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# $\sqrt[3]{A}$ —Law in Nuclear Transmutation of Metal Hydrides (II)


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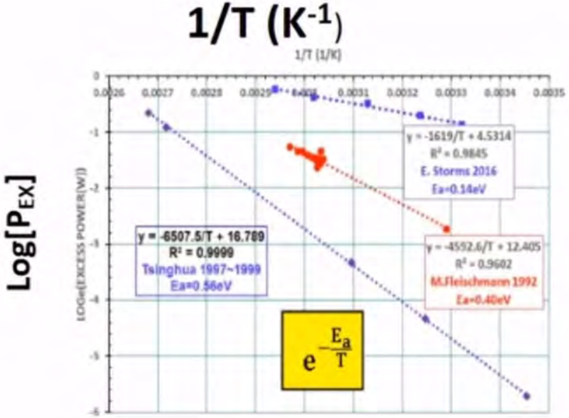
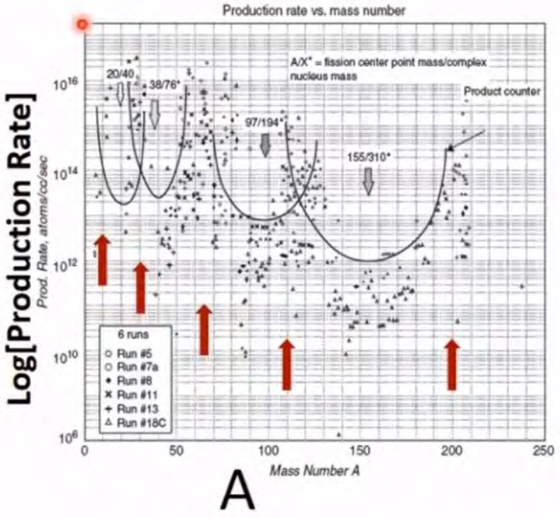
ICCF-25, 2023,8,26-31, Szczecin, Poland



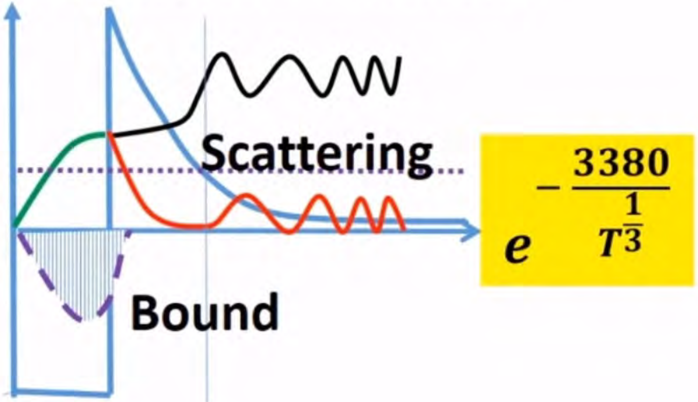

# $\sqrt[3]{A_N}$—Law in Nuclear Transmutation of Metal Hydrides (II)

$$\sqrt[3]{A_N} = 1.14\,N - 0.39, \text{ Miley}$$

$$\sqrt[3]{A_N} = 1.13\,N - 0.46, \text{ 2-Step, Resonance}$$

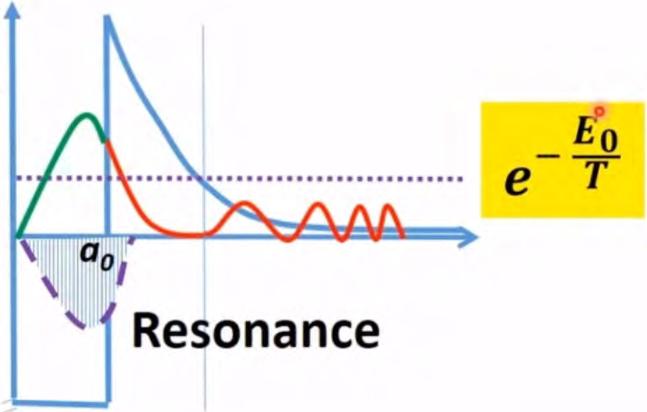
**Elastic Facilitates Resonance, Resonance Enhances Reaction**

# CONCEPT: Resonance→ Peaked Wave @ Nuclear Surface




Solar Energy Model (Bethe 1938)

Storms: Log[ $P_{EX}$] = a $(\frac{1}{T})$+b




Smooth Connection:

