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POSSIBLE IMPLICATIONS OF NONLOCAL–INTEGRAL NUCLEAR EFFECTS FOR NEW METHODS OF RECYCLING NUCLEAR WASTE

RUGGERO MARIA SANTILLI[1]
Istituto per la Ricerca di Base, Castello Principe Pignatelli, Molise, Italy

We identify new methods for quantitative treatments of nonlocal-integral nuclear effects due to mutual penetrations of the charge distributions of nucleons in a nuclear structure; we show that these effects imply the alterability of the intrinsic magnetic moments of nucleons; we present the apparently first exact representation of total nuclear magnetic moments; we point out possible new means of recycling nuclear waste by the nuclear power companies in their own plants which are implied by said nonlocal-integral effects; and we propose three basic experiments. A more detailed presentation is available in an adjoining paper.

1 Expected lack of exact character of relativistic quantum mechanics in nuclear physics. RQM resulted to be *exactly valid* for the atomic structure because it represented in an *exact* way *all* its experimental data. By comparison, RQM is not expected to be *exact* for the nuclear structure because it has ben unable to represent exactly *all* its experimental data, as it is the case, e.g., for total nuclear magnetic moments [1a] where about 1% is still missing despite all possible relativistic corrections [1b]. The understanding is that RQM provide a good *approximation* of nuclear data. Nevertheless, even though predictably small, the expected deviations have a fundamental role for possible new means of recycling nuclear waste and other basic mathematical, theoretical and experimental advances.

The lack of exact character of RQM in nuclear physics can also be seen via arguments based on symmetries. Computer visualization of the Poincare' symmetry indicates its representation of *Keplerian systems,* i.e., systems with the heaviest constituent in the center, as in the atomic structure. By comparison, *nuclei do not have nuclei* and the Poincare' symmetry must be broken to represent structures *without* the Keplerian center. In turn, the latter breaking is fully in line with the deviations from P(3.1) required by the representation of nuclear magnetic moments.

The most compelling arguments are of *dynamical* nature. RQM was constructed for the characterization of local-differential, action-at-a-distance interactions derivable from a potential, as occurring in the atomic structure. By comparison, nucleons in a nuclear structure are in an average state of mutual penetration of about 10^{-3} parts of their charge distribution [2a]. But hadrons are some of the densest objects measured in laboratory until now. Their mutual penetration therefore implies a (generally small) component of the nuclear force which is: 1) of *contact* type i.e., with zero-range, thus requiring new interactions *without* particle exchanges; 2) *nonlinear* in the wavefunctions and, possibly, their derivatives, thus requiring a theory with an exact superposition principle under said nonlinearity; 3)

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[1] Perm. addr.: *IRB, P. O. Box 1577, Palm Harbor, FL 34682, USA, ibr@gte.net*

nonlocal, e.g., of integral-type over the volume of overlapping, thus requiring a new topology; 4) *nonpotential*, in the sense of violating the conditions to be derivable from a potential or a Hamiltonian [2b], thus requiring new dynamical equations; and 5) of consequential *nonunitary* type as a necessary condition to exit from the equivalence class of RQM, thus requiring new mathematical methods.

2 Relativistic hadronic mechanics. In this note we use a covering of RQM known as *relativistic hadronic mechanics* (RHM), submitted by Santilli [3] (for independent studies see monographs [4] and papers quoted therein), which apparently resolves the above problematic aspects, by permitting quantitative and invariant studies of nuclear structures with extended, nonspherical and deformable nucleons under nuclear forces possessing novel nonlinear, nonlocal and nonunitary terms.

RHM is constructed via axiom-preserving maps of RQM called *isotopies* [3a] here referred to *maps of any given linear, local-differential and unitary theory into its most general possible nonlinear, nonlocal-integral and nonunitary extensions which are nevertheless capable of reconstructing linearity, locality and unitarity on certain generalized spaces called isospaces, over certain generalized fields called isofields*. The alterations characterized by RHM are called *mutation* [6] in order to distinguish them from the "deformations" of the current literature.

