observed value is 1836.15, see insert of Fig. 126a **(SP-27)**. In present-day physics an explanation of the observed mass ratio $m_{proton}/m_{electron}$ = 1835.15 is missing.

Till recently, it was theoretically expected that the quarks carry all the protons spin. However, in an experiment carried out in 2010 by the European Muon Collaboration (EMC) at CERN it became obvious that the obtained results were consistent with almost zero spin being carried by quarks. This is termed the "proton spin crisis" (see https://en.wikipedia.org/wiki/Proton_spin_crisis). Besides the non-detected spatial orbital angular momentum of the quarks in the proton's core, NEW PHYSICS states, that every subtle m_S-quantum which forms the proton's octahedral core is carrying a primordial spin 1/4. As indicate in Fig. 126a in two pairs of these spins can compensate each other, while the remaining two spins can associate to generate the observed proton's spin 1/2. This may solve the "proton spin crisis" **(SP-28)** due to spin-effects in the subtle core structure of the proton.

Neutron, its Instability, and its magnetic Moment: The reason for the radioactive decay of the neutron is so far unknown in particle physics. In Fig. 126b a possible reason is presented. On the one hand, the diameter of the electron's vortex may not fit well into the neutron's octahedral core. And on the other hand, the symmetry of the resulting octahedral core structure is significantly distrubed by the added m_S-quantum-vortex of the electron, which is indicated in Fig. 126b by smaller circles. Both effects of NEW PHYSICS can give reason for the neutron's radioactive instability **(SP-29)**. Furthermore, due to the neutron's unsymmetrical core structure, the neutron must exhibit a magnetic momentum **(SP-30a**, see Fig. 126b for **SP-30b)**, eventhough the total particle's electric charge is zero (cf., for example, https://en.wikipedia.org/wiki/Neutron_magnetic_moment). In principle, the **neutron** turns out to have a "**tetra quark**" structure **(SP-31)**, see Fig. 118k, and 126b.

4.7.5 Atomic Nuclei and Interactions

As outlined above for particles (see Fig. 124) and quarks we consider in the following phenemonlogically the subtle structures of atomic nuclei at the Planck level (at distances of the Planck length $l_P = 1.6 \cdot 10^{-35}$ m), eventhough a scaling up factor of f ≈ $2 \cdot 10^{20}$ (see Fig. 123) is needed to obtain the corresponding gross atomic nuclei structures of about $1 \cdot 10^{-15}$ to $3 \cdot 10^{-15}$ m (i.e. 1 to 3 fm, femtometers), according to their experimentally verfied dimensions. Nevertheless the follwing considetations yield an understanding of the geometrical aspects of atomic nuclei in the lattice of the universal "relativistic ether" (see Fig. 116) as Einstein called it.

In particle physics, the strong interaction or nuclear force ensures the stabily of ordinary matter, as it confines the quark elementary particles into hadron particles, (see Table 21 and cf. https://en.wikipedia.org/wiki.Strong_interaction). The strong interaction is observable in two areas: on a larger scale of about 1 to 3 fm, it is the force, carried by pions, that binds protons and neutrons (nucleons) together to form the nucleus of an atom, being formally composed of protons and neutrons. On a smaller scale (less than about 0.8 fm, the radius of a nucleon), it is the force, carried by gluons, that hold quarks together to form protons, neutrons and other hadron particles.

Proton p$^+$: Fig. 126a shows the subtle core structure of a proton which in addition is bound to one gluon. A gluon is sketched in dashed lines outside of the cube of the ether lattice which carries the octahedron forming the subtle core of the proton. The subtle quanta which generate the tetrahedron of a gluon are sketched smaller than the quanta which build the proton's core, to achieve a better clarity, eventhough they have the same size. Inside the cube three lines of a gluon bounding directly to the proton's octahedron are again sketched by dashed lines, to show their positions more clearly. The other three lines of the gluon have merged with three lines of proton's core, i.e. three subtle quanta of the gluon (small dashed cicles) and three subtle quanta of the proton are superimposed at one respective position of the proton's octahedron, indicating the binding of the two particles. The strong force is thought to be mediated by gluons, that are exchanged between quarks, antiquarks and other gluons as all carry a type of attractive charge called "color charge" which in the superposed binding process must generate a white color resulting from the superposition of three different colors. Up to today, the exact calculation of the strong force by "quantum chromo dynamics" (QCD) is not possible, however (see https://de.wikipedia.org/wiki/Starke_Wechselwirkung).

16 massless gluons (seven of which are not shown in Fig. 126a, but cf. Fig. 127) can in this way be bound around the octahedron of a nucleon, thus filling the octahedron's cube of the ether lattice completely. By their mutual attractive binding the 16 gluons within a cube, the resulting "gluon shell" generates and stabilizes the proton's octahedronal central structure. The "gluon cloud" can continue outside of the lattice cube, thus forming a stable "gluon matrix" around the proton's core **(SP-32)**, and can spread out to neighbouring nucleons, see Fig. 127b.

The strong force inherently has so high a strength that the energy of an object bound by the strong force (a hadron) is high enough to produce new massive particles. Thus, if hadrons are struck in scattering experiments by high-energy particles in particle accelerators, they give, if scattered, rise to new hadrons instead of emitting freely moving gluon radiation. This property of the strong force is called "color confinement", and it prevents the free "emission" of strong force (gluons), instead, in practice of such scattering experiments, jets of massive particles are observed.