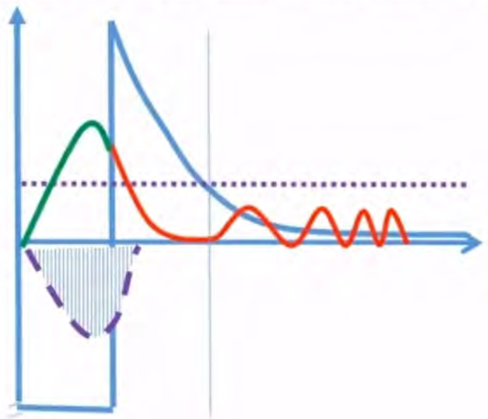
$$a_0 \propto (\sqrt[3]{A} + 1)$$

EQUATION: Logarithmic Derivative =That of Resonance Branch

# EQUATION: Smooth Connection @ Nuclear Surface for Resonance

$$k\,Cot[k\,a_0] = -\sqrt{\frac{2}{a_0\ a_c}}$$

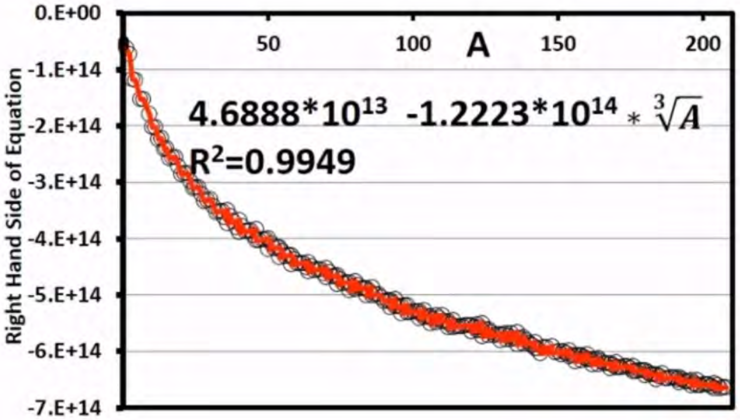
$$(\sqrt[3]{A}+1) \qquad \frac{1}{Z} \approx \frac{1}{A}$$



$$k\,[ka_0 - (2N+1)\frac{\pi}{2}]$$

↓

$$(\sqrt[3]{A}+1) \qquad -(1.22\sqrt[3]{A} - 0.469)\times 10^{14} m^{-1}$$




$$\sqrt[3]{A_N} = 1.13\,N - 0.46, \quad \text{2-Step, Resonance}$$

## COMPARISON: Isotope Depletion Peaks

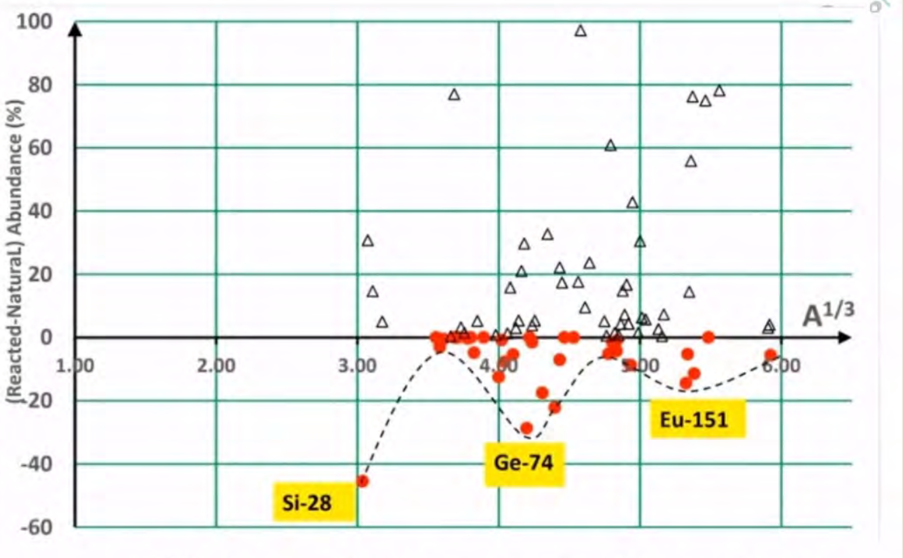
- $\sqrt[3]{A_N} = 1.14\,N - 0.39$, Miley.

  $\sqrt[3]{A_N} = 1.13\,N - 0.46$,
  2-Step Resonance.

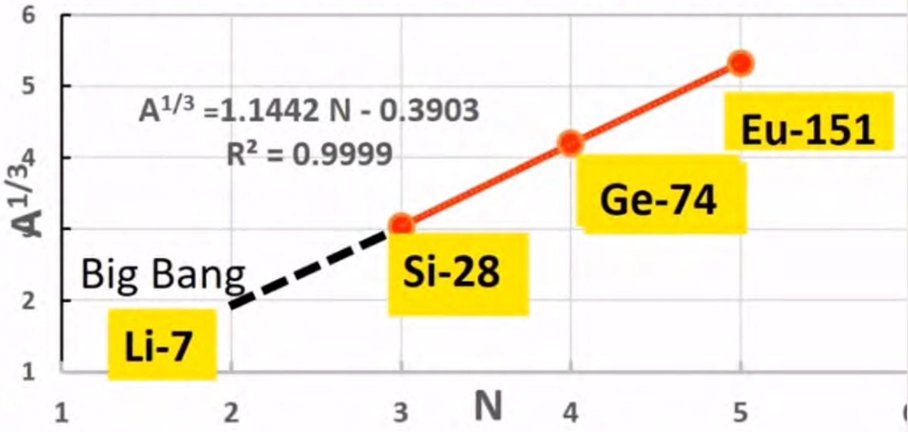
  $a_0 \propto \left(\sqrt[3]{A} + 1\right)$

**Target, Reactant, Not Product.**

- 2 weeks. New Products were still in H. If an Isotope was Interacting with Proton. It was the Target, and would be depleted. Any Depletion Peak gives Target $A_N$ for Resonance