The representation of physical systems via RHM requires the knowledge of *two* quantities: the Hamiltonian H for the representation of all local-differential, interactions; and the isotopic generalization of the conventional unit $I = \mathrm{diag.}\,(1, 1, 1, 1)$ of RQM, into the so-called *isounit*, $\hat{I} = \mathrm{Diag.}\,(n_1^2, n_2^2, n_3^2, n_4^2)\widehat{\times}(x, x, \psi, \partial\psi, ...) = \hat{I}^\dagger > 0$, where: n_1^2, n_2^2, n_3^2 represent *extended, nonspherical and deformable shapes of the nucleons* under the volume preserving condition $n_1^2 \times n_2^2 \times n_3^2 = 1$; n_4^Γ represents the *density of the medium in which motion occurs* (e.g., the local index of refraction); $\widehat{\text{and}}$ represents all nonlinear, nonlocal and nonpotential interactions.

The isotopic lifting of the basic (multiplicative) unit $I \rightarrow \hat{I}$ requires, for consistency, the corresponding lifting of the conventional associative product $A \times B$ of RQM into the *isoproduct* $A \hat{\times} B = A \times \hat{T} \times B$, $\hat{I} = \hat{T}^{-1}$, under which $\hat{I}$ is the correct left and right unit of the new theory, $\hat{I} \hat{\times} A = A \hat{\times} \hat{I} = A$ [3]. The *totality* of the products of RHM must therefore be isotopic for consistency.

A realization of RHM specifically conceived for the nuclear structure is presented in the adjoining paper [3g]. In essence, RQM can be reconstructed with respect to the new isounit $\hat{I}$ with isoproduct $A \hat{\times} B$ via the use of *nonunitary transforms*. In fact, for $U \times U^\dagger \neq I$, the isounit is given by the transform $I \rightarrow \hat{I} = U \times I \times U^\dagger = \hat{I}^\dagger$, the isoproduct is given by the transform $A \times B \rightarrow U \times A \times B \times U^\dagger = \hat{A} \times \hat{T} \times \hat{B} = \hat{A} \hat{\times} \hat{B}$, $\hat{A} = U \times A \times U^\dagger$, $\hat{B} = U \times B \times U^\dagger$, $\hat{T} = (U \times U^\dagger)^{-1} = \hat{I}^{-1}$, the fundamental relativistic commutation rules are subjected to the map $[p_\mu, x_\nu] = \delta_{\mu\nu} \times I \rightarrow U \times [p_\mu, x_\nu] \times U^\dagger = [\hat{p}_\mu \hat{,} \hat{x}\mathfrak{M}] = \hat{p}_\mu \hat{\times} \hat{x}_\nu - \hat{x}_\nu \hat{\times} \hat{p}_\mu = -i\, \delta_{\mu\nu} \times \hat{I}$, etc.

The reader should be aware that the above procedure implies: new field $\hat{F}$ ($= \hat{R}$ or $\hat{C}$ of real or complex) *isonumbers* $\hat{n} = n \times \hat{I}$ [3c]; new *isodifferential calculus* with $\hat{d}x^\mu = \hat{I}^\mu{}_\nu \times dx^\nu$, $\hat{\partial}/\hat{\partial}x^\mu = \hat{T}_\mu{}^\nu \times \partial/\partial x^\nu$ [3d]; new *isolinear momentum operator* $\hat{p}_\mu \hat{\times} | \hat{\psi} > = -i\hat{\partial}_\mu | \hat{\psi} > = -i\hat{T}_\mu{}^\nu \partial_\nu | \hat{\psi} >$; new *isohilbert space* $\hat{\mathcal{H}}$ with inner product $< \hat{\phi} | \times \hat{T} \times | \hat{\psi} > \times \hat{I} \in \hat{C}$

