A new calculable Orbital-Model of the Atomic Nucleus based on a Platonic-Solid framework and based on constant Phi

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Abstract :

Crystallography indicates that the structure of the atomic nucleus must follow a crystal-like order. Quasicrystals and Atomic Clusters with a precise Icosahedral- and Dodecahedral structure indicate that the five Platonic Solids are the theoretical framework behind the design of the atomic nucleus. With my study I advance the hypothesis that the reference for the shell-structure of the atomic nucleus are the Platonic Solids. In my new model of the atomic nucleus I consider the central space diagonals of the Platonic Solids as the long axes of Proton- or Neutron Orbitals, which are similar to electron orbitals. Ten such Proton- or Neutron Orbitals form a complete dodecahedral orbital-structure (shell), which is the shell-type with the maximum number of protons or neutrons. An atomic nucleus therefore mainly consists of dodecahedral shaped shells. But stable Icosahedral- and Hexagonal-(cubic) shells also appear in certain elements. Constant **Phi** which directly appears in the geometry of the Dodecahedron and Icosahedron seems to be the fundamental constant that defines the structure of the atomic nucleus and the structure of the wave systems (orbitals) which form the atomic nucelus. Albert Einstein wrote in a letter that the true constants of an Universal Theory must be mathematical constants like **Pi (π)** or **e**. My mathematical discovery described in chapter 5 shows that all irrational square roots of the natural numbers and even constant **Pi (π)** can be expressed with algebraic terms that only contain constant **Phi (φ)** and **1** Therefore it is logical to assume that constant Phi, which also defines the structure of the Platonic Solids must be the fundamental constant that defines the structure of the atomic nucleus. Indication for the important role which the Dodecahedron plays in the structure of matter also seems to come from the observation of the M87 black hole.

Please also see the following two Studies :

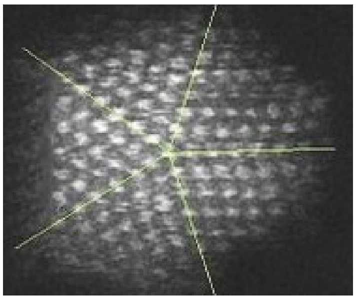
Genesis of an Universal Physical Theory based on constant Phi as considered by Albert Einstein

(or alternative → **here**)

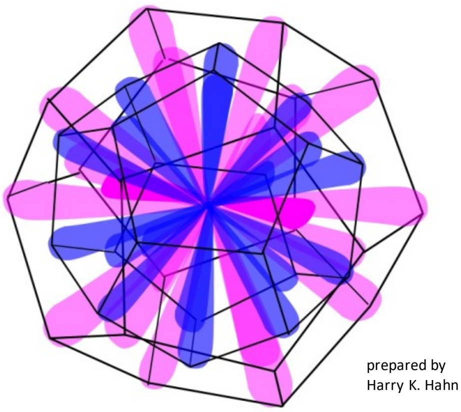
and

The Black Hole in M87 (EHT2017) may provide evidence for a Poincare Dodecahedral Space Universe

(or alternative → **here**)

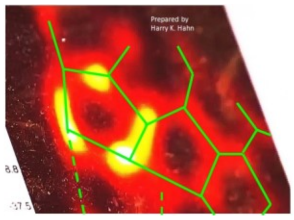


TEM-image of an **Icosahedral Gold nanoparticle (Atomic Cluster)**.



A new Orbital-Model of the Atomic Nucleus

The image shows an atomic nucleus with two Shells, according to the new model. The two Shells are fully occupied with the maximum of 10 Orbitals. The 10 Orbitals of each shell represent the diagonals of a Dodecahedron which is the reference srructure for a full Shell. The Shells are slightly rotated to each other.



Brightness- and contrast-enhanced image of the **shadow of the M87 central black hole (EHT2017)** which **indicates a Dodecahedral structure** of the gravitational singularity (grav. Maximum)
see : The Black Hole in M87...

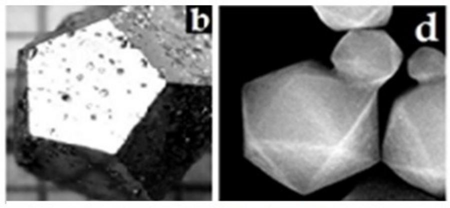


Fig 1 : **b.) Dodecahedral** Quasicrystal **Ho-Mg-Zn**
d.) Icosahedral Silica Quasicrystal (Nanocrystals)

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1 A new model for the Atomic Nucleus based on the Platonic Solids

Beside evidence which comes from Quasicrystals, Atomic Clusters and from Crystallography, and indication that comes from the M87 central gravitational singularity, that the structure of matter seems to be based on a framework which refers to the **Platonic Solids**, there are also some pure logical arguments which demand a new and redesigned model of the **atomic nucleus**.

From the logical point of view the current model of the atomic nucleus, a "disorderly heap of balls" can't be correct !

The ordered arrangement of **atoms** in **crystal structures** demands an ordered structure of the atomic nucleus, because there is a clear correlation between a crystal structure and the structure of the electron-shells of the atoms which form the crystal structure. Further **the electron shell structure** of an atom (element) **is clearly influenced by the atomic nucleus** as the **Hyperfine-Structure** of the spectral-lines of a certain element precisely indicates.

New Model

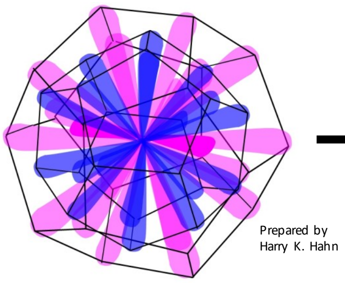


Fig 1: proposed Model of the atomic-nucleus

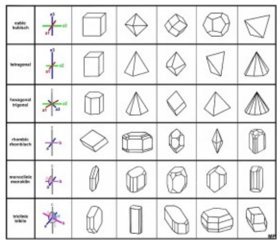
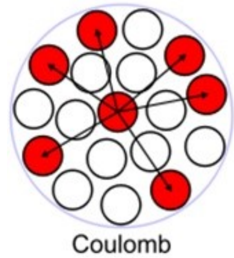


Fig 2: Crystal Classes

No logical Model of the atomic core

→ **Current Model !**



Coulomb Forces want to achieve equal distances between the Protons

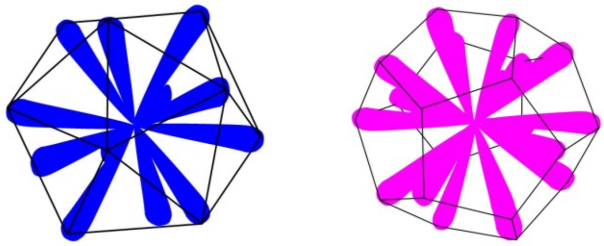


Fig 5: An **icosahedral** Sub-Shell with **6 Orbitals** and an **dodecahedral** Sub-Schell with **10 Orbitals**

To the concept for the new Atomic Nucelus model :

In the new model of the atomic nucleus I consider that the structure of the nucleus has clear similarities to the structure of the electron shells. This is logical from my point of view.

I also consider that a proton has an orbital-structure similar like an electron. And I consider that the mass of the Proton, which is 1836 times that of the electron, isn't a product of "hypothetical static quarks" but rather a result of the high frequency & energy of the wave that forms the proton orbital

→ (some indication that the "Quark-Theory" may be wrong :) **see : Link1, Link2**

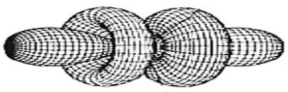


Fig 3: 4f-electron orbital

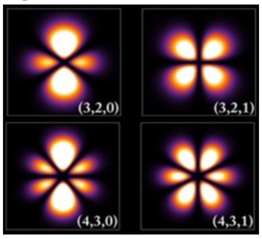


Fig 4: electron orbitals

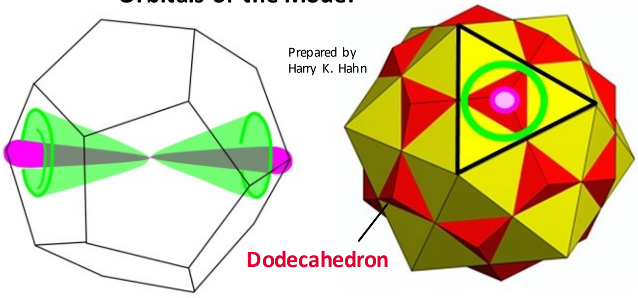
Definition of the Platonic Solid Orbitals

The **Platonic Solids** are the perfect reference framework for an ordered structure of the atomic nucleus.

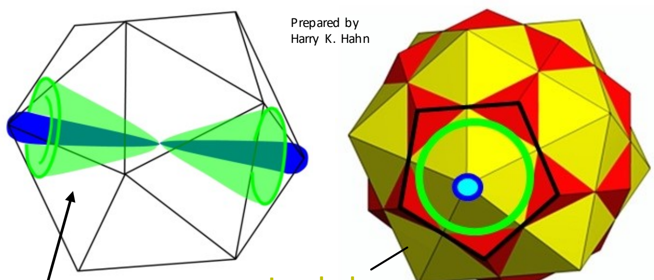
The **5 Platonic Solids** (**PS**) are regular convex **uniform polyhedrons** which consist of polygonal faces that are identical in shape & size, and all angles are equal between the space diagonals which pass through the center of the PS (→ the diagonals between two vertices on opposite sides of the PS).