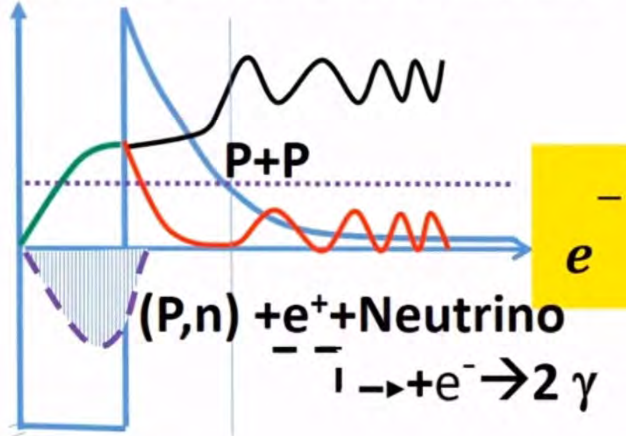



$A^{1/3}$--Law in Nuclear Transmutation of Ni-H

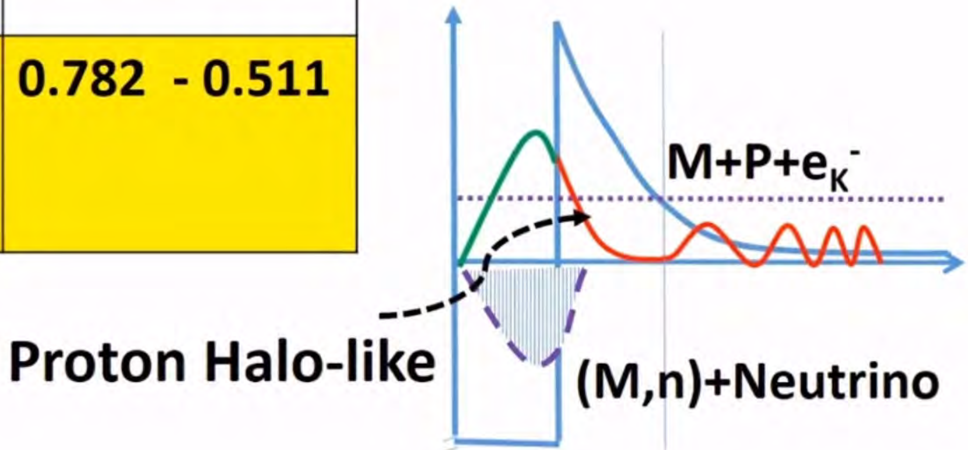


# NUCLEAR REACTION: K-Electron Capture vs. Positron Emission

| | Temperature | Charge | Energy Deficit (MeV) |
|---|---|---|---|
| SUN | ~1.5keV, Gas ionized | Z~1 | 0.782 + 0.511 |
| Miley | < 1 eV, K-Orbital Electrons | Z > 1, $(Z+1)^3$ | 0.782 - 0.511 |



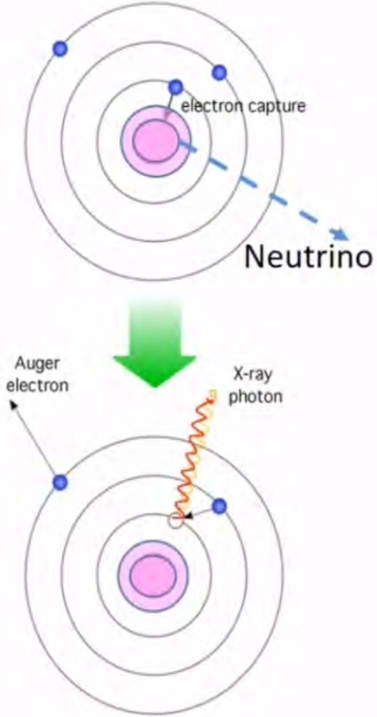

$$e^{-\frac{3380}{T^{\frac{1}{3}}}}$$




$$e^{-\frac{E_0}{T}}$$

# SUMMARY (M-H, M-D(1-rst Step ))

- **Controlled Weak Interaction:**
  **No Neutron, No $\gamma$;**
  ***Neutrino, Electrons, Recoil Ions, X-ray.***
  **Gordon's Co-deposited Film (M-H).**
- **2-Step Resonance:**
  **Miles(ICARUS), Letts, Mizuno, et al;**
  **Miley(Ti-H 2003), Mizuno, Ohmori, Little&Puthoff.**
- **Multiple-Scattering:**
  **Mckubre,Takahashi, Iwamura, Czerski, Kasagi, Hagelstein, Meulenberg, Violante, Dardik, Vysotskii**
- **Neutrino:**
  **$1W \Rightarrow 1\ M^2 \rightarrow 10^{15} / M^2 /Sec.$**




**Ardet nec consumitur**

# Потенциал Вудса — Саксона

Материал из Википедии — свободной энциклопедии [ править | править код ]

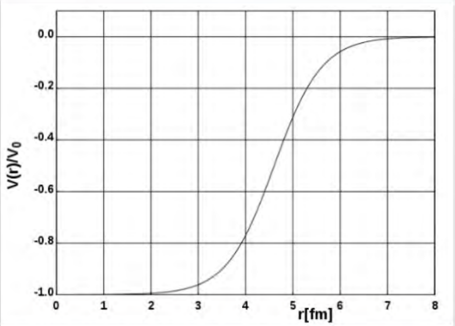
Текущая версия страницы пока не проверялась опытными участниками и может значительно отличаться от версии, проверенной 12 июля 2019 года; проверки требует 1 правка.