and normalization $<\hat{\psi}|\times\hat{T}\times|\hat{\psi}> = I$; new *isoeigenvalue equations* $\hat{H}\hat{\times}|\hat{\psi}> = \hat{E}\hat{\times}|\hat{\psi}> \equiv E\times|\hat{\psi}>$, $E \in F$, $\hat{E} = E\times\hat{1} \in \hat{F}$; new *Lie-Santilli isotheory* [3a,4] based on the isoproduct $[\hat{A}\hat{,}\hat{B}] = \hat{A}\hat{\times}\hat{B} - \hat{B}\hat{\times}\hat{A}$; new *isominkowski space* [3c] $\hat{M}$ over $\hat{R}$ with isounit $\hat{1} = \hat{T}^{-1}$, isometric $\hat{N}_{\mu\nu} = \hat{\eta}_{\mu\nu}\times\hat{1} = \hat{T}_{\mu}{}^{\alpha}(x, \dot{x}, \hat{\psi}, \partial\hat{\psi}, ...)\times\eta_{\alpha\nu}\times\hat{1}$, $\eta = \mathrm{Diag.}\,(1, 1, 1, -1)$, and isoseparation $(x - y)^{\hat{2}} = [(x - y)^{\mu}\hat{\eta}_{\mu\nu}(x - y)^{\nu}]\times\hat{1} \in \hat{R}$; a new image $\hat{P}(3.1)$ of the Poincare' symmetry first introduced by Santilli [3c,3d] under the name of *isopoincare' symmetry;* new *isofunctional analysis* [4b,4c];; etc.

An important property is that (for positive-definite isounits) all isotopic structures are locally isomorphic to the original ones, $\hat{F} \sim F$, $\hat{\mathcal{H}} \sim \mathcal{H}$, $\hat{M} \sim M$, $\hat{P}(3.1) \sim P(3.1)$, etc., and they coincide at the abstract, realization-free level by conception and construction. In particular, *RHM preserves the SR and only realizes it in isospace over isofields*. Thus, RHM *is not* a new mechanics, but merely a *new realization* of the abstract axioms of RQM, although the two realizations are *physically inequivalent* because connected by nonunitary transforms.

The reader should be aware that RHM admits a hierarchy of realizations to represent a hierarchy of physical conditions of increasing complexity, ranging from the minimal conditions of mutual overlapping of hadrons in the nuclear structure, to their maximal conditions of mutual penetration in the interior of collapsing stars. The realization needed for nuclear physics is constructed for the first time in the adjoint paper [3g], and it is conceived to *preserve conventional quantum laws*. In fact, we have the conventional uncertainties $\Delta\hat{r}\Delta\hat{p} \geq \frac{1}{2}<[\hat{p}, \hat{x})] = \frac{1}{2}<\hat{\psi}|\times\hat{T}\times\hat{1}\times\hat{T}|\hat{\psi}>/<\hat{\psi}|\times\hat{T}\times|\hat{\psi}> = \frac{1}{2}$ ($\hbar = 1$; the conventional spin $\frac{1}{2}$ and related Pauli's exclusion principle; and other conventional laws. This implies the preservation by RHM of causality under nonlocal interactions (because embedded in the unit), the validity of the superposition principle for a nonlinear theory (because of the reconstruction of linearity in isospace), the invariance under nonunitary time evolutions (because they are reduced to the isounitary law $W = \hat{W}\times\hat{T}^{1/2}$, $W\times W^{\dagger} \equiv \hat{W}\hat{\times}\hat{W}^{\dagger} = \hat{W}^{\dagger}\hat{\times}\hat{W} = \hat{1} \doteq I$), and other features [3b].

Nowadays RHM possesses several preliminary, yet numerical and significant verifications in nuclear physics, particle physics, astrophysics, superconductivity, biology and other fields which we cannot possibly review here for lack of space [3,4].