Fig 6: Proton- and Neutron-Orbitals of the Model

Dodecahedron :

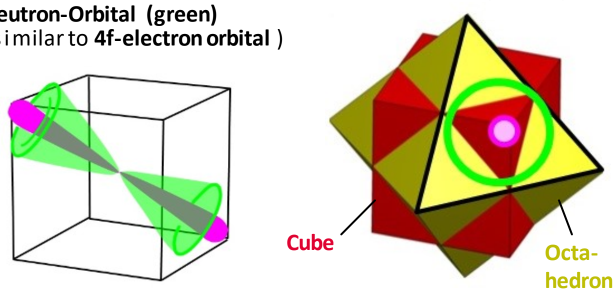


Icosahedron :



Proton-Orbital (blue) with a accompaning (shielding) **Neutron-Orbital (green)** (similar to **4f-electron orbital**)

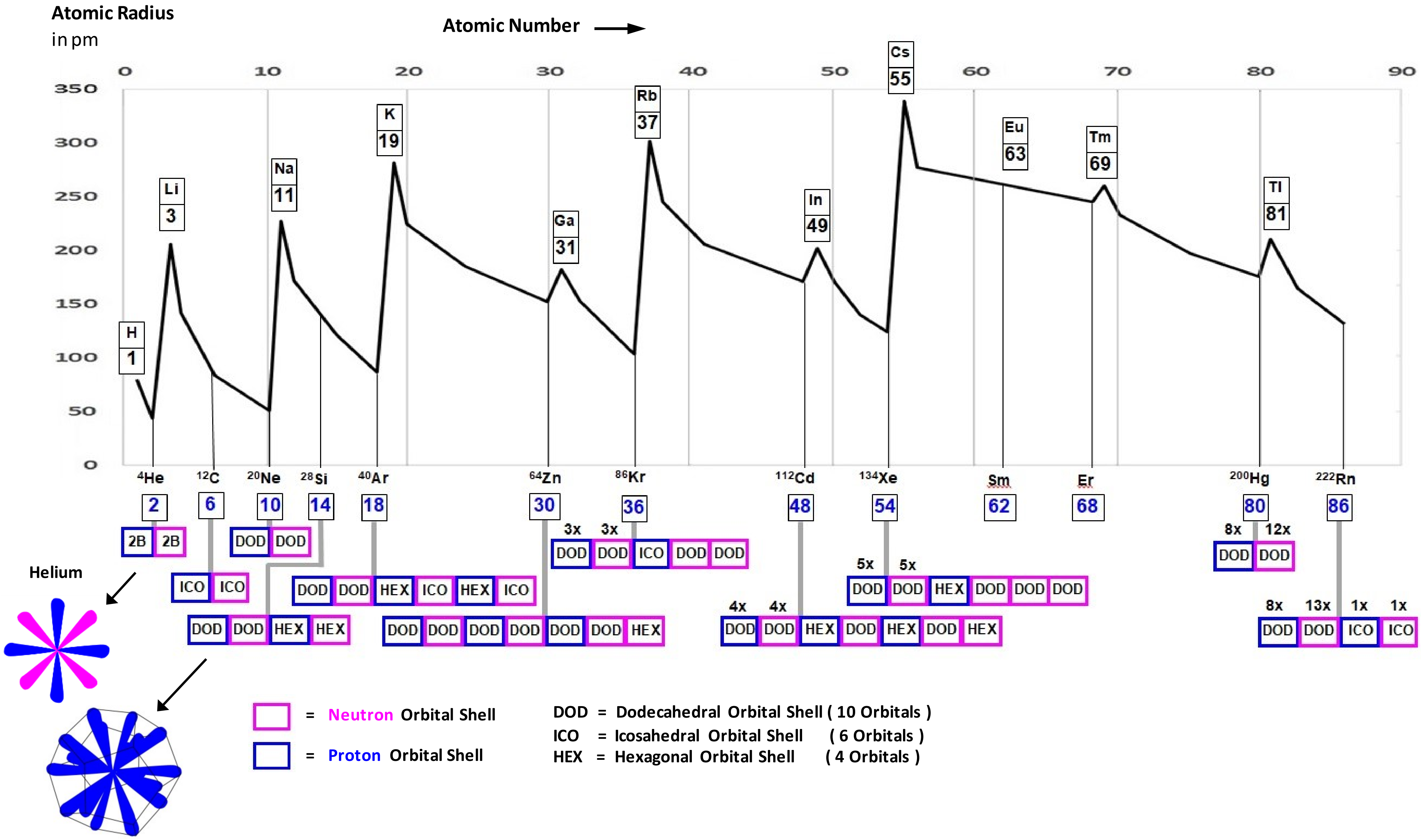
Hexahedron (Cube) :



In my model I consider the **space diagonals** between two vertices that pass through the center of the **PS** as the long axes of the **Proton- or Neutron-Orbitals**. Each Platonic Solid has a specific number of such space-diagonals and therefore a defined maximal number of Orbitals which can be occupied.
For example the **Icosahedron** has **6** & the **Cube 4** such orbitals
The **Dodecahedron** has the highest number of **10** such orbitals
A full occupied "**Dodecahedral Orbital-Structure**" therefore is considered to be a "**full Sub-Shell**" in this nucleus model.

The **inner sub-shells** of most **elements** are considered to be full occupied "**dodecahedral Sub-Shells**". But there seem to be also "**hexagonal- and icosahedral sub shells**" that occur in some elements. Because there are nearly always more Neutrons than Protons in an atomic nucleus, the Neutron is considered to be a "**companion-Orbital**" that belongs to each Proton. (**see image**). However it is also considered that "**excess-neutrons**" can form complete **Neutron-Sub Shells**

A new Atomic Nucleus Model based on a Platonic-Solids Framework : → selected elements of the periodic table are described with the new Model in a schematic way → see below



Dodecahedral Orbital Shell
fully occupied → 10 Orbitals

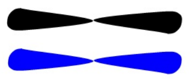
1.1 A new Orbital-Model of the atomic nucleus defined by the diagonals of the Platonic Solids

The described new model of the **atomic nucleus** can also explain the **magic numbers** in nuclear physics : (**2, 8, 20, 28, 50, 82, 126**..) easily with a **framework based on the Platonic Solids**, (**& based on constant Phi**)

1.) In this model **1 Proton or 1 Neutron is represented by one orbital similar to p- or f-orbitals of Hydrogen**
2.) **The diagonals** of the Platonic Solids represent & **define the long axes of these Proton- & Neutron-Orbitals**
3.) **The Platonic Solids represent Shells of the new nuclear shell model (NSM)** (→ general info to NSM **here**)
If a Shell is complete (→ each Shell tries to form a Dodecahedron !), then a new shell begins.
4.) **All Proton- & Neutron-Orbitals can be precisely calculated** with **wave equations** (e.g. Schrödinger WE)
5.) **The defined nucleus orbitals influence the electron orbitals** and cause in this way the **Hyperfine-Structure**
6.) Each Shell consists either of **Proton-Orbitals accompanied by Neutron-Orbitals** or of **Neutron-Orbitals**

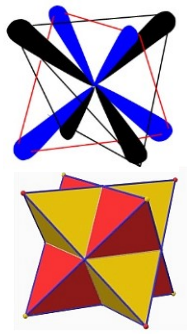
One base orbital unit :

1 Protons or **1 Neutron**



(Double) Tetrahedron :

2 Protons or **2 Neutrons**
(swinging orbitals ?)

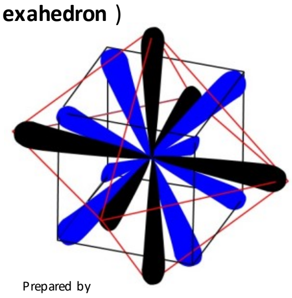


double Tetrahedron

Octahedron :

3 Protons or 3 Neutrons

Cube : 4 Protons or **4 Neutrons**
(Hexahedron)



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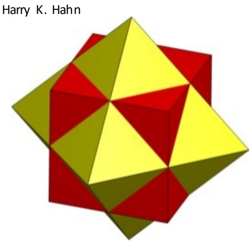
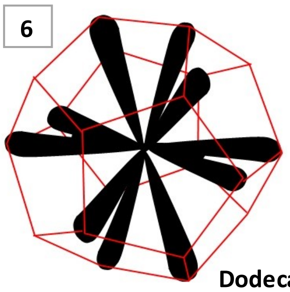
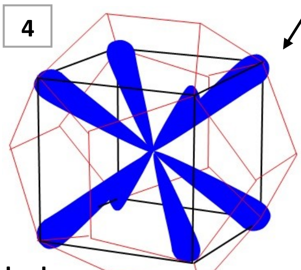


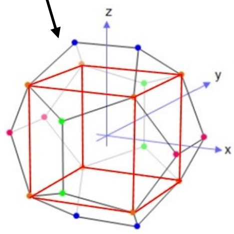
Hexahedron (Cube) & Octahedron

Dodecahedron : → **Note : 8 of 20** Dodecahedron-Vertices form a **Hexahedron** (Cube)

10 Protons or **10 Neutrons** (6 + 4 = 10)







Dodecahedron

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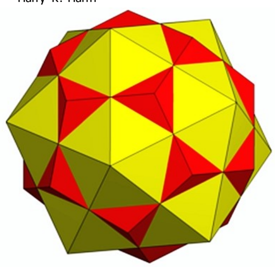
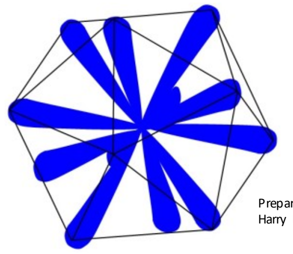


Dodecahedron & Icosahedron



Icosahedron :
6 Protons or
6 Neutrons

→ 12 vertices
(6 diagonals)

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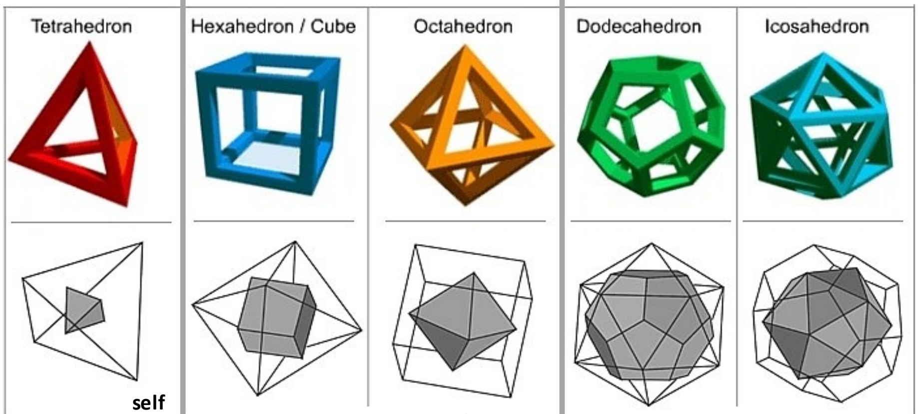


Name :	T	self dual	H	dual	O	D	dual	I	Sum
Faces	4		6		8	12		20	50
Vertices	4		4 ← (8)		(6) → 3	10 ← (20)		(12) → 6	50

Magic Number System :