**Потенциа́л Ву́дса — Са́ксона** — функция потенциальной энергии, предложенная[1] американскими физиками Д.Саксоном и Р.Вудсом, как приближение для той части потенциальной энергии нуклона в атомном ядре, которая обусловлена ядерными силами и центрально-симметрична.

$$U(r) = -\frac{U_0}{1+\exp(\frac{r-R}{a})},$$

где

- $R = r_0 A^{1/3}$ — радиус ядра,
  - $r_0 \approx$ 1,25 фм, параметр, приближённо равный среднему расстоянию между нуклонами в ядре;
  - $A$ — массовое число ядра,
- $a$ — параметр диффузности, характеризующий размытие края потенциальной ямы (типичное значение — 0,5 фм),
- $U_0$ — глубина потенциальной ямы (типичное значение — 50 МэВ).



Форма потенциала Вудса — Саксона

## См. также [ править | править код ]

- Оболочечная модель ядра

# Poster 21

5) Первым найденным экзотическим решением является состояние с энергией $E_0 = -52.87$ эВ, орбитальный радиус $r_0 = 13.6 * 10^{-12}$ м. При этом соответствующее решение уравнения Дирака имеет энергию $E_0 = -54.4$ эВ и орбитальный радиус $r_0 = 13.22 * 10^{-12}$ м. Рис.2 [2].

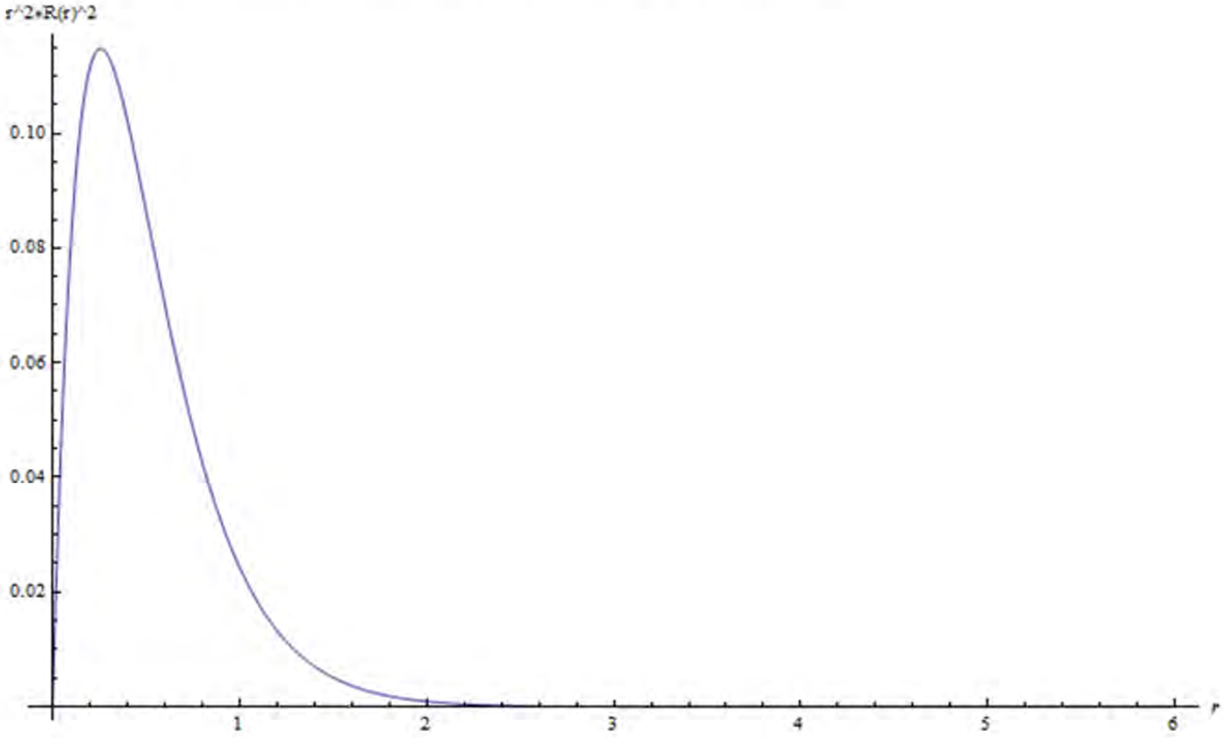



Рис.2 Нормированная радиальная плотность вероятности при $l = -\frac{1}{2}$ $E_0 = -52.8705eV$

Последним найденным экзотическим состоянием является состояние с параметрами $E_0 = -mc^2 = -510785.13388932$ эВ и орбитальный радиус $r_0 = 0.006726620641*10^{-12}$ м. Рис.3. При образовании этого состояния выделяется энергия $E = mc^2 \approx 511$ кэВ. Выделение энергии $E = mc^2 \approx 511$ кэВ при образовании компактного атома водорода, может объяснить феномен появления аннигиляционного пика во многих экспериментах по НЭЯР [5] и в природных явлениях [6].

Косвенным доказательством существования компактного нейтроноподобного атома водорода, может служить эксперимент Дон Карло Борги [7].