3 Exact representation of total nuclear magnetic moments. As indicated earlier, total nuclear magnetic moments still lack an exact representation via RQM after three-quarter of a century of studies. The most plausible explanation of the above occurrence was formulated by the Founding Fathers of nuclear physics in the late 1940's [1a]. Recall that nucleons are not point like, but have extended charge distributions with the radius of about 1 fm. Since perfectly rigid bodies do not exist in nature, the above "historical hypothesis" (as hereon referred to) assumes that such distributions can be deformed under sufficient external forces. But the deformation of a charged and spinning sphere implies a necessary alteration of its intrinsic magnetic moment. In turn, this permits the exact representation of total nuclear magnetic moments as shown below.

Our fundamental assumption is that the exact representation of total nuclear magnetic moments requires the lifting RQM → RHM, with basic lifting P(3.1) →

$\hat{P}(3.1)$ [3c]. In fact, the intrinsic characteristics of nucleons are perennial and immutable under P(3,.1), while $\hat{P}(3.1)$ has been constructed precisely to represent their alterability under sufficient conditions.

One of the first experimental verifications of RHM is then the exact-numerical representation of total nuclear magnetic moments. It was presented for the first time in ref. [5] under a joint mutation of angular momentum and spin. In this note we submit, apparently for the first time, a new representation under mutated magnetic moments but conventional values of angular momentum and spin.

The basic equation of RHM needed for a quantitative treatment of the historical hypothesis is the isotopic image of Dirac's equation, called *isodirac equation* [3b]. It is characterized by a nonunitary image of the conventional equation for total 6-dimensional isounits $\hat{1}_{tot} = \hat{1}^{Orb} \hat{\times} \hat{1}^{Spin}, \hat{1}^{Orb} = \mathrm{Diag.}\,(n_1^2, n_2^2, n_3^2, n_4^2) \hat{\times} = \mathrm{Diag.}\,(\hat{1}_{11}, \hat{1}_{22}, \hat{1}_{33}, \hat{1}_{44}), \hat{1}^{Spin} = U^{Spin} \times U^{\dagger\, Spin} \neq \hat{1}$ (see [3g] for details)

$$[\hat{N}_{\mu\nu} \hat{\times}^{Orb} \hat{\gamma}_\mu \hat{\times}^{Spin} (\hat{p}_\nu - \hat{i} \hat{\times} \hat{e} \hat{\times} \hat{A}_\nu) - i \times \hat{m}^2) \hat{\times}^{Orb} \hat{\psi} = 0, \tag{1a}$$

$$\{ \hat{\gamma}_\mu \hat{,} \hat{\gamma}_\alpha \} = \hat{\gamma}_\mu \times \hat{1}^{Spin} \times \hat{\gamma}_\alpha + \hat{\gamma}_\alpha \times \hat{1}^{Spin} \times \hat{\gamma}_\mu = 2 \hat{\eta}_{\mu\alpha} \times \hat{1}^{Spin}, \tag{1b}$$

$$\hat{\gamma}_\mu = (\hat{1}_{\mu\mu}{}^{Orb})^{1/2} \times U^{Spin} \times \gamma_\mu \times U^{\dagger\, Spin} \times \hat{1}^{Spin}, \tag{1c}$$

where $\hat{i} \hat{\times} \hat{e} \hat{\times} \hat{A}_\mu = (i \times e \times A_\mu) \hat{\times} \hat{1}$ and the elm potential A_μ is conventional, being external.