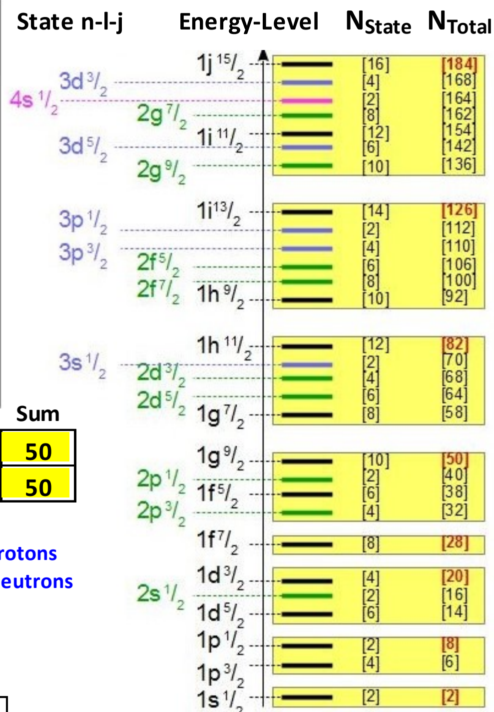
↓ 4 Protons or Neutrons ↓ 3 Protons or Neutrons ↓ 10 Protons or Neutrons ↓ 6 Protons or Neutrons

8 = 2 + 6 or 4 + 4
20 = 10 + 10 or 10 + 6 + 4
28 = 10 + 10 + 4 + 4 or 10 + 10 + 6 + 2
50 = 5x 10 or (4x 10) + 6 + 4
82 = (7x 10) + 6 + 6 or (8x 10) + 2
126 = (12x 10) + 6
184 = (18x 10) + 4 or (16x 10) + (4x 6)
196 = (19x 10) + 6 or (16x 10) + (6x 6)

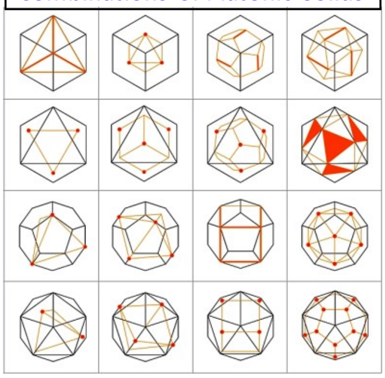
114 = (11x 10) + 4 or (9x 10) + (4x 6) (→ for Neutrons)

As **doubt must be cast on the theory of Quarks** (see **Link1**, **Llink2**) an orbital-model is prefered. In the described model **fully occupied Shells have a Dodecahedral-Shell-Structure.** This model can explain **dodecahedral gravitational singularities as EHT2017 which must be a result of a principle Dodecahedral atomic nucleus structure**
Note : All Platonic Solids are only based on **φ** & **1** !

current Nuclear Shell Model (weblink **Table**)



Combinations of Platonic Solids



Area & Volume of Platonic Solids if the edge length is 1 (→ Numbers replacable by φ & 1 !)

solid	A	V
cube	1	1
dodecahedron	$\frac{1}{4}\sqrt{25+10\sqrt{5}}$	$\frac{1}{4}(15+7\sqrt{5})$
icosahedron	$\frac{1}{4}\sqrt{3}$	$\frac{5}{12}(3+\sqrt{5})$
octahedron	$\frac{1}{4}\sqrt{3}$	$\frac{1}{3}\sqrt{2}$
tetrahedron	$\frac{1}{4}\sqrt{3}$	$\frac{1}{12}\sqrt{2}$

1.2 The Platonic Solids also provide the framework for Platonic-Solid Shell-Wave-Systems

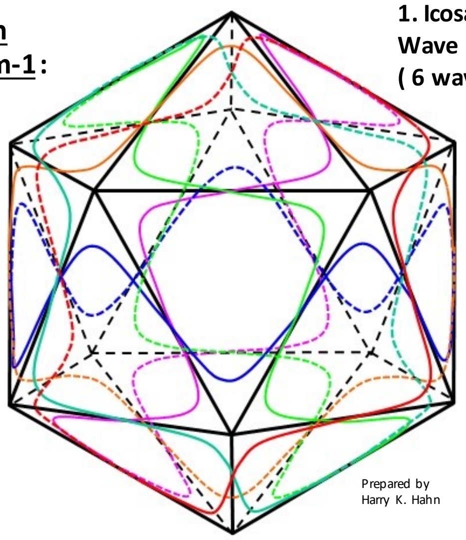
Beside an Orbital Model for the **atomic nucleus** that is based on the diagonals of the **Platonic Solids**, there is also a **system of** "**Platonic-Solid Shell-Waves**" thinkable. → see the following images below !
In such a model the shown "**Platonic-Solid Shell-Waves**" **may directly represent Protons or Neutrons.**
Or such "Platonic-Solid Shell-Waves" may have the function to stabilize Proton- & Neutron-Orbitals along the diagonals of the Platonic Solids (framework) **as described on the previous page**. In this case they may be high-energetic electromagnetic waves. Note: The existence of icosahedral atomic clusters and of icosahedral- & dodecahedral Quasicrystals indicates that outer atomic nucleus shells of certain elements (e.g. Gold) may have icosahedral- or dodecahedral structures which influence the shape of their electron shell (→ **Hyperfine-Structure**)

Icosahedron with 3D- Wave System-1:

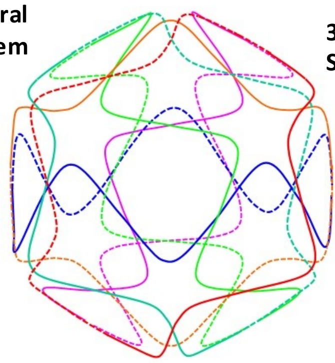
Wave system consisting of 6 Waves

Each wave moves over 10 triangles

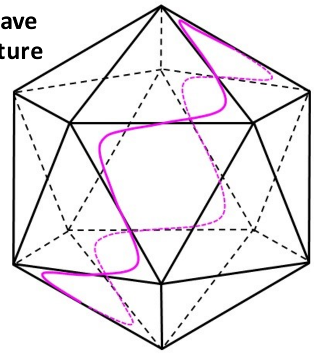
Each waves Is missing 10 of the 20 triangles



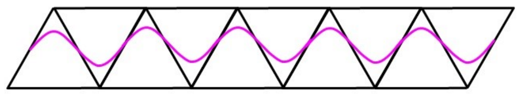
1. Icosahedral Wave System (6 waves)



3D Wave Structure



flat pattern of wave (2D Wave Structure)

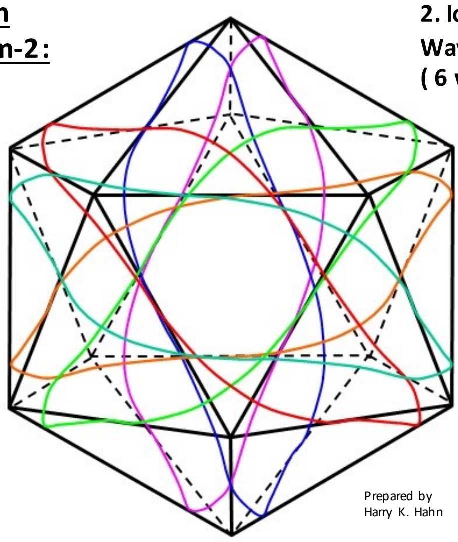


Icosahedron with 3D- Wave System-2:

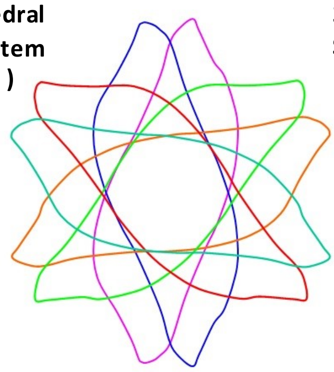
Wave system consisting of 6 Waves

Each wave moves over 12 triangles

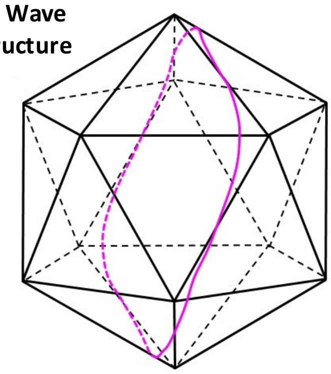
Each waves Is missing 8 of the 20 triangles



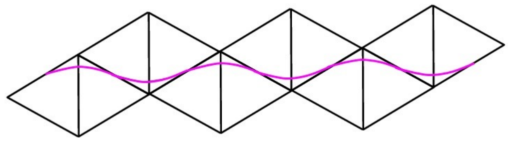
2. Icosahedral Wave System (6 waves)



3D Wave Structure



flat pattern of wave (2D Wave Structure)

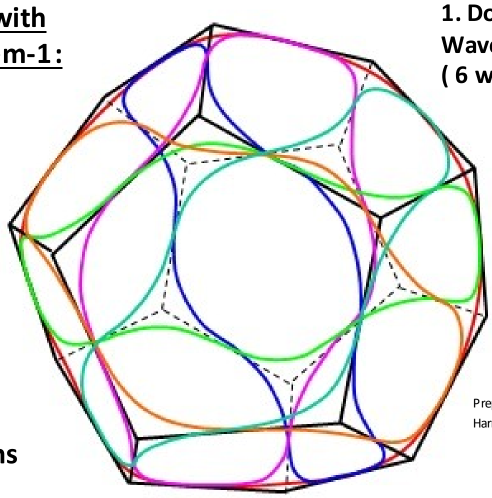


Dodecahedron with 3D - Wave System-1:

Wave system consisting of 6 Waves

Each wave moves over 10 pentagons

Each waves Is missing 2 of the 12 pentagons



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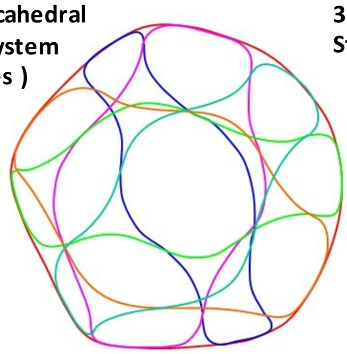
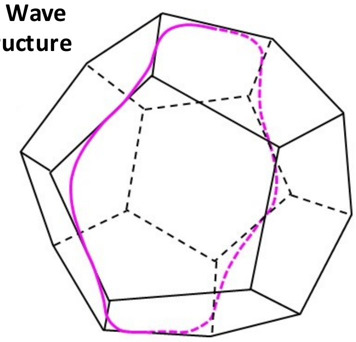
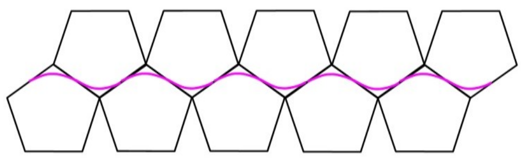
1. Dodecahedral Wave System (6 waves)