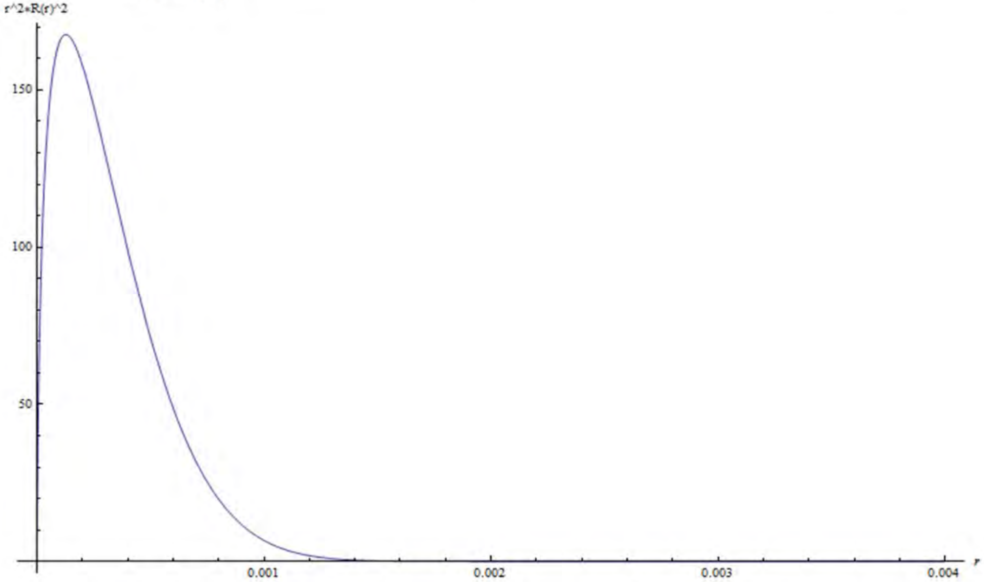



Рис. 3 Радиальная плотность вероятности при $l = -\frac{1}{2}$ и $E_0 = -510785.13388932$ эВ

# Theoretical framework for LENR experiments.

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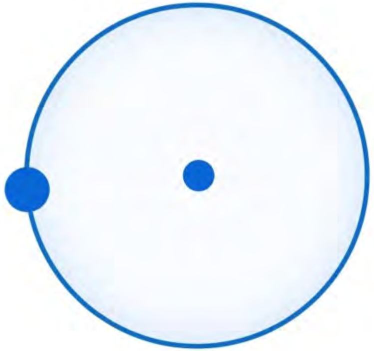

Hydrogen Atom

# Theoretical framework for LENR experiments.

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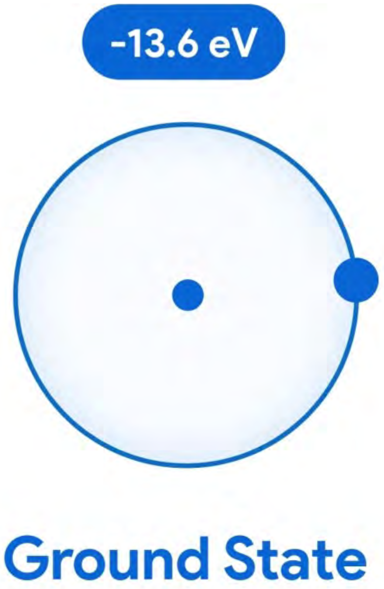

# Theoretical framework for LENR experiments.


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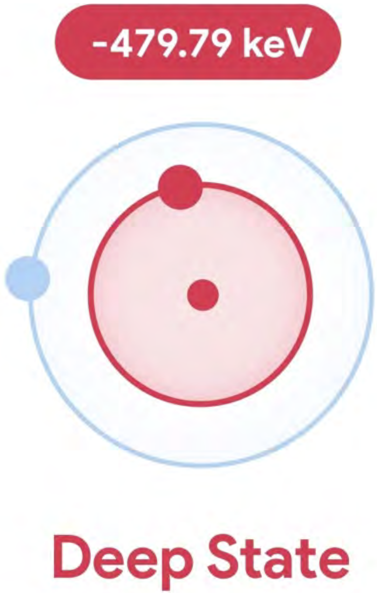

# Theoretical framework for LENR experiments.


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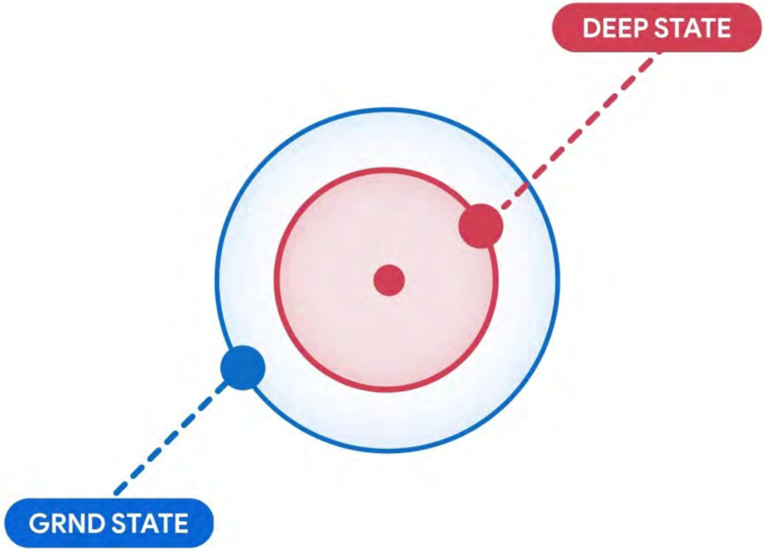


Exotic State

# The radial M2 equation for a hydrogen atom.

$$\Delta\Psi - \frac{1}{\hbar^2}\left[\frac{m^4c^6}{(E-U(\vec{r}))^2} - m^2c^2\right]\Psi = 0 \qquad (1)$$

Our journey begins with the relativistic M2 equation ***(Equation 1)***.