It is easy to see that isodirac equation (1) preserves the conventional eigenvalues of angular momentum and spin due to its very construction via nonunitary transforms of conventional equations (see [3g] for details) ,while providing the desired *mutation of the magnetic moment of nucleons* [3b,5]

$$\hat{\mu}_N = \mu_N \times n_4 / n_3, \quad N = n \text{ or } p. \tag{2}$$

The application to the *exact* representation of total nuclear magnetic moments is straightforward. Assume to a good approximation that protons and neutrons have the same shape ($n_{kn} = n_{kp}$) and that they move in the same medium ($n_{4n} = n_{4p}$). Then, a simple isotopy of the QM model [1a] yields the *RHM model for the total nuclear magnetic moments*

$$\hat{\mu}^{Tot} = \textstyle\sum_k (\hat{g}_k{}^L \times \hat{M}_{k3} + \hat{g}_k{}^S \times \hat{S}_{k3}), \tag{3a}$$

$$\hat{g}_n = g_n\, n_4 / n_3 \sim g_n / n_3, \quad \hat{g}_p = g_p\, n_4 / n_3 \sim g_p / n_3, \tag{3b}$$

where $e\hbar/2m_p c_0 = 1$, $g_n{}^s = -3.816$, $g_p{}^s = 5.585$, $g_n{}^L = 0$, $g_p{}^L = 1$. As an illustration, the above model yields the following *exact representation of the deuteron magnetic moment*

$$\hat{\mu}_{Theor}{}^{Tot} = g_p\, n_{4p}/n_{3p} + g_n\, n_{4n}/n_{3n} \sim (g_p + g_n)\, n_4 / n_3 \equiv \mu_D{}^{Exp} = 0.857, \tag{4a}$$

$$n_4{}^2 = 1.000, \quad n_3{}^2 = 1.054, \quad n_1{}^2 = n_2{}^2 = 1 / n_3{}^2)^{1/2} = 0.974. \tag{4b}$$

As one can see, $\mu_D{}^{Exp}$ is represented exactly by merely assuming that the charge distribution of the nucleons in the deuteron experiences a deformation of shape of about 1/2 %. Note that the mutation is of *prolate* character which implies a *decrease* of the (absolute value of the) intrinsic magnetic moment of nucleons, exactly as needed. Note also that the representation is of *geometric* character; it is independent from any assumed nucleon constituent; and it identifies the polarization of the constituent orbits which is needed for their compliance with physical reality. Corrections due to the value $n_4 \doteq 1$ for the deuteron are of 2-nd or higher order (due to the relatively large nucleon distance in the deuteron).

The application of model (3) to the exact representation of the total magnetic moment of tritium, helium and other nuclei is straightforward.

4 The basic principle for possible new recycling of nuclear waste. In their realization for nuclear physics [3g], RHM and the isopoincare' symmetry $\hat{P}(3.1)$ predict the possible mutation not only of the intrinsic magnetic moment of the neutron, but also of its meanlife, to such an extent that the former implies the latter and viceversa (as one can see via the use of the Lorentz isoboosts [3c]).

In turn, the possible control of the meanlife of the neutron *de facto* would imply new means for recycling nuclear waste. Their main expected characteristic is that of being usable by nuclear power companies in their own plants, thus offering a possibility of avoiding the expensive and dangerous transformation of the waste to a (yet unknown) dumping area which has been estimated to cost in the US 230 *billion* dollars solely for the first five years of operation [6a].

To study new means of recycling nuclear waste, the first physical reality which should be noted (and admitted) is that total nuclear magnetic moments constitute clear *experimental evidence* on the alterability of the intrinsic magnetic moments of nucleons. The alterability of the mean lives of unstable structure is then a mere consequence of the isopoincarè symmetry.

The second physical reality which should be noted (and admitted) is that, by no means, the neutron has a constant and universal meanlife, because it possesses: a meanlife of the order of seconds when belonging to certain nuclei with rapid beta decays; a meanlife of the order of 15 minutes when in vacuum; a meanlife of the order of days, weeks and years when belonging to other nuclei; all the way to an infinite meanlife for stable nuclei.