Neutron n^0: Similar conditions as outlined above for the proton hold also for the the subtle core structure of the neutron, see Fig. 126b, and other hadrons (cf. Table 21). In present-day physics the reason for the neutron's radioactive decay is unknown. The reason becomes obvious, as due to the loss of the high internal symmetry of the neutron's subtle core structure caused by the assembled vortex of the electron **(SP-33)**, and in comparison to the proton. Thus the neutron is not stable in time but decays in free form in radioactive β-decay, which is mediated by the weak force (i.e. by its corresponding particles W^-, W^+ or Z^0, see Table 21), within about 15 minutes via an intermediate W^- boson to a proton p^+, an elelctron e^-, and

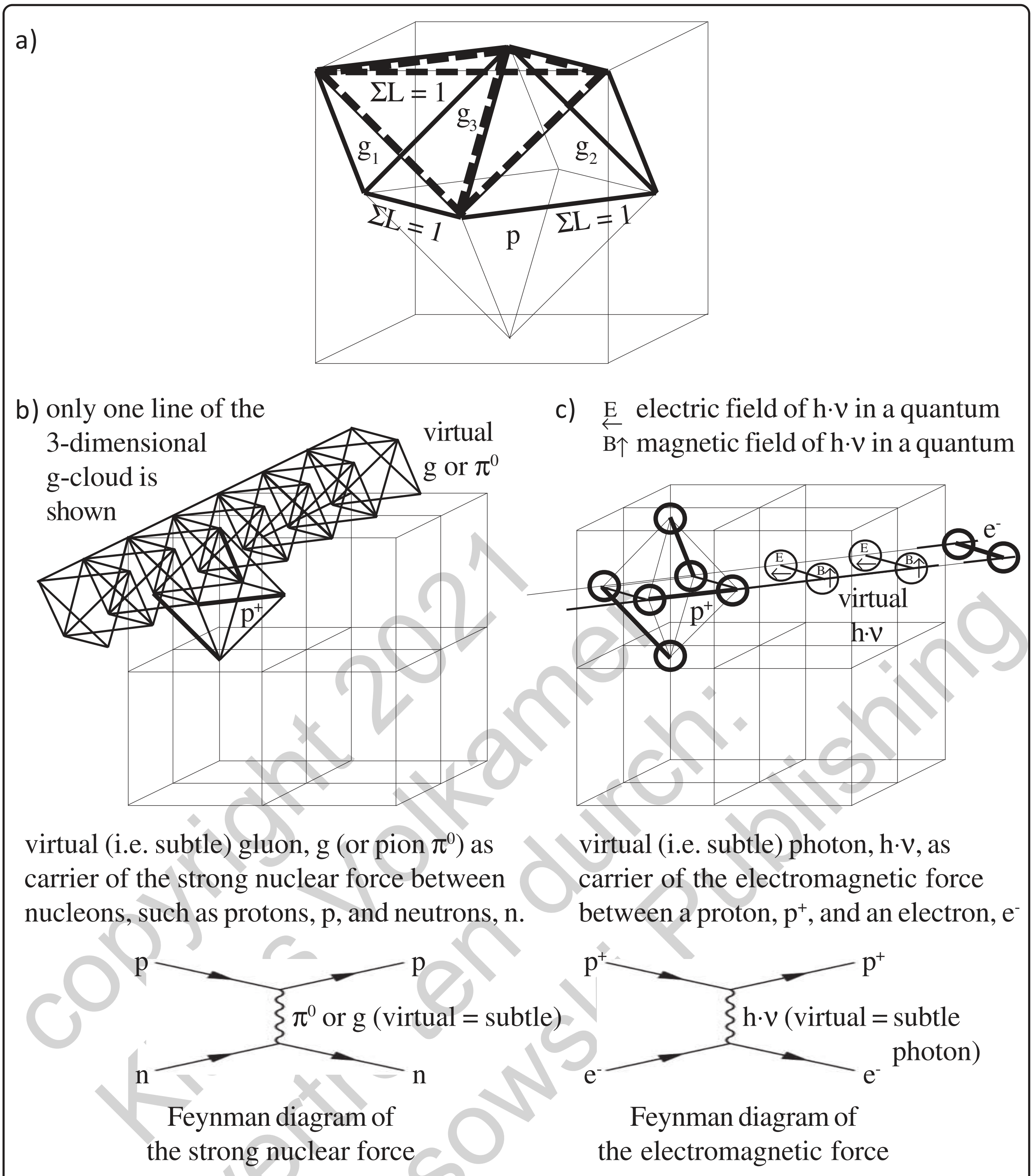


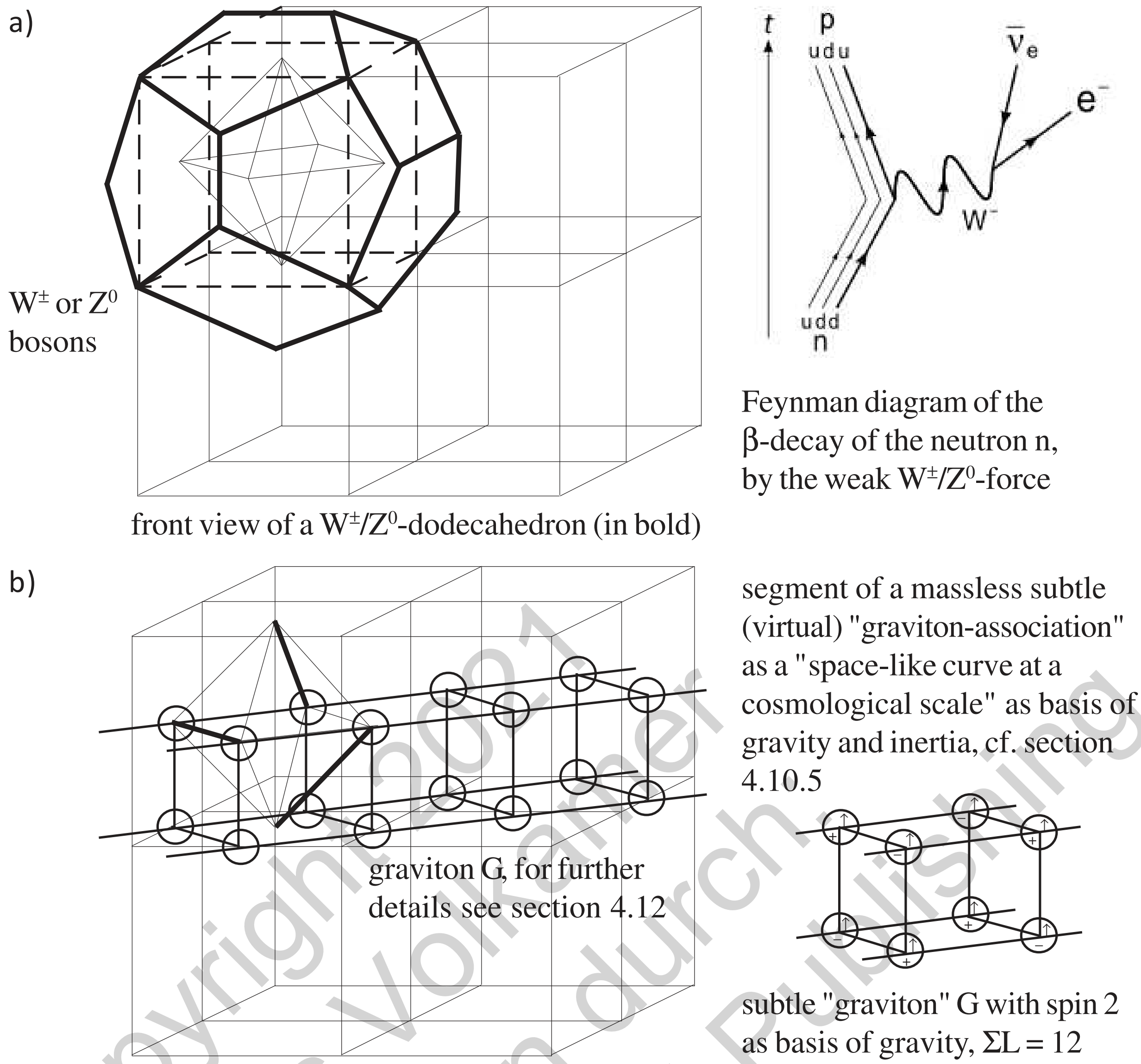
Fig. 127: a) As a supplement of Fig. 126a, the above sketch a) shows that not only the two gluons g_1 and g_2 have identical tetrahedronal stuctures, but that this is also the case for the gluon g_3 marked by dotted lines between g_1 and g_2. Thus, a core octahedron of a nucleon is embedded within a total of 16 gluons in a lattice cube's cell, a structure which thus geometrically defines the central's position of the nucleon. b) Geometrical sketch of the transmission of the strong nuclear force between a proton, p, and a neutron, n, by gluons or π-pions, see the sidled line in the Feynman diagram below. The geometrical sketch depicts the upper part of the below given Feynman diagram. c) Geometrical sketch of the transmission of the electromagnetic force of a proton, p+, to an electron, e^-, by the exchange of virtual photons, $h \cdot \nu$, between the electric charges. The geometrical sketch depicts the upper part of the below given Feynman diagram.

an electron antineutrino ν_e^0, according to the relation $n^0 \rightarrow p^+ + W^- \rightarrow p^+ + e^- + \nu_e^0$ (see Fig. 128, and https://www.wikipedia.org/wiki/Beta_decay). Under the conservations laws of the baryon number (i.e. +1 for n^0 and p^+, respectively), the lepton number (+1 for the electron, and -1 for the emitted antineutrino ν_e^0), the electric charge (+1 for p^+, -1 for e^- and 0 for ν_e^0), and of the conservation of energy and momentum this process can be quantitatively described. In β^--decay, the weak interaction converts an atomic nucleus into a nucleus with atomic number increased by one. If neutrons are bound by strong force in atomic nuclei, however, they can be stabe in time and are crucial for the stability of nuclei, see below.

