Beyond hydrogen loading

Gianni Albertini
Università Politecnica delle Marche (UNIVPM) Via Brecce Bianche, 60131 Ancona, Italy
and
Massimo Rogante
Rogante Engineering Office, Contrada San Michele 61, 62012 Civitanova Marche, Italy

Abstract

While experimental and technological attention is focused on the operational methods for hydrogen loading in metals and on the observed anomalies with respect to well-established rules, we aim to remark that these methods and these consequences can be seen as a part of a more general problem. In fact, most of the experiments and deductions of material sciences are based on the assumption that space-time is flat and isotropic (Minkowskian). After discarding this assumption, a theory of Deformed Space Time (DST) was developed in the last decades. Following this theory, experimental results were obtained which are not predicted by the Standard Model. The DST-theory concerns the fundamental interactions and in particular the nuclear ones, that can play the main role in the observed anomalies.

In order to consider a nuclear reaction as a DST-reaction, four main phenomenological features were deduced: occurrence of an energy threshold; change of atomic weight; absence of gamma radiation; anisotropic emission of nuclear particles in intense beams having a very short life span.

From the experimental point of view, rather than looking for fortuitous events that produce the conditions for DST-reactions, more systematic research can be undertaken by following the above reported four general rules. In particular, the occurrence of a thresholds can correspond to a latency time, necessary to reach the energy density necessary to deform space-time. The absence of gamma radiation cannot be considered as a sign that nuclear reactions are not present; in fact, in absence of detected gamma radiation elements were found which were not present before the reaction. The nuclear emissions, which are anisotropic and impulsive, can be difficult to detect with the traditional methods, thus inducing incertitude on the occurring reactions. Finally, a rapid variation of energy density is an experimental common factor of DST-reactions.

Thus, the DST-theory can be the leading theory in the design of the experiment and in the interpretation of its experimental results.

Foreword

While reading this contribution, we invite you to free your mind from previous assumptions and to imagine a world different from the one our experience and the experience of past generations push us to consider as real.

In fact, the most of our knowledge is based on the inputs coming from our instruments and from sight, hearing, touch, taste, smell: their functioning is based on the electromagnetic interaction. Thus, the world we know is mainly the world of electromagnetic interaction: the space is isotropic, homogeneous and flat while the time flows at a rate that, until the end of the XIX century, was assumed to be constant.

Imagine that, beside this world, other worlds exist where the opposite directions are not specular (this is already accepted in the Standard Model for the weak nuclear interaction) and/or space-time is not flat and/or time flows at different rates (as Einstein relativity says) with respect to our detection instruments; each of the four fundamental interactions acts in a different world. No matter that the electromagnetic and the weak nuclear ones are the same interaction, as all the interactions are tried to be seen as one sole interaction in the Great Unification Theory! In the range of energy where we live, four interactions are acting and each one gets its own world [*].

The question if the different worlds are in the same position at the same time can be without answer, as different space-times occur.

A neutron can live in these four different worlds and, while free to wander in the world of an interaction, it can be confined in the nucleus in another interaction. If an appropriate energy concentration can deform the world of the latter interaction in such a way as to make it somehow similar to the first, "deformed" world of the former, the neutron can escape from the nucleus without gamma emission, as the gamma energy is used to keep the space-time deformed; so, other neutrons in the surrounding can escape and an intense beam is emitted.

These emissions are not isotropic in space nor constant in time for us, as they were produced in a space-time that is deformed with respect to ours.

Thus, while in the traditional nuclear reactions a large amount of energy is needed to overcome the energy barrier keeping the nucleon confined and some gamma energy is emitted, in a Deformed Space-Time (DST) reaction the amount of energy can be lower and no gamma emission is observed.

As the reactions occur in a deformed space-time, in our world they are not-isotropic and not-constant in time, so that a violation of the Local Lorentz Invariance (LLI) is evident, as this invariance imposes an isotropic space and a flat (Minkowskian) space-time.

In the same way, the violation of LLI occurs in the electron emissions from ^{60}Co: in fact, parity is well known not to be conserved due to the weak nuclear interaction.

Introduction

According to what is now called the DST-theory (Deformed Space Time theory), different metric parameters correspond to the different fundamental interaction (Mignani Metrics)[1,2].