Once the above occurrences are admitted, the *basic principle for possible new recycling of nuclear waste predicted by RHM and its universal isopoincare' symmetry is the "stimulated neutron decay" (SND) consisting of resonating or other subnuclear mechanisms suitable to stimulate its beta decay.* A number of possibilities are under study and some of them are under patenting. Among them, we quote here the possible *gamma stimulated neutron decay* (GSND] according to the reaction [7b] $\gamma + n \rightarrow p^+ + e^- + \bar{\nu}$, which is predicted by RQM to have a very small (and therefore practically insignificant) cross section as a function of the energy, but which is instead predicted by RHM to have a resonating peak in said cross section at the value of 1.294 MeV (corresponding to 3.129×10^{20} Hz) [7b,7c]. As such, the above mechanism is of *subnuclear* character, in the sense of occurring in the *structure of the neutron,* rather than in the nuclear structure, the latter merely implying possible refinements of the resonating frequency due to the (relatively smaller) nuclear binding energy [7c]. When stable elements are considered, the above GSND is admitted only in certain instances, evidently when the transition is compatible with all conventional laws [7B].

The point important for this note is that the GSND is predicted to be admissible for large and unstable nuclei as occurring in the nuclear waste. The possible new form of recycling submitted for study in this note is given by *bombarding the radioactive waste with a beam of photons of the needed excitation frequency and of the maximal possible intensity*. Such a beam would cause an instantaneous excess of peripheral protons in the waste nuclei with their consequential decay due to instantaneous excess of Coulomb repulsive forces.

It should be stressed that this note can only address the *basic principle* of the GSND and it would be unrealistic to expect the joint treatment of its possible technological realization (for initial studies, see [7d]).

The important point is that, being restricted to the production of photons via synchrotron and other means, the equipment of the above recycling is expected to be much smaller in size, weight and cost than large particle accelerators currently projected following the transportation and storage of the waste [6b]. As such, the proposed recycling is expected to verify the basic requirement of usability by the nuclear power companies in their own plants.

A novelty of this note is that the study of recycling mechanisms is specifically restricted to the *subnuclear* level. A virtually endless number of possibilities exist for the reduction of the meanlife of the waste via mechanisms of *nuclear*, and, therefore, of QM type, e.g., those of patents [8]. The understanding is that, to maximize the efficiency, the final equipment is expected to be a combination of various means of both subnuclear and nuclear character.

As a final comment, the reader should be aware that any new recycling of nuclear waste is unavoidably linked to possible new sources of energy. In fact, the GSND $\gamma_{res} + Mo(100, 42) \rightarrow_{Stim.} Tc(100, 43) + \beta \rightarrow_{Spont.} Ru(100, 44) + \beta$ is *de facto* a potential new source of *subnuclear* energy called *hadronic energy* [7b] (releasing the rather large amount of about 5 MeV plus the energy of the γ_{Res} per nucleus). It should be noted that, if confirmed, the new energy would not release harmful radiations, would not imply radioactive waste, would not require heavy shield or critical mass, and would be realizable in large or minuterized forms, thus having the necessary pre-requisites for additional studies.

5 Suggested basic experiments. The continuation of quantitative scientific studies on the proposed new recycling of nuclear waste (as well as on possible subnuclear forms of clean energy) beyond the level of personal views one way or another, requires the following three basic experiments, all of moderate cost and fully realizable with current technology.

I. Finalize the interferometric 4π spinorial symmetry measures [9]. Preliminary direct experimental measures on the alterability of the *intrinsic* magnetic moments of nucleons were conducted from 1975 to 1979 by H. Rauch and his associates [9a-9e]. The best available measures [9e] indicate about 1% deviations from 720°. But such deviation is *smaller* than the error, and the measures are therefore undefined. Similar unsettled measures were conducted by Werner and others [9f].