Interactions: In Fig. 127a,b,c is shown that not only the subtle (i.e. "virtual") core structures of nucleons (and particles in general, see Fig. 118) can be geometrically sketched, but also their interactive force-carriers, arising from the exchange of "virtual" (i.e. subtle) particles (so called "gauge bosons") between the subtle cores of the respective particles being involved. The weak interaction does not produce bound states (i.e. associations of particles) nor does it involve binding energy, something that gravity (see Fig. 128a) does on an astrophyssical scale, that the electromagnetic force (see Fig. 127c) does at the microscopic atomic and molecular level, and that the strong nuclear force (see Fig. 110d) does at the sub-microscopic scale inside nuclei (see https://en.wikipedia.org/wiki/Weak_interaction). That the weak force is unable to generate associations of particles can be seen from Fig. 128, which shows that the transmitters of the weak force, i.e. $W^{\pm}$, and Z^0 bosons with dodecahedronal structure, do not fit into the symmetry of the subtle ether lattice **(SP-34)**.

The weak force, which is responsible for special radioactive particle decays and other destructive processes, contributes 25% to the known physical interactions, a similar value as the entropically, i.e. destructively acting dark matter (i.e. subtle matter with a positive sign) which contributes about 23% of the mass in the Universe. The other three constructively working forces contribute 75%, similarly as dark energy (i.e. subtle matter with a negative sign) which comprises about 73% of the universal matter content. It is an interesting, but open question, whether this coincidence has a deeper physical reason. A similar question is also, whether the fact that the dodecahedron as carrier of the weak interaction breaks parity-symmetry, and CP-symmetry (see https://en.wikipedia.org/wiki/Weak_interaction), is resulting also, because it does not fit into the universal ether's lattice.

The ongoing emission and reabsorption of virtual electromagnetic photons of every charged particle (generating thus an electromagnetic field around the particle) must be linked to the ongoing creation and annihilation of the particle in zitterbewegung, which also leads to the particle's Compton frequency $\nu_C = c/\lambda_C = m \cdot c^2/h$, see Fig. 120, and Table 17. It is an open question whether the pulsation of mass m of the particle simultaneously generates an **"electro-gravitative" field**, which may be identical to the "non-electromagnetic" subtle form-specific interaction of matter, detected by the described weighing experiments, see, for example, Fig. 2, 3 and 4. From symmetry reasons also a "magneto-gravitative" form of radiation may result. Such hypothetical considerations are not purely speculative, because from Vedic



c) electromagnetic de-excitations: $e^{-*} \Rightarrow e^- + \nu_e + \nu_{ea} = e^- + h\cdot\nu$ ($h\cdot\nu$ = leader bridge, see Fig. 118b)

Fig. 128: a) Sketch of the front view of a dodecahedron, printed on bold, as the subtle core structure of the carriers of the weak force, i.e. the vector bosons $W^{\pm}$, and Z^0, cf. Table 21. These particles can be understood as excitations of the cube of the universal ether lattice, indicated above in dashed lines **(SP-33)**. However, the $W^{\pm}/Z^0$- bosons do not fit into the symmetry of the ether lattice which may be the reason for various physical anomalies. At the right side is shown a Feynman diagram of the radioactive β-decay of a neutron, n, induced by the weak force which corresponds to the geometrical sketch at the left. b) To explain gravity, in quantum field theories a virtual bosonic particle called "graviton" with spin S = 2 was postulated, which however, could so-far not be experimentally detected in accelerators. We will come back to back to an explanation of the mechanism of gravity, see section 4.10.4. h) The de-excitation process of excited electronic states in atoms or molecules, i.e. e^{-*}, to de-excited states, i.e. e^-, can be interpreted as being accompanied by the emission of an electron neutrino, ν_e, and its antipartner, ν_{ea}, which together assemble as a photon, $h\cdot\nu$, see Fig. 118b and 164.

Science it is known, that a total of 5! = 120 forms of non-visible kinds of subtleties may exist, from which the weighabe form of subtle matter is only the the most gross one.

Furthermore, the geometrical sketches of interactive subtle particles shown in Fig. 110d,e,f represent geometrical presentations of the Feynman diagrams of their respective interactions **(SP-35)** (cf. also Table 26, and see https://en.wikipedia.org/wiki/Feynman_diagram).

In Fig. 110g a possible mechanism of gravity is depicted, based on a special form of the expected exchange particle, i.e. the "graviton", which, however, could so far not be detected in accelerator experiments. We will come back to an explanation of gravity in section 4.10.4.

So far, we have assumed that "virtual particles" in our visible Universe UI are "subtle particles" in the parallel Universe UII, see Fig. 114 and 120, and Fig. 127b through 128b. This implies, however, a physical entanglement of processes in our visible Universe UI and in the parallel Universe UII as depicted in Fig. 129a.

Deuteron D ($^2H_1$): In the binding of protons and neutrons (together termed nucleons) to generate atomic nuclei of higher elements in the Periodic Table of chemical elements, again the strong force plays a central role. The number of protons in an atomic nucleus determine the atomic number of an element (and thus specifies the different chemical properties of elements), which may have various so called isotopes with a different number of neutrons. Down to deviations of less than 1 %, the atomic weights of all of the 92 naturally occuring elements are multiples of a nucleons mass, indicating that nucleons generate the atomic nuclei.