3D Wave Structure



flat pattern of wave (2D Wave Structure)

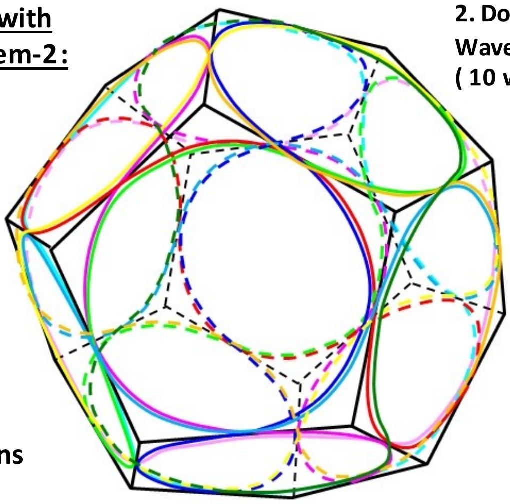


Dodecahedron with 3D - Wave System-2 :

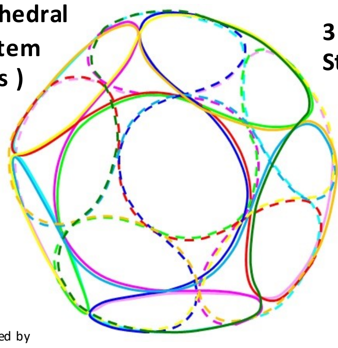
Wave system consisting of 10 Waves

Each wave moves over 6 pentagons

Each waves Is missing 6 of the 12 pentagons



2. Dodecahedral Wave System (10 waves)



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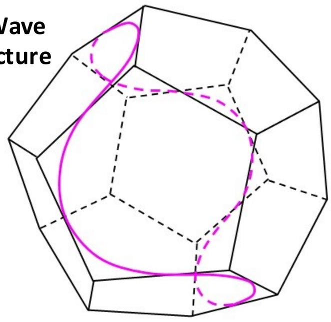
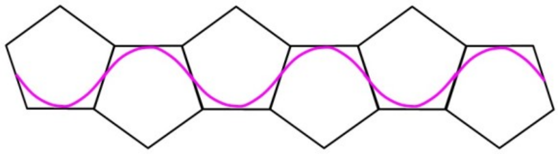
3D Wave Structure



flat pattern of wave (2D Wave Structure)

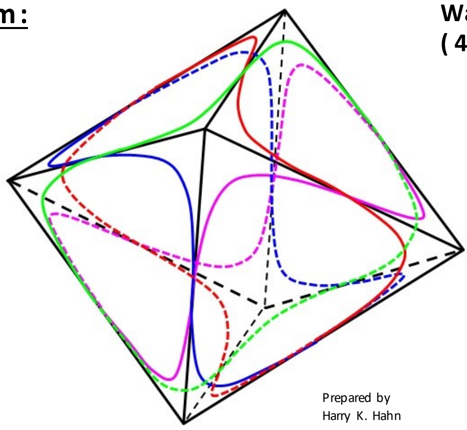


Octahedron with 3D - Wave System :

Wave system consisting of 4 Waves

Each wave moves over 6 triangles

Each waves is missing 2 of the 8 triangles



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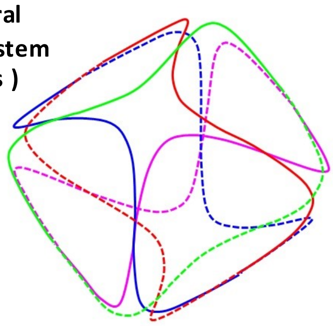
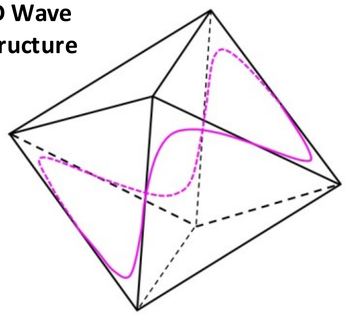
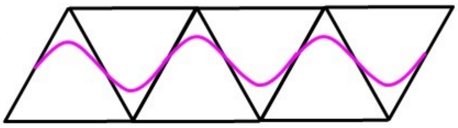
Octahedral Wave System (4 waves)



3D Wave Structure



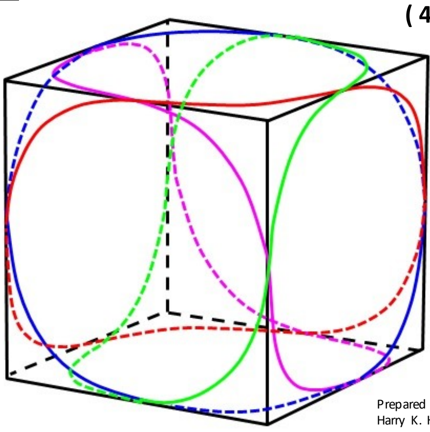
flat pattern of wave : (2D Wave Structure)



Hexahedron (Cube) with 3D - Wave System :

Wave system consisting of 4 Waves

Each wave moves over all 6 squares



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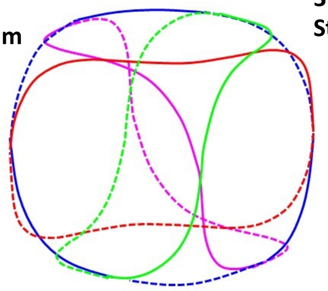
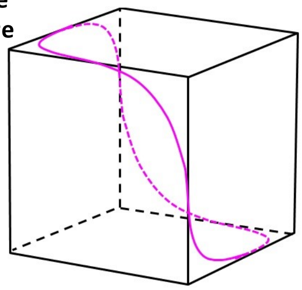
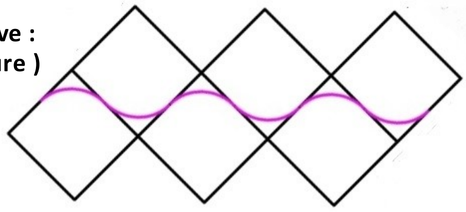
Hexahedral Wave System (4 waves)



3D Wave Structure



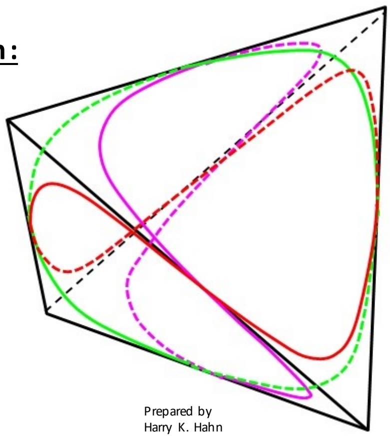
flat pattern of wave : (2D Wave Structure)



Tetrahedron with 3D - Wave System :

Wave system consisting of 3 Waves

Each wave moves over all 4 triangles



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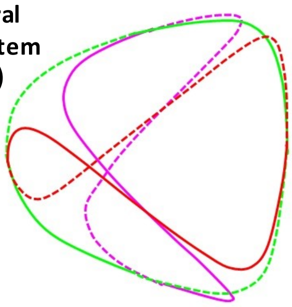
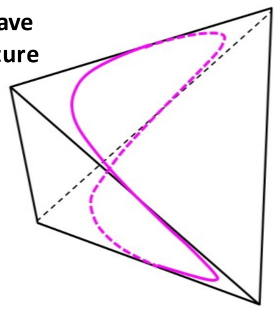
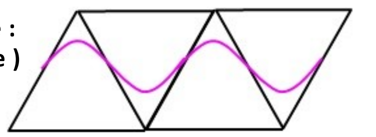
Tetrahedral Wave System (4 waves)



3D Wave Structure



flat pattern of wave : (2D Wave Structure)



1.3 Development of a Reference-Framework for the Atomic Nucleus based on Platonic Solids

The image on the right shows an example how a reference framework for a **nuclear shell model** based on **Platonic Solids** can be developed. The Platonic Solids can be inscribed into each other, or superimposed in different combinations, but geometrically precisely defined in their orientation.

There are various shell-models possible. The shown shell-system is only an example. Shell-systems with many more layers (shells) can be defined ! **The Inscribed Spheres, Mid-Spheres and Circumscribed Spheres of the Platonic Solids can here be used as inner- and outer limits of different shells or orbitals of the orbital- and/or shell model.** The following youTube video-clips give some 3D-views & ideas : Clip1; **Clip2**; **Clip3**; Clip4; Clip5

The framework for the nuclear shell- and/or orbital-model must be based on simple relations !

For example if the edge length of the innermost Platonic Solid is defined with **a = 1** , then the edge lengths of the other Platonic solids, in the shown group, can be expressed by simple relations of constant **Phi** (**φ**) and **Sqrt 2** as shown in **Table 1** below. **Sqrt 2** can be expressed by **Phi** and **1** !

