterium nuclei, calculations for dipole/quadrupole radiation show, that the resulting energies, that would be emitted in one radian are way to high and thus such a radiation is impossible. But if only a fraction of the excess energy will be converted into a (nuclear*****) magnetic moment, then long range coulomb-barrier distortions can couple to the exited nuclear field and efficiently distribute the energies as XUV quanta or auger like radiation.

Such a mechanism has not yet been investigated. But under a perfect impact, ^4He or a pre-fused D-D-compound is strongly oscillating, an electron (of ^4He) orbit other that toroidal (center oscillation axes) is not possible, what also leads to a magnetic coupling! It is just a matter of the relaxing time constant, how long it will take to fully radiate the excess energy over such a long range H-field coupling. But this is speculation!

***** Also in LENR an exact 180 degree meeting angle is unlikely. But the deviation from 180 degrees is usually very small. Such a small deviation leads to an (small) angular momentum, which can indeed accelerate the axial rotation of the nucleus. Whether this will impact the charge too has to be shown.

8 Open Questions / experiments needed

- How***** exactly does the nuclear charge distribution follow an ultra high external H-field
- Which energies can be stored in molecular / atomic rotators
- Which combinations of rotators are able to from out a high density short time stable H-field
- Scattering Experiments with stabilized nuclear axes (beam aligned) are needed!
- Nuclear charge/mass oscillation (^4He) with a small rotational perturbation has to be modeled! With external electron orbits!
- Nuclear charge/mass exchange under the above shown condition has to be modeled
- The Lipinski experiment has to be refined, to find the exact resonance condition for proton-current-density /proton energy/ bias-frequency.
- Repeat the Lipinski experiment with a Li/Ni mixture – stacked layers.
- Repeat Ni-Li-H experiments with optimally designed cavities and external H-field support.

***** In [24] a huge effort has been made by standard physics to find some analytic and experimental answers to this question. But we ask to include the considerations/models proposed by R.Mills to refine the approach. Especially the metric should be discussed!

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EVIDENCE OF CATALYTIC PRODUCTION OF HOT ATOMIC HYDROGEN IN RF GENERATED HYDROGEN/HELIUM PLASMAS

[23] Effect of nuclear motion on spectral broadening of high-order harmonic generation

Xiaolong Yuan,1,2 Pengfei Wei,3,* Candong Liu,1,4 Xiaochun Ge,1 Yinghui Zheng,1 Zhinan Zeng,1 and Ruxin Li1,5

State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China [2]University of Chinese Academy of Sciences, Beijing 100049, China [3]Department of Physics, Shaoxing University, Shaoxing 3 12000, China ; 2016 Optical Society of America

[24] Franziska Hagelstein[a], Rory Miskimen[b], Vladimir Pascalutsaa

[a]Institut für Kernphysik and PRISMA Excellence Cluster, Johannes Gutenberg-Universität Mainz, D-55128 Mainz,

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J. Va'vra Stanford Linear Accelerator Center, Stanford University, Stanford, CA 94309, U.S.A.

J. A. Maly Applied Science Consultants 5819 Ettersberg Dr., San Jose, CA 95123, U.S.A.

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