Fig. 130 shows a schematic sketch of the subtle core structure of the deuteron D+ = $^2H^+$ the simples atomic nuclues. Usually the electric charges are not shown, when discussing the nuceli of elements. So, instead of $D^+ = {}^2H^+$ we use in the following the notation D = $^2H_1$, and add as the lower right index the number of protons in the nuclei, which ussually is noted at the left side index. The deuteron is composed of a proton p^+ and a neutron n^0 (both are together called nucleons, see Table 21) and are being hold together by the exchange of gluons and of pions (also called π-mesons, π^0, π^+ or π^-) as mediators of the strong interaction. Gluons and pions have the same geometrical subtle core structures, see Fig. 118c and 118g. Thus they fit well into the geometrical positions between the eight octahedral surface areas of a nucleon's subtle core structure and the eight corners of the subtle lattice cube in the universal ether (see Fig. 116).

It can be expected that a neutron decays within the deuteron's nucleus, as it splits by radioacive decay in free form, due to a significant increase of the internal symmetry of the deuteron's nucleus, cf. Fig. 130. In the case of a radioactive decay of a free neutron n, a virtual (i.e. subtle) W^- boson is emitted which subsequently

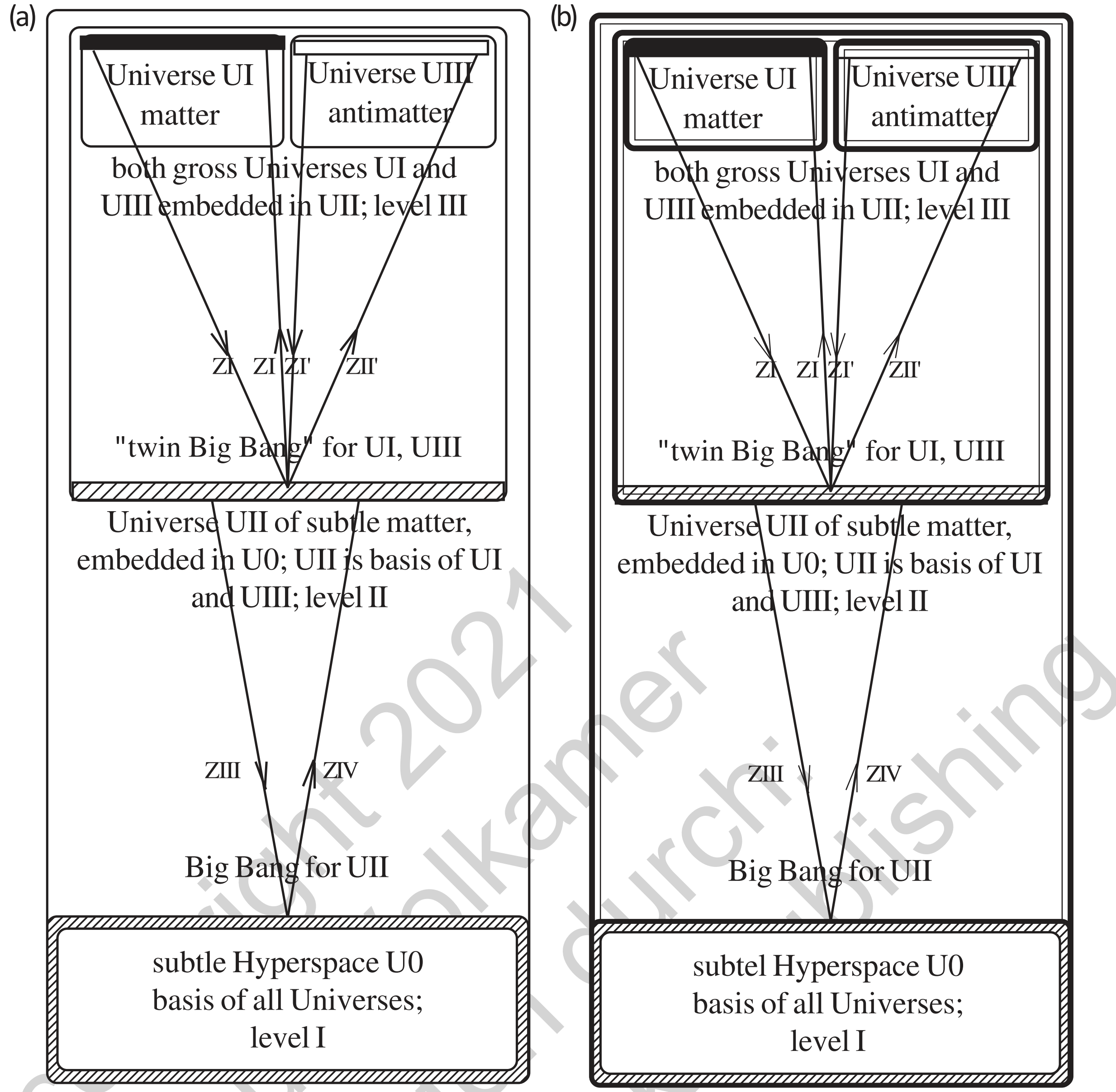


Fig. 129: (a) As indicated in Fig. 114, 118d through 118g and 120, "virtual processes" in our visible Universe UI (for example, as carriers of forces in UI) are regarded as "subtle processes" which occur in the non-visible parallel Universe UII. However, this implies an ongoing physical entanglement of UI/UII-processes. (b) In the right sketch above, the double-lines around each Universe shall schematically indicate, that every Universe, as a black hole, may be separated from the other ones by a shielding "gap". In such space-time-gaps, generated by one or more of the additional 5! = 120 non-visible subtilities (see text), the virtual processes, for example of our visible Universe UI, can occur without entanglement to one of the parallel Universes UII or UIII. This impiles, that the developed (UI/UII)-model of fundamental particles may be improved by its modification to a (UI/UI-gap)-model. The hypothetical assumption of such "gaps" between Universes is not purely speculative, because Monroe (Journeys out of the Body, 1971) as well as Buhlman (Out of Body, 2001) have reported about such subtle barriers in their OBE-experiences, see section 4.2. Independent on these consideration, field-bodies (see Fig. 106) are regarded as emerging from the UII-level.