PSF-1 : Top-view of a group of nested Platonic Solids

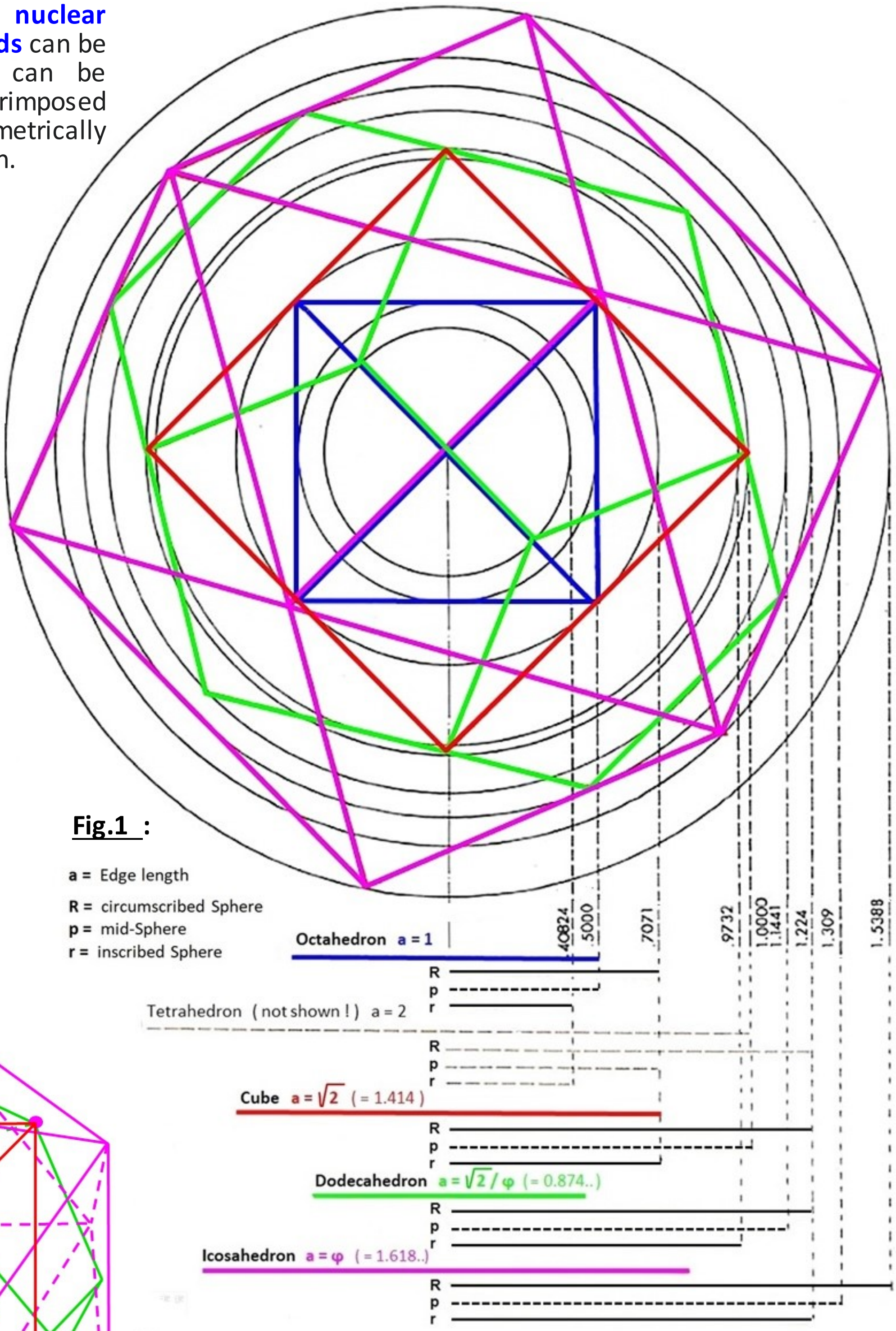


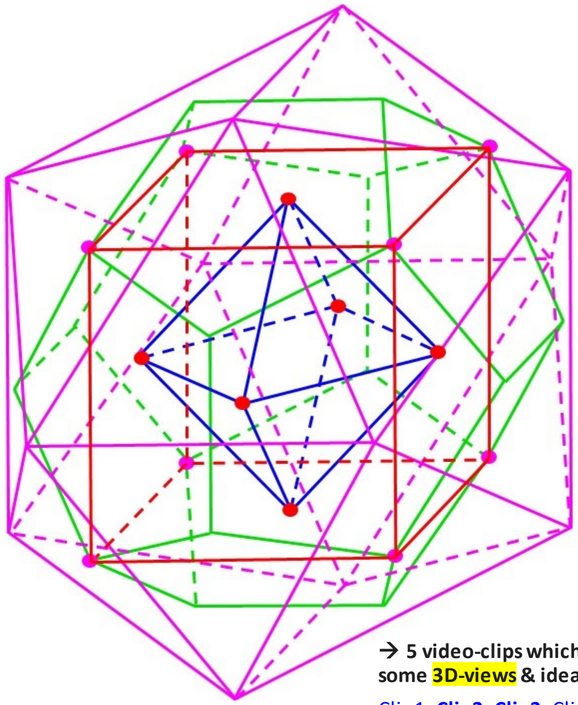
Fig.1 :

➔ The **5 Platonic Solids** are regular convex **uniform polyhedrons** that consist of polygonal faces which are identical in shape & size

In the **shown combination** of the **Platonic Solids** the **edge lengths** can can be defined as follows : (➔ 4 scenarios shown)

Table 1:

	1	**2**	**3**	**4**
Octahedron :	1	$1/\sqrt{2}$	$\varphi/\sqrt{2}$	$1/\varphi$
Tetrahedron :	$(\sqrt{2})^2$	$\sqrt{2}$	$\varphi\sqrt{2}$	$(\sqrt{2})^2/\varphi$
Hexahedron : (Cube)	$\sqrt{2}$	1	φ	$\sqrt{2}/\varphi$
Dodecahedron :	$\sqrt{2}/\varphi$	$1/\varphi$	1	$\sqrt{2}/\varphi^2$
Icosahedron :	φ	$\varphi/\sqrt{2}$	$\varphi^2/\sqrt{2}$	1



→ **5 video-clips which provide some 3D-views & ideas :**
Clip1; **Clip2**; **Clip3**; Clip4; Clip5

Fig.2 : 3D-view of nested Platonic Solids of Fig. 1
This angle view of Fig. 1 shows the Octahedron (blue) inscribed in the Hexahedron (red) that is inscribed in a Dodecahedron (green) which is inscribed in an Icosahedron (pink). The Icosahedron forms the outer shell of this nested Platonic Solids group.

2 Constant Phi (φ) defines the structure of Matter

Constant **PhI** (**φ**) seems to be **the fundamental constant that defines the scattering** (distribution) **of particles and waves in the universe**, and the **base unit** (number) **1** seems to represent **a base energy/wave element** like the **quantum of electromagnetic action** → the **Planck Constant h** that is **defined by Energy / Frequency**

The **Mathematical Physical Triangle (MPT)** and the **Square Root Spiral (SRS)** represent a starting point for an **Universal Mathematical- & Physical Theory**. To understand the meaning of the **MPT** & **SRS** for Physics we must understand the physical meaning of the most irrational constant **PhI** (**φ**) and the meaning of the **base unit 1** !

Please note that the **MPT**, the **SRS** and in all probability all existing **irrational constants** can be represented by transparent constructions out of **base unit** (**number**) **1** and the most **simple infinite continued fraction** : **Constant PhI (φ)** that is only **based on Number 1** ⟶

$$\varphi = \cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+..}}}$$

which essentially is the set-up for a universal theory **Albert Einstein** was looking for !

In Physics the socalled **Continued Fraction Method (MCF)** was developed for solutions of integral equations of the **Quantum Scattering Theory**, which describe particle-collisions and –scattering of particles and waves. For example the **MCF** is used for the **Fermi-Dirac Function**, which describes the macroscopic properties of a system consisting of **Fermions** (→ particles which form matter : quarks, leptons and baryons : (e.g. electrons, protons). → **see weblinks to some exemplary studies which use the MCF :**

Continued fraction representation of the Fermi Dirac function for large scale electronic structure calculations
Application of matrix valued integral continued fractions to the spectral problems on periodic graphs (see also : **Algebra of waves**)
The MCF for electron (positron)-atom scattering and **The MCF in the theory of slow electron scattering by molecules**

On the other hand there is clear indication that constant **Phi** (**φ**) also defines the distribution of matter in the astronomical-scale ! For example the **ratios of orbital periods of Solar-planetary and Exo-planetary systems show a preference for Fibonacci-Number ratios, which are defined by constant PhI** (**φ**). → **See the Study 5 in Chapter 8.5.** And if the **M87 gravitational singularity** (**EHT2017**) indeed **indicates a dodecahedral structure** then we even have a proof that **PhI** (**φ**) **defines the distribution of matter in very extreme gravitational fields.**

The Volume of the Dodecahedron and Icosahedron expressed only with constant φ and 1 !

$$V_{Dod.} = \frac{a^3}{4}\,(15 + 7\sqrt{5}) \;\rightarrow\; V_{Dod.} = \frac{\varphi^4\,(\varphi^4 - 1)}{\varphi^4 - \varphi^2 + 1} \quad ;\ \text{for } a = 1 \ (\text{edge})$$

$$V_{Ico.} = \frac{5\,a^3}{12}\,(3 + \sqrt{5}) \;\rightarrow\; V_{Ico.} = \frac{\varphi^2\,(\varphi^4 - 1)^2}{(\varphi^4 - \varphi^2 + 1)\,(\varphi^4 + 1)}$$

Dodecahedral and Icosahedral Quasicrystals

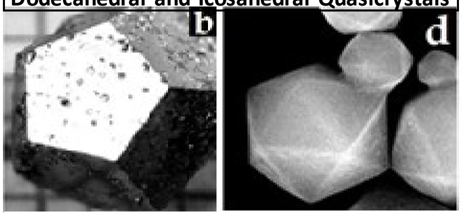
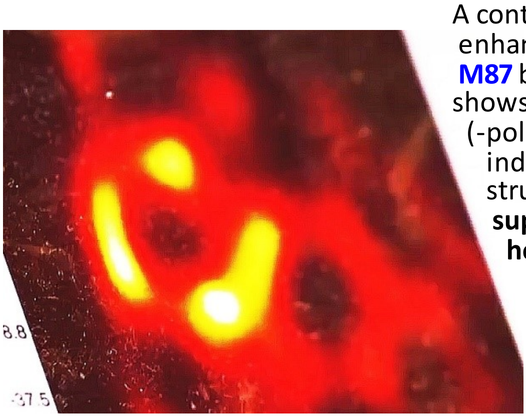


Fig 1 : b.) Dodecahedral Quasicrystal **Ho-Mg-Zn**
d.) Icosahedral Silica Quasicrystal (Nanocrystals)

→ Three possible ways to find the Universal Theory and uncover the true geometry of our Universe :

1.) Through advances in **Number Theory**. → By applying a **new mathematics based only on Phi and 1**
2.) By fully understanding **the Physics & Mathematics of Quasicrystals, Atomic-Clusters & Atomic-Nuclei**
3.) By **high-resolution astronomical observations of gravitational singularities**, like the one in **M87**

The M87 black hole has a complex (dodecahedral) **geometry**

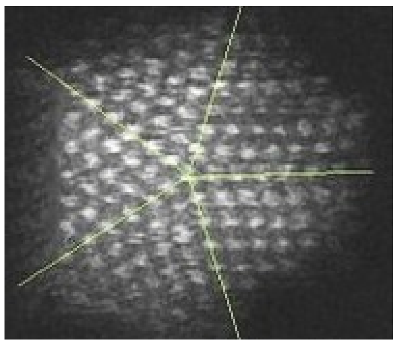


A contrast- & brightness enhanced image of the **M87** black hole shadow shows a polypentagonal (-polygonal) structure, indicating a complex structure of the **M87 super-massive black hole** (**EHT2017**), which may be the result of an **O5- Poincare-Dodecahedral Space universe.**

This image is from the section of the documentation **Black Hole Hunters** which shows how the algorithms calculate the first image of the M87 black hole shadow. **Note :** only the left (bright) ring was presented to the public ! The rest of the structure was ignored !