These parameters were deduced from the experimental data concerning the leptonic decay of the meson K_{0S}[3,4] (weak interaction), pion pair production[5] (strong interaction), superluminal waves in conducting waveguides[6-10] (electromagnetic interaction) and clock rates at different height[11] (gravitational interaction).

These parameters are not constant but depend on energy, thus allowing different

---

[*] We remark that we are not dealing the question of the so called "Parallel Universes". We are dealing the problem of the "Multimetrics", concerning the occurrence of different metric parameters of the interactions operating in the same phenomenon.

deformation of the space-time to occur at different energy.

The relationship between the time parameter “b_T”, the spatial parameters “b_X”, “b_Y” and “b_Z” and the space-time deformation is obtained by considering the generalized space-time distance “ds”:

$$ds^2 = b_T{}^2 \bullet c^2 \bullet dt^2 - b_X{}^2 \bullet dx^2 - b_Y{}^2 \bullet dy^2 - b_Z{}^2 \bullet dz^2$$

(ct, x, y, z being the coordinates of a point in the space-time and c the light speed in vacuum in a not-deformed space-time).

The deformation of one space-time with respect to another can be evaluated by a deformation coefficient, which is the ratio between the two corresponding values of ds^2.

The not-deformed condition (Minkowsky space-time) corresponds to all squared parameters equal to 1. The corresponding deformation coefficient is 1.

At increasing energy, four different thresholds occur for the four interactions, as shown in Fig. 1.

.

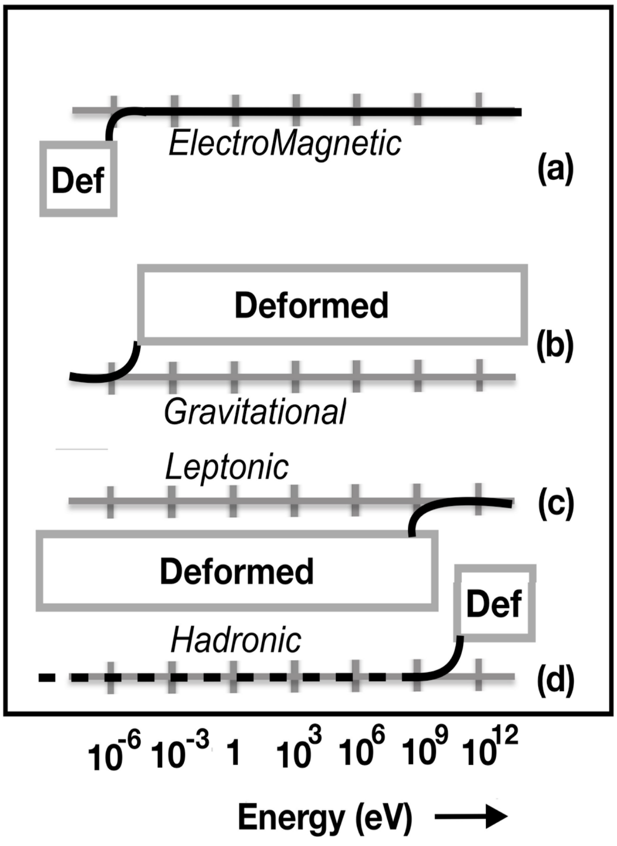

Fig. 1 Metric deformation coefficients of the four fundamental interactions as functions of energy (A pictorial representation).

The grey lines correspond to the Minkowsky space-time (all space and time parameters are equal to 1 and the deformation coefficient is 1).

(a) Electromagnetic interaction: space-time is deformed below the threshold of 4.5 μeV, due to the space parameters.

(b) Gravitational interaction: space-time is deformed above the threshold of 20 μeV, due to the time parameter

(c) Weak nuclear interaction: space-time is deformed below the threshold of 180 GeV, due to the space parameters.

(d) Strong nuclear interaction: space-time is deformed above the threshold of 367.5 GeV, due to one space parameter and the time parameter. Below this threshold, however, space is not isotropic (dashed black line).

To the electromagnetic interaction, space-time is deformed below the threshold of 4.5±0.2 μeV, due to the space parameters; the deformation coefficient is less than 1 and increases with energy until attaining the value 1 at the threshold.

To the gravitational interaction, the space-time is deformed above the threshold of 20.2±0.1 μeV, due to the time parameter, and the deformation coefficient increases at higher energy. (The behaviour of space parameters could not be deduced from the behaviour of clocks at different heights)

To the weak nuclear (or leptonic) interaction, the space-time is deformed below the threshold of 180.4±0.2 GeV, due to the space parameters and the deformation coefficient reaches the value 1 coming from lower values.