## The radial M2 equation for a hydrogen atom.

$$\frac{d^2R}{dr^2}+\frac{2}{r}\frac{dR}{dr}-\frac{l(l+1)}{r^2}R-\frac{1}{\hbar^2}\left[\frac{m^4c^6}{\left(E+\frac{Ze^2}{4\pi\varepsilon_0 r}\right)^2}-m^2c^2\right]R=0 \qquad (2)$$

By integrating the Coulomb potential energy and separating variables, we derive the radial M2 equation, specifically tailored for hydrogen-like ions with nuclear charge **Z**.

# The radial M2 equation for a hydrogen atom.

Next, we will apply the Hartree atomic unit system. In Hartree atomic units, physical constants have the following values:

$$a_0 = 1, m = 1, e = 1, \hbar = 1, c = 137.03599971, 4\pi\varepsilon_0 = 1$$

Application of the Hartree Atomic Unit System

## The radial M2 equation for a hydrogen atom.

The radial M2 equation, now expressed in Hartree atomic units.

$$\frac{d^2R}{dr^2}+\frac{2}{r}\frac{dR}{dr}-\frac{l(l+1)}{r^2}R-\left[\frac{c^6}{\left(E+\frac{Z}{r}\right)^2}-c^2\right]R=0 \quad (3)$$

M2 equation in Hartree atomic units ***(Equation 3)***.

# The radial M2 equation for a hydrogen atom.

Solution Approach using Wolfram Mathematica

# The radial M2 equation for a hydrogen atom.

$$R(r)=\frac{1}{r}k_1 \exp\left(-\frac{r\sqrt{c^6-E^2c^2}}{E}\right)(Er+Z)^{\frac{1}{2}\sqrt{4L+\frac{4Z^2c^6}{E^4}+1}+\frac{1}{2}}\,\mathrm{HypergeometricU}\left(\frac{1}{2}+\frac{\sqrt{4L+\frac{4Z^2c^6}{E^4}+1}}{2}-\frac{c^6Z}{E^2\sqrt{c^6-E^2c^2}},\sqrt{4L+\frac{4Z^2c^6}{E^4}+1}+1,\frac{2\sqrt{c^6-E^2c^2}\,(Er+Z)}{E^2}\right) \quad (4)$$

The solution to the radial equation is a sum of two linearly independent parts. Generalized Laguerre polynomials and a degenerate hypergeometric function of the second kind. We will use the second linearly independent solution.

# The radial M2 equation for a hydrogen atom.

$$\frac{1}{2}+\frac{\sqrt{4l(l+1)+\frac{4Z^2c^6}{E^4}+1}}{2}-\frac{c^6Z}{E^2\sqrt{c^6-E^2c^2}}=-n_{rad}$$

$$E=\pm\frac{c\sqrt{(c+2cn)^2-Z^2}}{1+2n} \quad (6)$$

EXCITED STATE

$$E_0(Z)=c\sqrt{c^2-Z^2} \quad (7)$$

GROUND STATE

The quantum number takes values from the series $n=0,\frac{1}{2},1,\frac{3}{2},2,\frac{5}{2}$ with a step of $\frac{1}{2}$ .

When the quantum number is $n=0$, ***(Formula 6)*** transitions to the formula for the ground state energy equation ***(Formula 7)***.

# The radial M2 equation for a hydrogen atom.

$$E = 27.2\left(\frac{c\sqrt{(c+2cn)^2 - Z^2}}{1+2n} - c^2\right)\ \text{eV} \qquad (8)$$

$$E_0(Z) = 27.2\left(c\sqrt{c^2 - Z^2} - c^2\right)\ \text{eV} \qquad (9)$$

The energy obtained includes the electron rest energy $mc^2$. Taking this into account, we will finally write the binding energy formulas in electron-volts. We will use only positive energy values, although the M2 equation gives symmetrical solutions.