Icosahedral Atom-Clusters indicate an icosahedral structure of the atom's electron shell & atomic-core

Elements which are chemically inert often form **clusters** with an **icosahedral** shape. The shell structure of such **Icosahedral clusters** is defined by the **electron configuration** of the whole cluster, that is a consequence of the electron shell of the single atom, which again is **a result of the atom-core-structure** ! Image: **MacKay cluster** made of **Gold atoms.**



TEM-image of an **Icosahedral Gold nanoparticle**. A variety of nano-structures assume icosahedral form (e.g. condensing **Argon- & metal atoms**) → see : **Icosahedral Twins** (→ see also : **Superatom**)

3 Quasicrystals will help us to find the true geometry & dimensionality of Matter

Here on Earth we can find out the true geometry and dimensionality of space-time and matter by fully understanding Quasicrystals and quasicrystalline structures from the mathematical – and physical point of view. **Quasicrystals indicate that space-time and/or matter (energy) is based on higher geometrical dimensions of at least 4 maybe even 5 or 6 !**

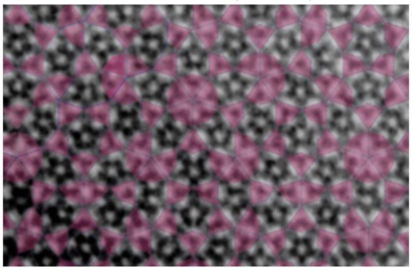
According to the classical Crystallographic Restriction Theorem crystals can only possess two-, three-, four- and six-fold rotational symmetries. However in 1984 **Quasicrystals with five-fold symmetry** were discovered !

Two types of Quasicrystals exist : 1.) Polygonal Quasicrystals which have one axis of 8-, 10- or 12-fold local symmetry.
2.) Icosahedral Quasicrystals. These Quasicrystals are aperiodic in all directions.

Similar to atomic clusters (→ previous page) the electron shell structure (electron configuration) of the whole quasicrystal defines ist structure → **see : Scanning tunnelling microscopy reveals a quasiperiodic order in the electronic wave functions**

For Quasicrystals **at least 5** linearly independent vectors are necessary in order to assign integer indices to the diffraction intensities of quasicrystals. We need **5 indices for polygonal quasicrystals** and **6 indices for icosahedral quasicrystals.** The necessary **n** vectors span a **nD-reciprocal space** in which a structure can be built that produces a diffraction pattern as observed for quasicrystals. **In higher-dimensional space we can describe a quasiperiodic structure as a periodic one.**

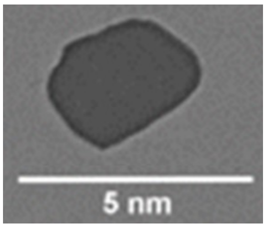
The mathematics which describes quasicrystals indicates that matter (energy) has higher embedded dimensions !
Nicolaas G. de Brujin showed that **aperiodic quasicrystal-like Penrose Tilings** can be viewed as **2-dimensional slices of five-dimensional hypercubic structures**. The study of Penrose Tilings is important for understanding Quasicrystals.
(→Simulation of 2D-quasicrystals : Quasicrystalline Bose-Einstein-Condensate provides a glimpse of **physics in higher dimensions**)



Electron Microscope image of a real Decagonal Quasicrystal (Weblink)

Interesting is the fact that **the production of Quasicrystals** in the lab **is difficult and tricky, requiring precise temperatures** and **strange conditions** including a **vacuum** and an **Argon-atmosphere**, see Weblink 4 (→ **Argon** is an inert noble gas that forms Icosahedral clusters during condensation)

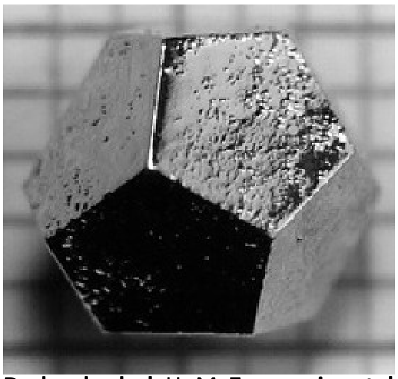
Natural (mineral) quasicrystals only seem to form under extreme high-pressure and – temperature conditions → see right image →



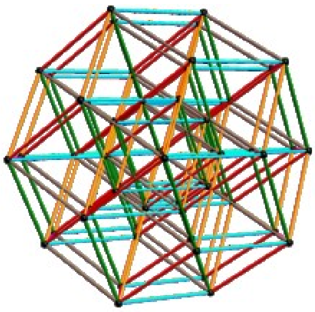
→ see :
Weblink 1
Weblink 2
Weblink 3
Weblink 4

Extraterrestrial Quasicrystal
A grain of stishovite that only occurs at **ultrahigh pressures (≥10 Gpa**), contains an **Icosahedrite Quasicrystal inclusion Al63Cu24Fe13**

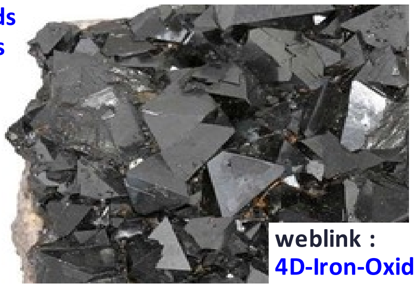
Three studies about the Mathematics of Quasicrystals:
1-The Noncommutative Geometry of Aperiodic Solids
2-Crystallography of Quasicrystals 3- Quasicrystals



Dodecahedral HoMgZn **quasicrystal**
A **Quasicrystal** is a structure that is ordered but not periodic, it lacks translational symmetry.
In a simulation scientists showed that the golden ratio (Phi) governs the interaction of the atoms. **See : The World's most complex Crystal**

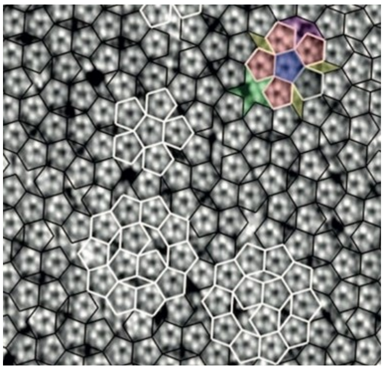


A **6-cube** projected into the rhombic triacontahedron using the golden ratio in the basis vectors. **This is used to understand the aperiodic icosahedral structure of quasicrystals**

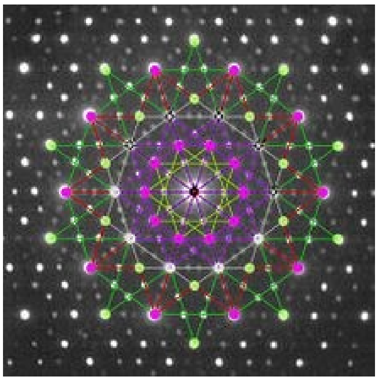


weblink : 4D-Iron-Oxid

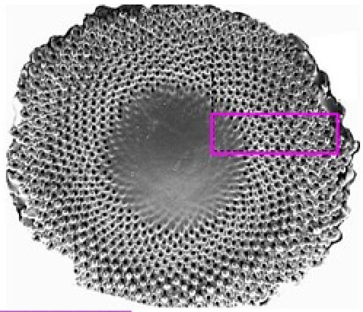
Four-Dimensional Iron-Oxid Fe_4O_5
below 150K this iron-oxid goes through an unusual phase transition related to a formation of charge-density waves—which lead to a **"four-dimensional crytal structure"**
It formed at very high temperatures and **very high pressure** hundreds of kilometres below Earth's surface.

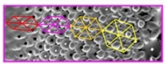


A special **Two-dimensional quasi-crystal** made from **self-assembling organic molecules** which form pentagons, stars, boats and rhombi
→ **see : Bizarre organic Quasicrystal**



A **5-cube** as an orthographic projection into 2D using Petrie polygon basis vectors overlaid on the diffractogram from an icosahedral Ho-Mg-Zn quasicrystal





Sunflower capitulum : The Fibonacci number spirals (Phyllotactic-pattern) indicate an icosahedral quasicrystal structure, probably caused by the large icosahedral **Water-Cluster** $(H_2O)_{100}$ or $(H_2O)_{280}$ → **see my following Study**

4 There is clear evidence that the structure of matter (the atomic nucleus) is related to the Platonic Solids

The Platonic Solids **Icosahedron** & **Dodecahedron** are closely related to **constant Phi** (**φ**). The Icosahedron plays an important role in the structure of extremely stable atomic- and molecular- clusters. And together with the Dodecahedron the Icosahedron can **describe quasi-crystalline structures with five-fold symmetry**.

The Dodecahedron also seems to play an important role in the large scale structure of the universe, especially in the formation of very strong gravitational maxima (supermassive black holes) like the one in **M87**.