To the strong nuclear (or hadronic) interaction, the space-time is deformed above the threshold of 367.5±0.4 GeV, due to two parameters: one of space and another of time; the deformation coefficient is higher for higher energy. Below this threshold, however, although the metric parameters are constant, the space is not isotropic.

In this framework, the space-time of electromagnetic interaction is Minkowskian in the range of energy in which we usually operate (i.e. greater than 5 μeV).

The core question

Using the above reported thresholds of energy in a technological problem is not easy. However, the corresponding thresholds of energy density, which is easier to evaluate in material science, were evaluated in a recent paper [12].

To this aim, the volume where this amount of energy is stored when a DST-reaction takes place was considered. In fact, two classes of experiments, one in liquid material and the other in solids, is evidence that the micro-reactors where the reactions occur are in any case of similar size: i.e. some microns.

In the case of liquids, the application of ultrasound, either to pure distilled water[13-15] or to water solutions [16], produced neutron emissions and modification of the elemental composition only if the sonication bubbles were a few microns in size.

People working in the field of ultrasound were sceptical about these results, as they never detected similar effects in their many-years of experience. However, a report[17] describes transmutations and particle emissions after sonication of pure water. In this case, no explanation was given in terms of DST-reactions, which presumably were unknown to the author.

In the case of solids, the application of ultrasound to four samples, two of sintered Ferrite and two of carbon hardened steel, resulted in the emission of neutrons and the presence of elements that were not present in the corresponding original samples[18] .

From electron microscopy images and elemental analysis by x-ray energy-dispersion spectra, it was deduced[19,20] that a nuclear reaction occurred inside some of the cavities already present in the material. The dimensions of these micro-reactors (Ridolfi cavities) were a few microns, similar to the sonication bubbles.

In order to slow down the particle emissions, the compression/expansion cycles induced by the ultrasound in the materials with a period of 50 μs were replaced by five slower compression/expansion cycles of mechanical presses[21,22] on the order of 10^2-10^3 s, each composed of a pre-load of 60 seconds at 300 N, a compression phase at fixed strain rate of 1, 2, 3, 4 or 5 micron/s respectively up to a load of 160 kN, and a fast stress release phase from 160 kN to 300 N of about 10 s. The rationale of this change is the same used in the classical nuclear reactors, where the fast processes of an atomic bomb are slowed down to use them in a less dangerous and more controlled way.

Also at this slower rate, nuclear particle emissions (alpha particle[21,22] or neutron[23] emissions) were detected.

Although the mechanical cycles were slowed down, we presume that the single reaction was caused by a sudden and catastrophic local variation of energy concentration, analogous to the case of ultrasound. In the studies making use of ultrasounds in liquids, a sudden catastrophic energy concentration was assumed to be created by the implosion of the bubbles. Due to its radius, which is very small with respect to the ultrasound wavelength, each bubble is subjected to a locally isotropic pressure during sonication. The reduction of the radius to almost zero occurs at the very high speed of a shock wave: thus, in a very short time the energy of the bubble was concentrated in a volume almost reduced to zero.

The conditions of high energy concentration in the space and high variation of energy density in the time were thus produced.

In a similar way, when ultrasound was applied to solids[18-20], the radius of the Ridolfi cavities was very small with respect to the ultrasound wavelength, so that an isotropic pressure acted on each cavity and compressed its internal part down, with consequent high variation of energy density in a short time.

Further support to this assumption came from two kinds of natural rocks, green Luserna granite and Carrara marble, which were compressed until they ruptured [24]. Neutron emissions were detected in granite, characterised by a brittle sudden fracture, while no intensity higher than the background noise was registered in marble, which is characterised by a slow ductile rupture.

The neutron emissions were not isotropic. In fact, they were in a very intense neutron beam detectable only in some directions.

The anisotropy was more deeply studied in an AISI 304 cylinder kept in the vertical position inside a cylindrical Teflon calorimeter, surrounded by 16 CR39AB neutron detectors[25-27]. The sample was irradiated by 20 MHz ultrasound with a maximum power of

2 kW.

Also in this case, neutron emissions were recorded: their intensity was very intense along two opposite horizontal directions and absent in the two horizontal opposite directions perpendicular to them. No gamma radiation above background was detected.