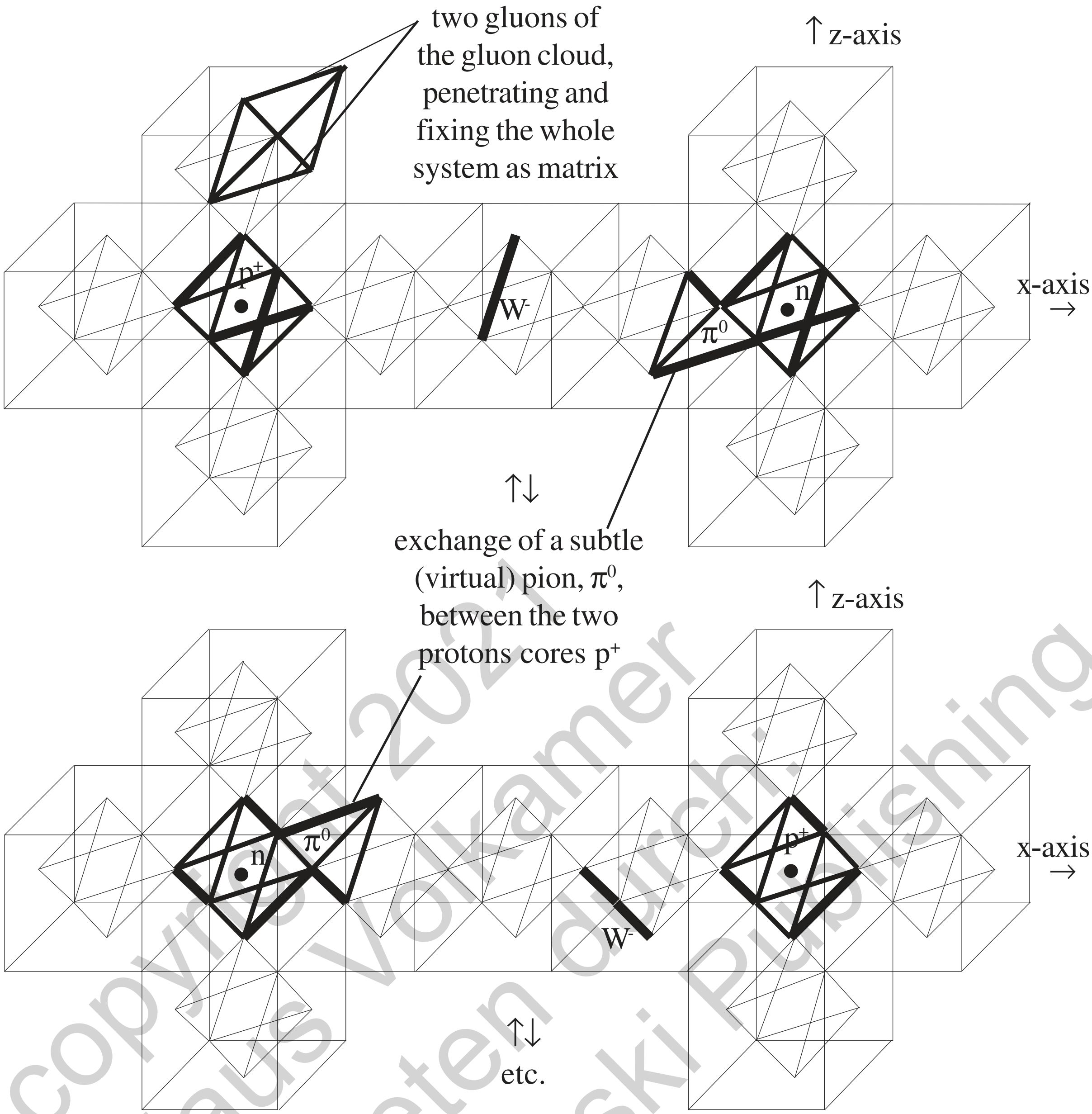
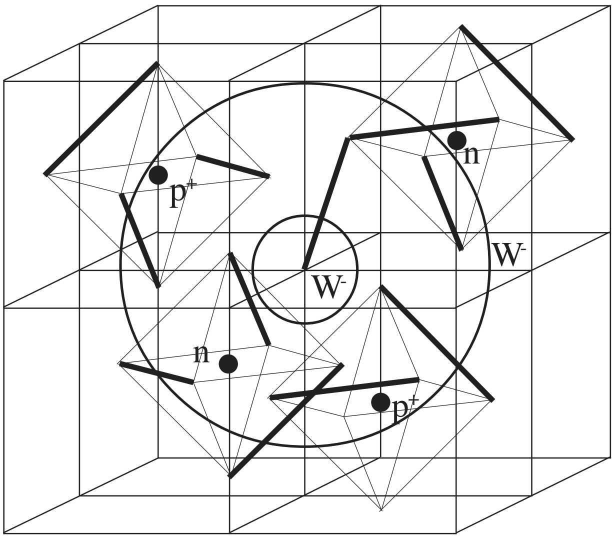