The **Icosahedron** & **Dodecahedron** form Quasicrystals that can only be described in „higher-dimensional“ space Therefore these Platonic Solids must play a crucial role in unifying Quantum Mechanics with General Relativity

The Icosahedron :

The **Icosahedron** is No. 5 of the five **Platonic Solids**

With 20 faces it has the most faces of the five Platonic Solids. The faces are equilateral triangles Further the Icosahedron has 30 edges and 12 vertices. It has the Schläfli symbol {3,5}

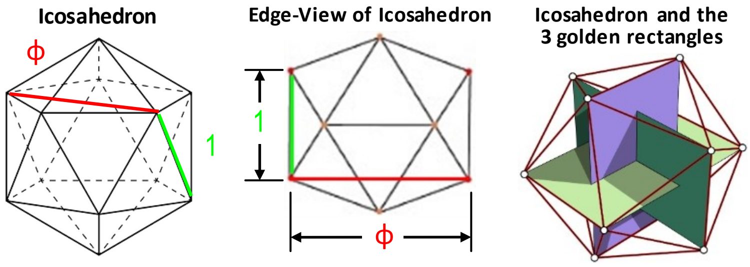


Fig 1 : shows how the **Golden Ratio** (→ **the ratio of constant Phi** (**ϕ**) **and 1**) is built into the Geometry of the **Icosahedron**

Formulas for the Icosahedron in reference to the sphere :

If the edge length of the Icosahedron is ***a***

the radius of a circumscribed sphere **ru** is : $r_u = \frac{a}{4} \cdot \sqrt{10 + 2 \cdot \sqrt{5}}$

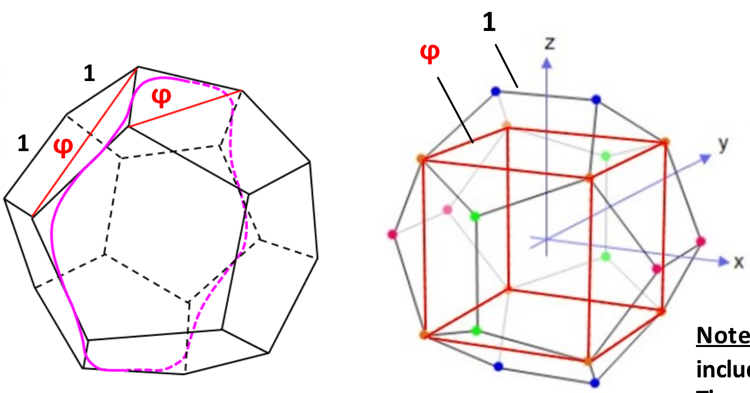
and the radius of an inscribed sphere **ri** is : $r_i = \frac{a}{12} \cdot \sqrt{3} \cdot (3 + \sqrt{5})$

while the mid-radius **rk** (mid of edges) is : $r_k = \frac{a}{4} \cdot (1 + \sqrt{5})$

The Dodecahedron :

The **Dodecahedron** is No. 4 of the five **Platonic Solids**

With 20 vertices It has the most vertices of all Platonic Solids. The 12 faces of the Dodecahedron are regular Pentagons. Further it has 30 edges, and its Schläfli symbol is {3,5}



Note : **The Dodecahedron includes the Cube structure ! The cube-edges cross all 12 pentagons**

Fig 3 : shows how **constant Phi** (**ϕ**) and **1** are built into the Geometry of the **Dodecahedron** and the **Pentagon**

Dodecahedral & Icosahedral Quasicrystals :

In the higher-dimensional space we can describe a quasi-periodic structure as a periodic one. The actual quasiperiodic structure in the 3D-physical space can then be obtained by appropriate projection/section techniques. Thus it is enough to define a single unit cell of the nD-structure. The contents of that nD-unit cell consists of "hyperatoms" (occupation domains, ..) in analogy to the atoms in a normal unit cell. This enables us to describe the whole quasicrystal structure with a finite set of parameters. If we described it in 3D-space only, we needed thousands of atoms to obtain a representative volume segment of the whole structure as well as all parameters that go with it (eg. thousands of positions).

→ see : **weblink**

→ **Image Source**

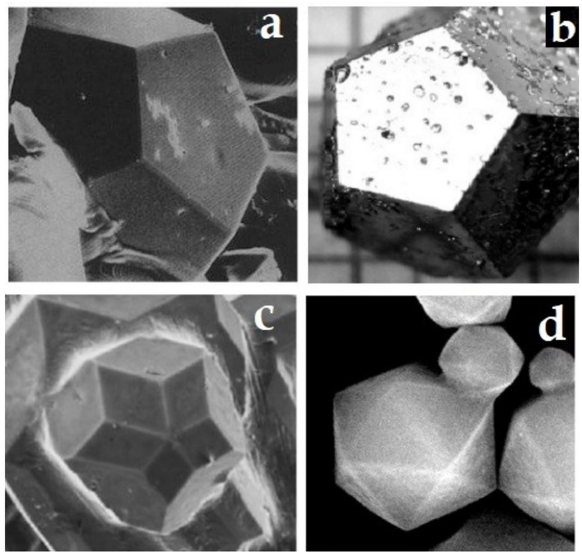
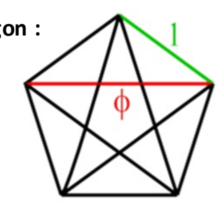


Fig 2 : a.) Dodecahedral Quasicrystal **Al65Cu20Fe15**
b.) Dodecahedral Quasicrystal **Ho-Mg-Zn**
c.) Quasicrystal **Al-Cu-Fe** with **Triacontahedron** shape
d.) Icosahedral Silica Quasicrystal (Nanocrystals)

Pentagon :



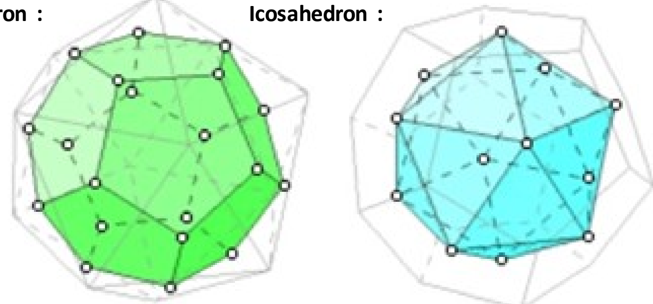
The Dodecahedron :

A regular **Dodecahedron** or **pentagonal dodecahedron** is a dodecahedron that is regular, which is composed of twelve regular pentagonal faces (**Pentagons**) three meeting at each vertex

The Dodecahedron has 12 faces, 20 vertices, 30 edges, and 160 diagonals (60 face diagonals, 100 space diagonals).

It is represented by the Schläfli symbol {5,3}.

Dodecahedron : **Icosahedron :**



The **Dodecahedron** is the **dual** of the **Icosahedron**

Connecting the centers of adjacent faces of the dodecahedron results in an icosahedron, and connecting the centers of the icosahedron faces results in a dodecahedron.

If the edge length of a regular dodecahedron is ***a*** , the radius of a circumscribed sphere **r_u** (one that touches the regular dodecahedron at all vertices) is :

and the radius of an inscribed sphere **r_i** (tangent to each of the regular dodecahedron's faces) is :

while the midradius **r_m**, which touches the middle of each edge, is :

Weblink to more formulas of the dodecahedron
see : polyhedra_dodecahedron

$$r_u = a\frac{\sqrt{3}}{4}\left(1+\sqrt{5}\right) \rightarrow$$

$$r_i = a\frac{1}{2}\sqrt{\frac{5}{2}+\frac{11}{10}\sqrt{5}} \rightarrow$$

$$r_m = a\frac{1}{4}\left(3+\sqrt{5}\right) \rightarrow$$

These quantities can also be expressed as :

$$r_u = a\,\frac{\sqrt{3}}{2}\phi$$

$$r_i = a\,\frac{\phi^2}{2\sqrt{3-\phi}}$$

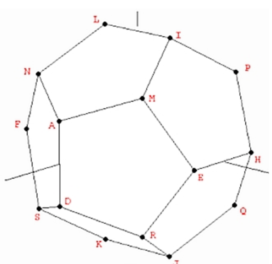
$$r_m = a\,\frac{\phi^2}{2}$$

where ϕ is the golden ratio.

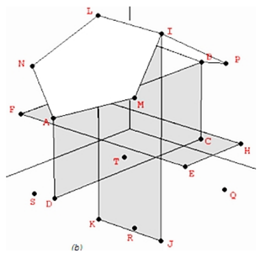
Please have a look at the following websides
→ The golden ratio Phi (φ) in Platonic Solids : → Phi_sacred_Solids ⟶

The Dodecahedron in cartesian coordinates :

The vertices of the dodecahedron obtained from the **cube** and **three orthogonal Golden Rectangles** with the side relationship **1 / φ²** (= 2/φ : 2φ)



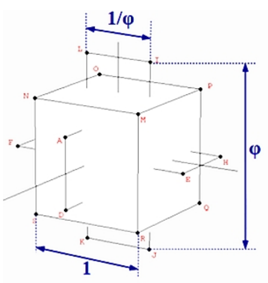
(c)



(b)

A (	φ,	0,	1/φ)
B (	-φ,	0,	1/φ)
C (	-φ,	0,	-1/φ)
D (	φ,	0,	-1/φ)
E (	1/φ,	φ,	0)
F (	1/φ,	-φ,	0)
G (	-1/φ,	-φ,	0)
H (	-1/φ,	φ,	0)
I (	0,	1/φ,	φ)
J (	0,	1/φ,	-φ)
K (	0,	-1/φ,	-φ)
L (	0,	-1/φ,	φ)

M (	1,	1,	1)
N (	1,	-1,	1)
O (	-1,	-1,	1)
P (	-1,	1,	1)
Q (	-1,	1,	-1)
R (	1,	1,	-1)
S (	1,	-1,	-1)
T (	-1,	-1,	-1)



(a)

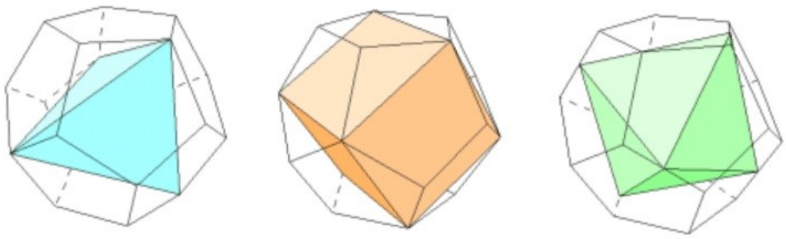
A_1(	0,	φ²,	φ,)
B_1(	0,	φ²,	-φ,)
C_1(	0,	-φ²,	-φ,)
D_1(	0,	-φ²,	φ,)
E_1(	φ²,	φ	0)
F_1(	φ²,	-φ	0)
G_1(	-φ²,	-φ	0)
H_1(	-φ²,	φ	0)

I_1(	φ,	0,	φ²)
J_1(	-φ,	0,	φ²)
K_1(	-φ,	0,	-φ²)
L_1(	φ,	0,	-φ²)

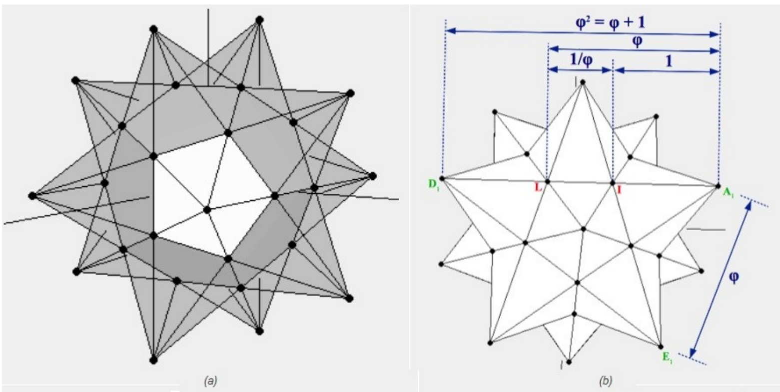
Table 4: The cartesian coordinates of the small stellated dodecahedron. The vertices of the original dodecahedron (Table 3), though visible, are not vertices of the stellation.