The geometry of this experiment was the starting point for the realisation of a reactor able to transform liquid Mercury into solid material[28-30]. This material contained elements not present in the original sample nor in the parts of the experimental apparatus in contact with it. Among the produced elements, rare earths were also found[30].

Discussion

In the above reported experiment, low-energy nuclear reactions are described which are based on DST-reactions.

Different materials were used: pure water[13-15], water solutions[16], natural rocks like marble and granite[24], technological metals like ferrite and steels [18-23], a liquid metal i.e. mercury[28-30].

Also, different techniques were applied to induce the adequate energy concentration inside the materials.

A question arises: what are the main features we can extract from all these experiments, so that we can recognize a reaction as a DST-reaction?

The occurrence of one or more thresholds in energy is the first characteristic. In order to transform a flat space-time into a deformed one, or vice versa, an adequate energy density must be achieved. This value not only depends on the energy threshold, but also on the occurrence of suitable sites, having the right size, to act as micro-reactors[12].

There is a reason why a larger site with a larger amount of energy, thus having the same density, or with smaller density, thus containing the same energy, is not suitable. This can be determined by considering the time. As the space-time – not only the space – is the critical parameter, the density of energy in time, or better the variation of energy per unit time, is also important.

We hypothesise that a "coherence time interval" must be considered, for the effective variation of energy. Thus, a larger distance corresponds to a time too long to consider all the energy as a sole amount of energy. However, no measurement has been performed to better define this time interval.

From a technological point of view, reaching the required energy density means that a latency time[31] can be observed between the input of energy and the start of the reaction. From the macroscopic point of view, reaching this density corresponds to the beginning of the reaction. Conversely, the sudden variation of energy – not the amount of energy – is responsible of the single reaction inside the single micro-reactor.

Nuclear DST-reactions are of great interest to shed light on the large number of experiments dedicated to LENRs[31]. However, DST-reactions concern all interactions, not only nuclear ones.

A further characteristic of DST-reactions is that, although variations of atomic weights and/or nuclear particle emission are detected, no gamma emission is detected. This fact is explained if the energy of the gamma radiation is adsorbed to keep the space-time deformed.

This point is of great importance for the people working in the field of LENRs, as one of the main reasons why sceptics find it difficult to accept these nuclear reactions is the absence of gamma radiation.

In DST-reactions, the emissions of nuclear particles are very intense, anisotropic and impulsive beams. Their detection needs precautions. In fact, a large solid angle must be explored to include the few directions of emission. In addition, most traditional detectors and their electronics may count a short-living signal of many particles as one only particle, which can be included in the statistic fluctuation of the background, or even cancel it out as a noise, due to its short duration.

These facts make the evaluation of the mass balance of the studied reactions difficult.

In this framework, a leading guide for future experiments of hydrogen loading is that the different methodologies will get an "*a priori*" planning or an "*a posteriori*" explanation considering them as different methods to realise the conditions suitable for DST-reactions.

Those difficulties that made LENRs difficult to accept by the scientific community – mainly: absence of gamma radiation; energy input too low to realise nuclear reactions; mass balance not possible – are resolved and, on the contrary, are good indicators for considering the occurrence of a DST-reactions.

Conclusions

Hydrogen loading in a suitable way can be one of the methods to create the conditions necessary to induce nuclear DST-reactions.

There are some common features to recognize these reactions and, more usefully from the technological point of view, to induce them.

The most important condition is to obtain the right energy density in the space and the right variation of energy over time. However, these quantities are concerned with the microscopic scale while the experimenter operates at a macroscopic scale. Thus, different technologies must be tested and analysed to obtain these conditions.

The knowledge of these suitable conditions, and of the experimental evidence already obtained, is a reference point for the design of future experiments and for understanding the past and future experimental results.

As an example, the importance of deuterium has been discussed for a long time, and some analogy with the well-known fusion of hydrogen has been searched for. If one considers the alpha emissions obtained in DST-reactions, the occurrence of helium can rather be a consequence of alpha emission than the product of traditional fusion. On the other hand, the active role of deuterium, as well as of hydrogen, should be analysed in terms of energy accumulated, for instance in deforming the crystal lattice, and in abrupt energy release, for instance when the crystal lattice collapses locally.

In a similar way, in the other cases the DST-theory can be the leading theory for the interpretation of experimental results.