Fig. 130: Schematic sketch of the geometrical binding of the subtle core structure of a proton, p^+, to the core of a neutron, n, at the Planck scale by the strong force to generate the core of a deuteron D = $^2H_1$, i.e. the subtle core of the atomic nucleus of heavy hydrogen, cf. Fig. 110d. The dots, •, indicate the gross point-like UI-components of p^+ and n which emerge, accordingt to the particles' UII/UI-model of NEW PHYSICS, in oscillation from the subtle octahedral field-like UII-core structures. Regarding a scaling up factor f > 1 of the system, see Fig. 123. Shown are two configurations as cross sections along the x/z-plane, omitting the extension in the y-direction. All subtle lattice cubes are completely filled up with the subtle core structures of gluons (see Fig. 118c) as described for the proton in Fig. 126a. The resulting selfinteracting subtle gluon cloud (see Fig. 127) extends around the deuteron, thus generating a gluon matrix which holds the nucleons in fixed positions. Besides the exchange of a W^- boson between the two nucleons also the exchange of a pion (π^0, see Fig. 118g) as mediator of the long range part of the strong force is depicted, see Tables 26 and 27.

decays to an electron e^- and an antineutrino ν_e, due to the conservation of the lepton number (see https://en.wikipedia.org/wiki/Beta_decay and https://en.wikipedia.org/wiki/Lepton_number). However, within the deuteron's nucleus the W^- boson emitted by the neutron is not radiated into the surroundings as in the neutron's decay but is caught by the adjecent proton under conservation of the lepton number of the system. As a hypothesis, the reversibtle n/p-exchange of an "electron and an antineutrino" can occur by a tunneling process of a W^- boson, similar as a DC Josephson effect (see https://en.wikipedia.org/wiki/Josephson_effect). Fig. 130 indicates also the exchange of a pion (π^0-meson) between the proton and the neutron which can follow in its exchange the geometrical structures within the subtle gluon matrix or can happen also by tunneling. In principle, Fig. 130 is a geometrical sketch of a subtle (i.e. virtual) Yukawa-exchange of a pion between two protons as well as it is a sketch of the Feynman diagram of such an event, cf. Tables 26 and 27. In the case of a radioactive beta decay of a nucleus (mediated by the weak force) their must exist a certain branching rate between the absorption of a tunneling W^- boson within a nucleus and its emission off the nucleus.

Besides the strong nuclear force bewteen the two nucleons in the deuteron's nucleus (diameter $d = 4.28 \cdot 10^{-15}$ m), mediated by gluons, and the additional exchange of pions, there exsits also a third attractive force. It arises from the quantum mechanical superposition of the de Broglie waves $\lambda_N = h/(m_N \cdot v_N) = 1.34 \cdot 10^{-14}$ m (i.e. m > d) of the two nucleons which are significantly larges than d. The value of m_N can be obtained from the masses of the proton m_p and of the neutron m_n, according to $m_N \approx (m_p + m_n)/2 = (1.673 \cdot 10^{-27} + 1.675 \cdot 10^{-27})/2 = 1.674 \cdot 10^{-27}$ kg. The velocity v_N of the movement of a nucleon within the deuterons's nucleus results from the uncertainty relation $\Delta x \cdot m_N \cdot v_N = h/(2 \cdot \pi)$, yielding about $v_N = h/(2 \cdot \pi \cdot \Delta x \cdot m_N) = 2.94 \cdot 10^7$ m/s, where $\Delta x \approx d/2 = 2.14 \cdot 10^{-15}$ m is the diameter of the deuteron's nucleus. However, due to the nucleon's dynamic, no sharp energy eigenstates result, but broad energy bands. Nevertheless, like the superposition of the de Broglie waves of electrons in the hydrogen moelcule, also the superposition of the λ_N-waves of the nucleons within a $^2H_1$-nucleus must yield an attractive force. Similar considerations hold also for nuclei with atomic numbers larger than 1.

Helium $^4He_2$ (α particle): Fig. 131 shows a sketch of the subtle core structure of the atomic nucleus of helium $^4He_2$. Eight cubes of the ether lattice generate in this case an energetically especially stable, while highly symmetrical configuration where the nucleons can assemble not only in the four cubes shown in Fig. 131, but can quantum mechanically be delocalized in all eight ones, thus filling up the eight cubes by the octahedrons of the nucleons and the associated tetrahedrons of the gluons **(SP 36)**, as shown in Fig. 126a for the proton. The high stabilty of the He^{2+} nucleus is the reason that in the radioactive alpha decay such particles are emitted as "α particles" from the heaviest radioactice atomic nuclei (see https://en.wikipedia.org/wiki/Alpha_decay). α-decay transforms the nucleus of an atom into a nucleus with a mass number that is reduced by four and an atomic number that is reduced by two.