The above measures are manifestly fundamental for possible new forms of recycling as well as for possible new subnuclear energy. In fact, deviations from 720° are not representable via the Poincarè symmetry while our isopoincare symmetry provides an *exact representation* of the measures via the isospinorial transform $\hat{\psi}' = \hat{R}(\theta_3)\hat{\times}\hat{\psi} = \{\exp(i\,\gamma_1\gamma_2\hat{\theta}_3/2)\}\times\hat{\psi}$, $\hat{\theta} = \theta/n_1 \times n_2 = 720°$ [3b], with numerical values, e.g., for a 1% deviation $n_1^2 = n_2^2 = 713° / 720 = 0.990$, $n_3^2 = 1.020$, $\hat{\mu}/\mu = n_4/n_3 \sim 713°/720°$, $n_4 = n_3 \times 713 / 714 = 1.000$, with similar exact representation for the expected final measures. Mutations of meanlives are then consequential.

II. Repeat don Borghi's experiment [7e] on the apparent synthesis of the neutron from protons and electrons *only*. Despite momentous advances, we still miss fundamental knowledge on the structure of the neutron, e.g., on how the neutron is synthesized from protons and electrons *only* in young stars solely composed of hydrogen according to the reaction $p^+ + e^- \rightarrow n + \nu$ which: is the "inverse" of the GSND; is predicted by RQM to have a very small cross section as a function of the energy; while the same cross section is predicted by RHM to have a peak at the threshold energy of 0.80 MeV in singlet p-e coupling [7c].

The possible synthesis of the neutron has a fundamental relevance for waste recycling, besides other industrial applications. If the electron "disappears" at the creation of the neutron, as in current theoretical views, the GSND becomes of difficult if not impossible realization.

But the electron is a permanent and stable particle. As such, doubts as to whether it can "disappears" date back to Rutherford's very conception of the neutron as a "compressed hydrogen atom" [7a]. As well known, RQM does not permit such a representation of the neutron structure on numerous counts. Nevertheless, the covering RHM has achieved an exact-numerical representation of all characteristics of the neutron according to Rutherford's original conception [7c]. The novelty is that, when immersed within the hyperdense proton, the electron experiences a mutation $e^- \rightarrow \hat{e}^-$ of its *intrinsic* characteristics (by becoming a quark ŝ) including its rest energy (because $n_4 \neq 1$ inside the proton, thus $E_{\hat{e}} = mc^2 = m_e c_0 2/n_4^2$). The excitation energy of 1.294 MeV is predicted by our covering isopoincare' symmetry under the condition of recovering all characteristics of the neutron for the model $n = (p^+_{\uparrow}, \hat{e}^-_{\downarrow})_{RHM}$, including its primary decay for which $\hat{e}^- \rightarrow e^- + \bar{\nu}$ [7c].

A preliminary experimental verification of the synthesize the neutron in laboratory was done by don Borghi's and his associates [7e]. Since experiments can be confirmed or dismissed solely via other experiments and certainly not via theoretical beliefs one way or the other, don Borghi's experiment should be run again. The test can be repeated either as originally done [7e], or in a number of alternative ways, e.g., by hitting with a cathodic ray of 0.80 MeV a mass of beryllium saturated with hydrogen, put at low temperature and subjected to an intense electric field to maximize the p-e singlet coupling. The possible detection of neutrons emanating from such a set-up would establish their synthesis.

III. Complete Tsagas' experiment [7f] on the stimulated neutron decay. The latter experiment has been recently initiated by N. Tsagas and his associates [7f]. It consists of a disk of the radioisotope Eu^{152} (emitting gammas of 1.3 MeV) placed parallel and close to a disk of an element admitting of the GSND, such as the Mo(100, 42) (or a sample of nuclear waste). The detection of electrons with at least 2 MeV emanating from the system would establish the *principle* of the GSND (because such electrons can only be of subnuclear origin, Compton electrons being of at most 1 MeV [7f]). The detection via mass spectrographs of traces of the extremely rare Ru(100, 44) after sufficient running time would confirm said principle. The practical realization of the proposed form of waste recycling would then be shifted to the industrial development and production of a photon beam of the needed frequency and intensity.

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