References

[1] F. Cardone, R. Mignani, Energy and Geometry, ed. World Scientific, Singapore, (2004).

[2] F. Cardone, R. Mignani, Deformed Spacetime, ed. Springer, Dordrecht, The Netherlands. ISBN 978-1-4020-6282-7 (HB) ISBN 978-1-4020-6283-4 (e-book) (2007).

[3] S. H. Aronson, G. J. Bock, H. -Y. Chang and E. Fishbach “Energy dependence of the fundamental parameters of the K0− K0 system. II. Theoretical formalism” Phys. Rev. D28 , 495 (1983).

[4] N. Grossman, K. Heller, C. James, M. Shupe, K. Thorne, P. Border, M. J. Longo, A. Beretvas, A. Caracappa, T. Devlin, H. T. Diehl, U. Joshi, K. Krueger, P. C. Petersen, S. Teige, and G. B. Thomson “Measurement of the lifetime of K0S mesons in the momentum range 100 to 350 GeV/c” Phys. Rev. Lett. 59 , 18 (1987).

[5] UA1 Collaboration “Bose-Einstein Correlations in pp Interactions at $\sqrt{s}$= 0.2 to 0.9 TeV” Phys. Lett. B226 , 410 (1989). DOI: 10.1016/0370-2693(89)91221-5

[6] A. Enders and G. Nimtz “On superluminal barrier traversal” J. Phys. I (France) 2 , 1693-1698 (1992). DOI: 10.1051/jp1:1992236

[7] A. Enders and G. Nimtz “Zero-time tunneling of evanescent mode packets” J. Phys. I (France) 3, 1089-1092 (1993). DOI: 10.1051/jp1:1993257

[8] A. Enders and G. Nimtz “Evanescent-mode propagation and quantum tunneling” Phys. Rev. E48, 632 (1993). DOI:https://doi.org/10.1103/PhysRevE.48.632

[9] A. Ranfagni, D. Mugnai, P. Fabeni and G. P. Pazzi “Delay-time measurements in narrowed waveguides as a test of tunneling” Appl. Phys. Lett. 58 , 774 (1998). DOI: https://doi.org/10.1063/1.104544

[10] A. Ranfagni, P. Fabeni, G. P. Pazzi and D. Mugnai “Anomalous pulse delay in microwave propagation: A plausible connection to the tunneling time” Phys. Rev. E48, 1453 (1993). DOI:https://doi.org/10.1103/PhysRevE.48.1453

[11] C.Alley “Proper time experiments in gravitational fields with atomic clocks, aircraft, and laser light pulses” in Meystre, P., and Scully, M.O. (eds.) “Quantum Optics, Experimental Gravitation, and Measurement Theory, Proceedings of the NATO Advanced Study Institute on Quantum Optics and Experimental General Relativity. August 1981, Bad Windsheim, Germany”, NATO Science Series: B, vol. 94, pp. 363-427 Plenum Press, New York,), 5 (1983)

[12] F. Cardone, V. Calbucci and G. Albertini, “Deformed space time of the piezonuclear emissions”, Modern Physics Letters B28, N. 2 - (2014).

[13] F. Cardone and R. Mignani “Possible evidence for transformation of chemical elements in cavitated water”. Int. J. Mod. Phys. B (1995), 17, 307

[14] F. Cardone, R. Mignani, W. Perconti, E. Pessa and G. Spera “Possibile evidence for production of an artificial radionuclide in cavitated water” Jour. Radioanalytical Nucl. Chem (2005), 265, 151

[15] F. Cardone, R. Mignani, W. Perconti, E. Pessa and G. Spera “Nucleosynthesis of an artificial radionuclide by cavitation” Gravitation and Cosmology (2005), 11, 1-2 (41-42)

[16] F. Cardone, G. Cherubini, R. Mignani, W. Perconti, A. Petrucci, F. Rosetto and G. Spera “Neutrons from Piezonuclear Reactions” Annales de la Fondation Louis de Broglie, vol. 34,138 (2009)

[17] Mark Leclair “Water alchemy: harnessing the power of cavitation reentrant jets” Pulse Magazine, issue 2, 6-11, Spring 2014 (2014)

[18] F. Cardone, R. Mignani, M. Monti, A. Petrucci and V. Sala, “Piezonuclear reactions from Iron” Modern Physics Letters A27 No. 18 (2012)