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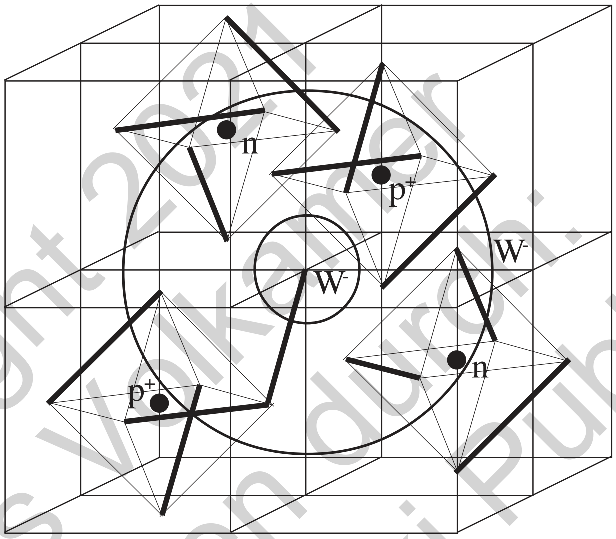

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etc.

Fig. 131: Sketch of the subtle core structure of the nucleus of the helium atom $^{4}He_{2}$ in eight cells of the universal ether lattice at the Planck scale. The four octahedrons charaterize the two protons p^{+} and the two neutrons n, i.e. the nucleons. The lines printed in bold indicate the three quarks, i.e. the subtle vortices, within the nucleons, respectively. The dots,●, indicate the gross point-like UI-components of p^{+} and n which emerge, accordingt to the particles' UII/UI-model of NEW PHYSICS, in oscillation from the subtle octahedral field-like UII-core structures. The exchanged W^{-} bosons can generate quantum mechanical shells in the system. All octahedral surface areas are bound to tetrahedral gluons of a gluon-cloud which fill up the system of eight cube cells of the universal ether lattice, thus stabilizing the embedded octahedrons in a "macro cube" as shown. As indicated, the octahedrons of the four cells which are shown empty in the above sketch can contribute in the quantum mechanical delocalization of the nucleons, thus, contributing to the special stability of the nucleus of the helium atom. Regarding a scaling up factor f > 1 of the system, see Fig. 123 and 132.

Lithium, $^{6}Li_3$ and $^{7}Li_3$: From the nuclei of the element lithium, Li, two stable isotopes are known, i.e. $^{6}Li_3$ (abundance 7.5 %) and $^{7}Li_3$ (abundance 92.5 %). The subtle core structure of the nucleus of $^{6}Li_3$ can be sketched as shown in Fig. 132. In comparison to the very high symmetry of the core structure of the helium's nucleus a kind of symmetry breaking becomes obvious. This must be seen as the reason why the nucleus of $^{6}Li_3$ (as well as of $^{7}Li_3$) has a so far unexplained anomalous low nuclear binding energy per nucleon compared to the next lighter and heavier elements, helium and beryllium. This implies that among all stable light elements, lithium can produce net energy through nuclear fission **(SP-37)**. For $^{7}Li_3$ hold similar considerations. The two lithium nuclei have lower binding energies per nucleon than any other stable nuclides other than deuterium, i.e. the deuteron $^{2}H_1$, and helium-3, $^{3}He_2$, (see https://en.wikipedia.org/wiki/Lithium).

Beryllium, $^{9}Be_4$, and higher Nuclei: Beryllium $^{8}Be_4$ decomposes by radioactive decay with a very short half-life of $7 \cdot 10^{-17}$ s into two more symmetrical helium nuclei $^{4}He_2$, respectively. The subtle core structure of the only stabe isotope of beryllium is $^{9}Be_4$, with four protons and 5 neutrons. Its subtle core structure can be composed, with respect to the nucleus of helium $^{4}He_2$, by placing five additional nucleons at five of the six areas of the helium's "macro cube" (see Fig. 131), thus increasing the symmetry with respect to the two lithium isotopes. By placing six, instead of five nucleons at the six areas of the "macro cube" of the subtle core structure of the nucleus $^{4}He_2$ (or inside the $^{4}He_2$'s macro cube), one obtains $^{10}Be_4$. This isotope of beryllium is instable, due to a surplus of neutrons, and transforms by β-decay, with a quite log half-life of $1.36 \cdot 10^{6}$ years, however, into the stable isotpe $^{10}B_5$ of boron (see https://en.wikipedia.org/wiki/Beryllium).

The subtle core structures of nuclei of higher elements than beryllium can in a systematic way be constructed, analogous to the sketches given in Fig. 130 through 113 **(SP-38)**.

4.7.6 Low Energy Nuclear Reactions (LENR)

In the developed 8-dimensional (UII-subtle/UI-gross)-model of entities, called individual "particles", transmutative reactions can occur or can at a technical scale be achieved in nuclear physics at two levels.

Of course, gross particles, i.e. the 4-dimensional "4-D_{UI}-iceberg components" at the **UI-level** of the 8-dimensional entities of particles, can, for example, be accelerated in high-tech accelerators, such as the Large Hadron Collieder (LHC) of CERN, to high velocities and can be applied in high energy scattering experiments. Or the energy content of special radioactive isotopes, such as $^{235}U_{92}$ can, for example, be technically applied in nuclear power stations to gain free energy by controlled interaction with gross neutrons and fission of the $^{235}U_{92}$-nuclei. In both cases only the present-day known 4-dimensional gross 4-D_{UI}-components of nuclei at the visible UI-level are involved.