# The radial M2 equation for a hydrogen atom.

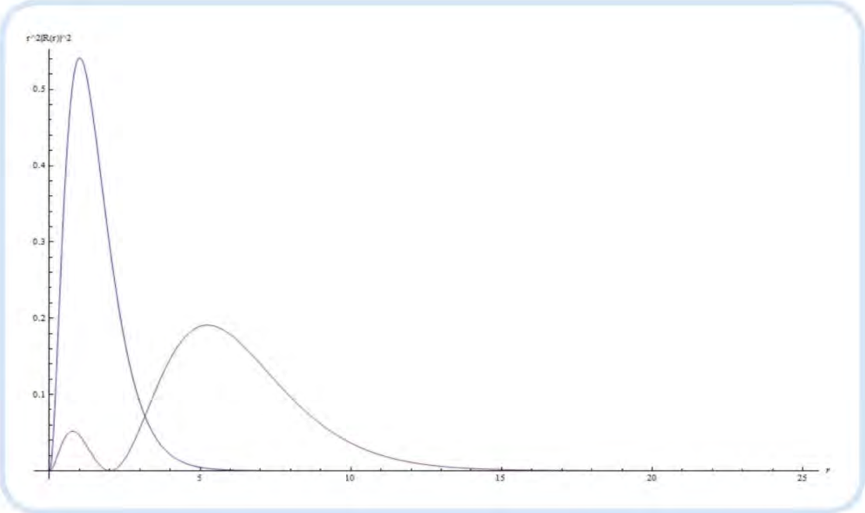


**Figure 1.** Normalized radial probability density of the ground and first excited states in Hartree atomic units.

# Compact, deeply localized states of the hydrogen atom.

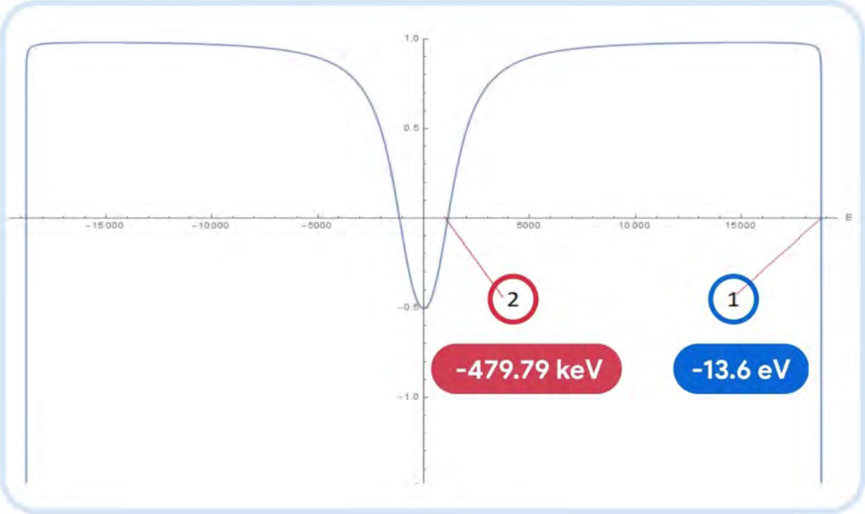


**Figure 2.** Graph of energy dependence on the radial quantum number $-n_{rad}$ at $l = 1$ for the M2 equation.

## Compact, deeply localized states of the hydrogen atom.

| l\n | 0 | -1 | -2 | -3 | -4 | -5 |
|---|---|---|---|---|---|---|
| 0 | -13.60 | | | | | |
| 1 | -3.40 | -479790.38 | | | | |
| 2 | -1.51 | -492901.40 | -472899.07 | | | |
| 3 | -0.85 | -498141.38 | -486843.79 | -470863.05 | | |
| 4 | -0.54 | -500991.93 | -492944.69 | -484672.95 | -469882.58 | |
| 5 | -0.38 | -502789.26 | -496482.52 | -490847.08 | -483541.22 | -469305.29 |

**Table 1.** Binding energies of compact hydrogen atom as a function of quantum numbers (in eV).

# Radial Probability Density

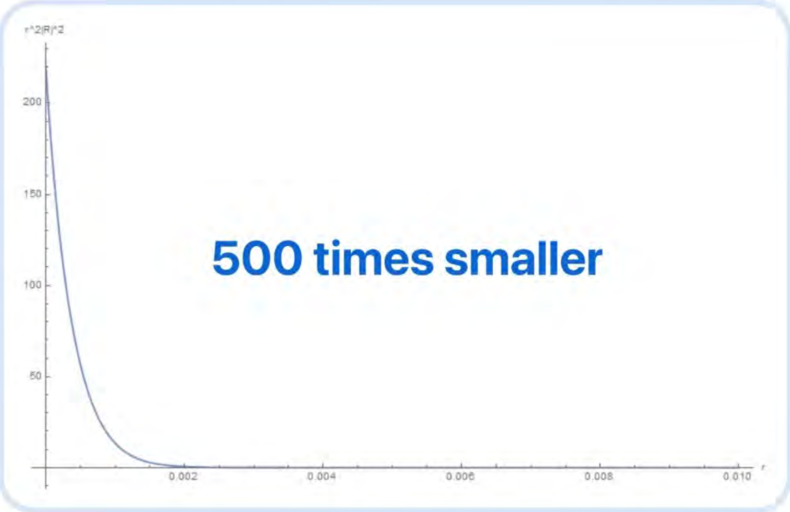


**Figure 3:** The radial probability density of state 2 demonstrates the potential for compact states in hydrogen atoms, a pivotal discovery in our study.

# Решение уравнения М2
# в цилиндрической системе координат

# M2 Equation in Cylindrical Coordinates

$$\frac{\partial^2 R}{\partial r^2} + \frac{1}{r}\frac{\partial R}{\partial r} + \frac{\partial^2 R}{\partial z^2} - \left[ \frac{c^6}{\left(E + \frac{Z}{\sqrt{r^2 + z^2}}\right)^2} - c^2 \right] R = 0 \qquad (10)$$