[19] F. Ridolfi, F. Cardone and G. Albertini, “Ultrasonic Damages in Iron” J. Adv. Phys. 2, No. 4,. 40-44 (2013)

[20] G. Albertini, F. Cardone, M. Lammardo, A. Petrucci, F. Ridolfi, A. Rosada, V. Sala and E. Santoro, "Atomic and isotopic changes induced by ultrasounds in iron", Journal of Radioanalytical and Nuclear Chemistry 304, n. 2, 955-963 (2015)

[21] F. Cardone, V. Calbucci and G. Albertini “Possible evidence of Piezonuclear alpha emission” J. Adv. Phys. 2013, Vol. 2, No. 1, pp. 20-24(5) (2013) - 2168-1996/2013/2/001/005 – doi: http://dx.doi.org/10.1166/jap.2013.1029

[22] G. Albertini, V. Calbucci, F. Cardone, G. Fattorini, R. Mignani, A. Petrucci, F. Ridolfi and A. Rotili “Evidence of alpha emission from compressed steel bars” International Journal of Modern Physics B, Vol. 27 n. 23 September 2013, 1350124 (2013) (14 pages) DOI: 10.1142/S0217979213501245

[23] G. Albertini, V. Calbucci and F.Cardone “Statistics of piezonuclear emissions: early results” Mod. Phys. Lett. B (MPLB) - Volume No.28, Issue No. 5. (2014) DOI: 10.1142/S0217984914500365.

[24] F. Cardone, A. Carpinteri and G. Lacidogna, “Piezonuclear neutrons from fracturing of inert solids”, Physics Letters A373 4158-4163 (2009)

[25] A. Petrucci, A. Rosada and E. Santoro “Asymmetric neutron emissions from sonicated steel”, Modern Physics Letters B29, 1550067 (2015)

[26] F. Cardone, G. Cherubini, M. Lammardo, R. Mignani, A. Petrucci, A. Rosada, V. Sala and E. Santoro “Violation of Local Lorentz Invariance for Deformed Space-Time neutron emission” The European Physical Journal –Plus 130, 55(2015)

[27] A. Petrucci and A. Rosada “Ultrasonic neutron emission” J. Adv. Phys. 5, 63–68 (2016)

[28] F. Cardone, G. Albertini, D. Bassani, G. Cherubini, E. Guerriero, R. Mignani, M. Monti, A. Petrucci, F. Ridolfi, A. Rosada, F. Rosetto, V. Sala, E. Santoro and G. Spera “Nuclear Metamorphosis in Mercury” International Journal of Modern Physics B Vol. 29 (2015) 1550239 (13 pages) © World Scientific Publishing Company DOl: 10.1142/S0217979215502392

[29] F. Cardone, G. Albertini, D. Bassani, G. Cherubini, E. Guerriero, R. Mignani, M. Monti, A. Petrucci, F. Ridolfi, A. Rosada, F. Rosetto, V. Sala, E. Santoro and G. Spera “Deformed Space-Time transformations in Mercury” International Journal of Modern Physics B31, 1750168 (2017) DOI: 10.1142/S0217979217501685

[30] F. Cardone, G. Albertini, D. Bassani, G. Cherubini, E. Guerriero, R. Mignani, M. Monti, A. Petrucci, F. Ridolfi, A. Rosada, F. Rosetto, V. Sala, E. Santoro and G.

Spera, "Nuclear Metamorphosis in Mercury: the Rare Earths production" J. Condensed Matter Nucl. Sci. 27, 1 (2018)

[31] G. Albertini and D. Bassani "Deformed Space-Time Reactions and their Phenomenology" Physics Journal Vol. 1, No. 3, 2015, pp. 382-387

Figure Caption.

Fig.1 Metric deformation coefficients of the four fundamental interactions as functions energy (A pictorial representation).

The grey lines correspond to the Minkowsky space-time (all space and time parameters are equal to 1 and the deformation coefficient is 1).

(e) *Electromagnetic interaction: space-time is deformed below the threshold of 4.5 μeV, due to the space parameters.*

(f) *Gravitational interaction: space-time is deformed above the threshold of 20 μeV, due to the time parameter*

(g) *Weak nuclear interaction: space-time is deformed below the threshold of 180 GeV, due to the space parameters.*

(h) *Strong nuclear interaction: space-time is deformed above the threshold of 367.5 GeV, due to one space parameter and the time parameter. Below this threshold, however, space is not isotropic (dashed black line).*