**Equation 10:** M2 equation in cylindrical coordinates in Hartree atomic units

M2  Equation H  F=Psi

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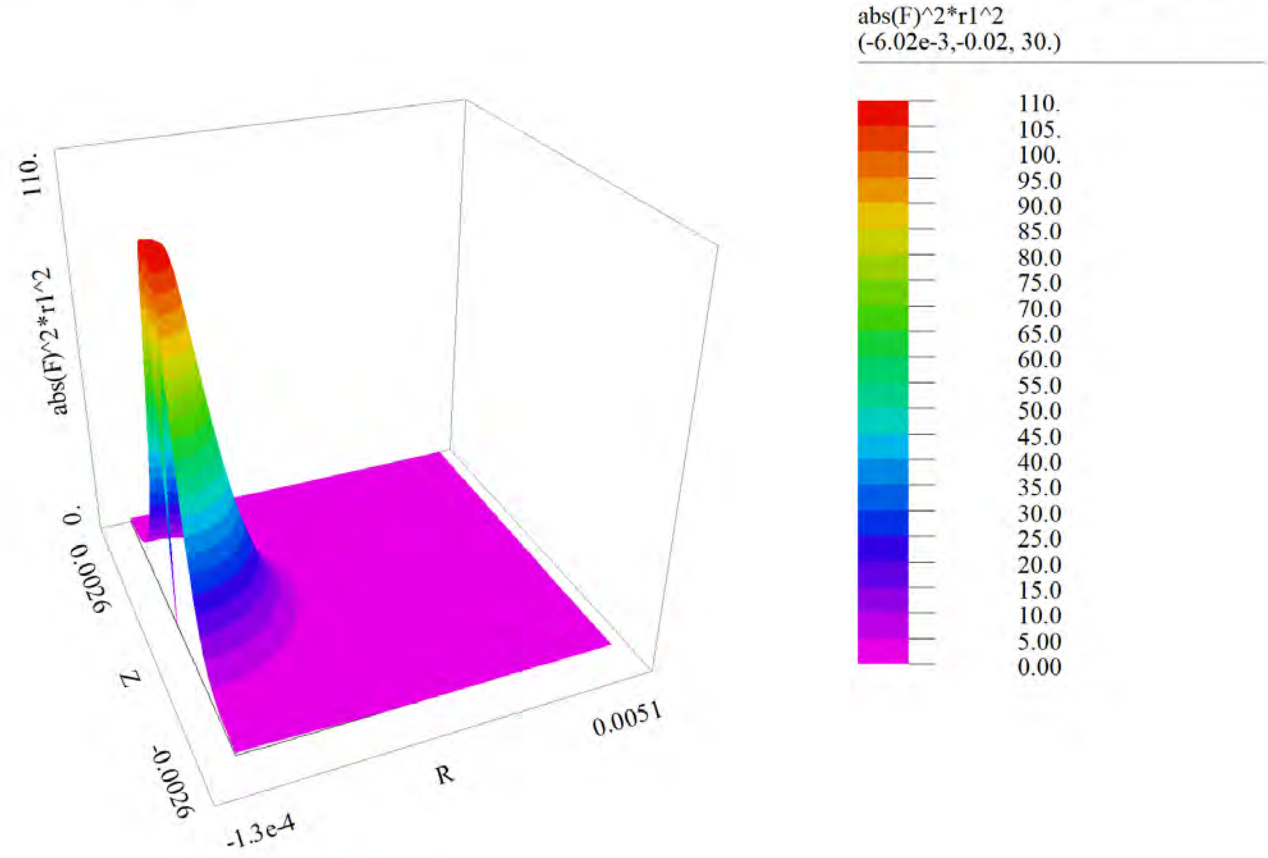
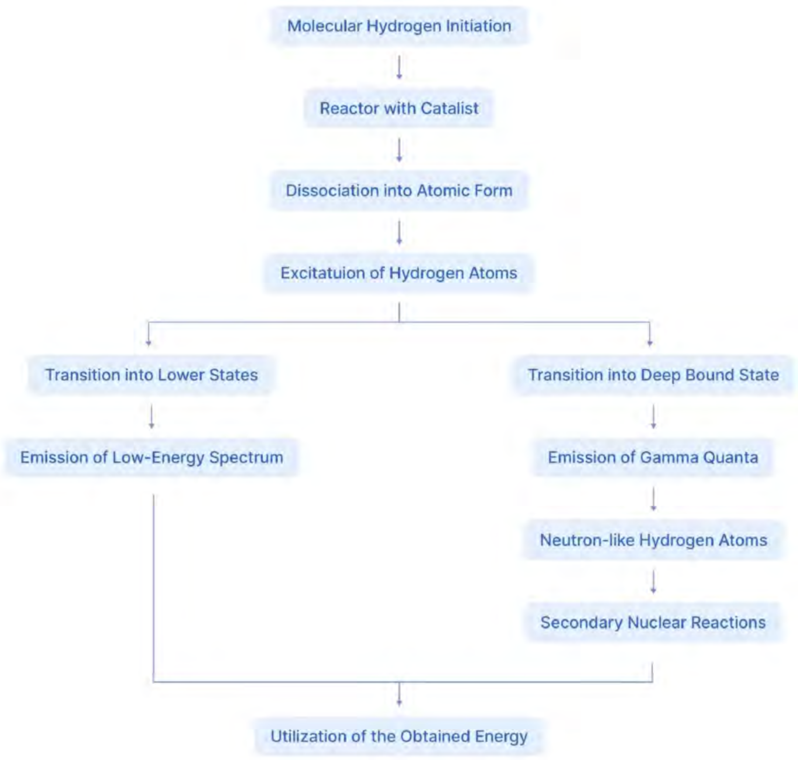
FlexPDE 5.0.22




M2Z=1:  Grid#6  p2  Nodes=12501 Cells=6148 RMS Err= 2.e-7
E0 eV= -479790.4  Orbital Radius*52.9 (pm)=  0.010445  Vol_Integral=  4.246931e-7

## Building on the deep state hydrogen atom theory:

1. Molecular hydrogen is introduced into a catalyst-filled reactor.
2. The hydrogen, upon interacting with the catalyst, transitions into its atomic form.
3. We then excite these hydrogen atoms.
4. During this excitation, some atoms transition into a deep bound state, emitting energy as gamma quanta.
5. Others move to lower states, releasing both gamma quanta and a typical low-energy spectrum.
6. These compact, neutron-like hydrogen atoms can participate in secondary nuclear reactions.
7. We then harness this released energy using various methodologies.



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# THANK YOU!

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