The Dodecahedron has geometric relations to the other four Platonic Solids (see also image above → dual of the Icosahedron) :

By connecting selected vertices of the dodecahedron, it is possible to form a **Tetrahedron** or a **Cube.** By connecting midpoints of certain edges, it is possible to form an **Octahedron :**



The small stellated Dodecahedron contains three powers of φ



(a) (b)

Figure 6: The small stellated dodecahedron contains three powers of the Golden Ratio. This can be clearly appreciated in its pentagram faces. Its outer vertices define an icosahedron whose edge length (A_1E_1) is in a proportion 1:φ² with the edge of the original dodecahedron (IL).

5 The important connection between Mathematics & Physics - The Mathematical Physical Triangle (MPT)

The following study regarding Special Relativity provided an **important algebraic term** for cathetus **u** of the **MPT**, which makes it possible to base Number Theory and Geometry (and Physics !) on a transparent construction out of **Number 1**, as **Albert Einstein** was hoping for ! :

➔ **„Phase spaces in Special Relativity : Towards eliminating gravitational singularities“** - by Peter Danenhower

See Weblink : https://arxiv.org/pdf/0706.2043.pdf

This study uses phase spaces in special relativity by expanding Minkowski Space to model the physical world.

The phase spaces developed in this study indicate that graviational singularities can be eliminated !

The key mathematical idea used in this study is the inclusion of a complex phase factor, such as, $e^{i\phi}$ in the Lorentz transformation , and to use both the proper time and the proper mass as parameters. Additional a simple (invariant) parameter, the **“energy to length“ ratio**, defined by c^4/G was used for any spherical region of space-time-matter.

This study may show a way forward to combine General Relativity with Quantum Mechanics.

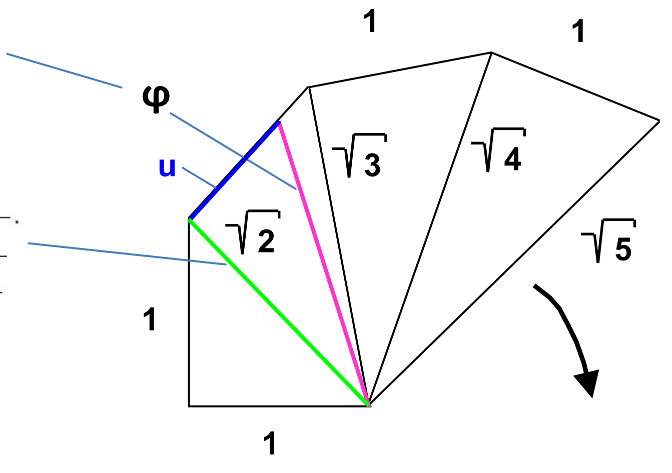
The Mathematical Physical Triangle and the start section of the Square Root Spiral, together with a more profound (number theoretical- and geometrical) analysis of the Square Root Spiral will help with this task :

The first right triangles of the Square Root Spiral, which are only defined by **constant φ and 1**, not only define the complex structure of the square root spiral, but also the Platonic Solids , and they also form the base of Number Theory, Geometry and Physics as well !

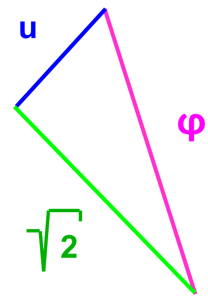
The start of the Square Root Spiral is shown with the constant φ drawn in :

$$\varphi = \cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+..}}}$$

$$\sqrt{2} = 1 + \cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{2+\ddots}}}}.$$



The Mathematical Physical Triangle (MPT) :



With the help of the constants in this right triangle we will find an important starting point on the way to the universal theory :

From the right triangle φ , square root of 2 & u follows :

$\varphi^2 = (\sqrt{2})^2 + u^2$; application of the Pythagorean theorem

➔ $u = \sqrt{\varphi^2 - 2} = 0{,}786151377.....$; we can calculate this value of **u** with the calculator

I did some research in the internet with Google, and I found a study where the constant u was expressed with an algebraic term ! With the help of this algebraic term it was possible to find interesting new properties of constant φ

➔ **See next page !**

Here the abstract of the study where I found the algebraic term for Constant U :

PHASE SPACES IN SPECIAL RELATIVITY : TOWARDS ELIMINATING GRAVITATIONAL SINGULARITIES

from PETER DANENHOWER → see weblink : **https://arxiv.org/pdf/0706.2043.pdf**

Abstract : This paper shows one way to construct phase spaces in special relativity by expanding Minkowski Space. These spaces appear to indicate that we can dispense with gravitational singularities. The key mathematical ideas in the present approach are to include a complex phase factor, such as, $e^{i\phi}$ in the Lorentz transformation and to use both the proper time and the proper mass as parameters. To develop the most general case, a complex parameter σ = s + im, is introduced, where s is the proper time, and m is the proper mass, and σ and σ /|σ| are used to parameterize the position of a particle (or reference frame) in space-time-matter phase space. A new reference variable, u = m/r , is needed (in addition to velocity), and assumed to be bounded by 0 and $c^2/G = 1$, in geometrized units. Several results are derived: The equation $E = mc^2$ apparently needs to be modified to $E^2 = (s^2c^{10})/G^2 + m^2c^4$, but a simpler (invariant) parameter is the "energy to length" ratio, which is c^4/G for any spherical region of space-time-matter. The generalized " momentum vector" becomes completely "masslike" for **u ≈ 0.7861…,** which we think indicates the existence of a maximal gravity field. Thus, gravitational singularities do not occur. Instead, as u → 1 matter is apparently simply crushed into free space. In the last section of this paper we attempt some further generalizations of the phase space ideas developed in this paper.

Extract from page 11 of the study (equation 4.9) :

$$\hat{\mathbf{P}} = \frac{[(\sqrt{1-u^2}-u^2)+i(u\sqrt{1-u^2}+u)]}{\sqrt{1+u^2}}\gamma < 1, v >$$

See also this document :
→ Space-Time-Matter

In this form the real and imaginary part of **P** have a very interesting property, namely, if

(4.10) $u = \frac{\sqrt{2\sqrt{5}-2}}{2}$ **≈ 0.786151377… = u ,** then the real part of **P** is zero, and the imaginary part takes its maximum value (= 1).

I think it makes sense to argue that when the real part of **P** = 0, **P** is entirely "mass like", which we could understand to be representative of the state of space-time-matter for which the maximal gravity field occurs. In this picture gravity is understood to be the propensity of space-time-matter to become completely mass like. The more mass-like a region of space-time-matter is, then the stronger the external gravity field. Thus, within the discussion of this paper, I think **the only reasonable interpretation of the existence of the special value of u given in equation 4.10** is that **there is a maximal gravity field at this value of u**. It is important to observe that the **value of u** considered above, substantially exceeds **the value of u for a typical neutron star (≈ 0.1 – 0.2).**
Thus, I think the maximal gravity field concept can be used to explain all of the experimental evidence for enormous gravity fields.

→ **Now we can equate the two algebraic terms which represent the same constant ! :**

$$\sqrt{\varphi^2 - 2} = \frac{\sqrt{2\sqrt{5} - 2}}{2} \quad \text{; we square both sides}$$

$$\rightarrow \quad 4\varphi^2 - 8 = 2\sqrt{5} - 2 \quad \text{; and transform}$$

$$\varphi^2 = \frac{\sqrt{5} + 3}{2} \quad \text{; (1) we solve for } \varphi^2$$

$$\sqrt{5} = 2\varphi^2 - 3 \quad \text{; (2) we solve for } \sqrt{5}$$

→ **Now we use the following right triangle :**

$$(\sqrt{6})^2 = (\sqrt{5})^2 + 1^2 \quad \text{; Pythagorean theorem}$$

$$6 = (2\varphi^2 - 3)^2 + 1 \quad \text{; we replace } \sqrt{5} \text{ by (2)}$$

$$\rightarrow \quad 3 = \frac{\varphi^4 + 1}{\varphi^2} \;(3) \rightarrow \sqrt{3} = \sqrt{\frac{\varphi^4 + 1}{\varphi^2}} \;(4)$$

→ square root 3 expressed by **φ** and **1** !

With the other right triangles of the square root spiral we can calculate all square roots of the natural numbers expressed only by φ and 1 : (see Appendix 1 of study !)

$$2 = \frac{\varphi^4 - \varphi^2 + 1}{\varphi^2} \;(5) \text{ and } \sqrt{2} = \sqrt{\frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}} \;(6)$$

$$\sqrt{5} = 2\varphi^2 - \frac{\varphi^4 + 1}{\varphi^2} \quad \rightarrow \quad \sqrt{5} = \frac{\varphi^4 - 1}{\varphi^2} \;;\; (7)$$

$$6 = \frac{\varphi^8 - \varphi^4 + 1}{\varphi^4} \;(8) \text{ and } \sqrt{6} = \sqrt{\frac{\varphi^8 - \varphi^4 + 1}{\varphi^4}} \;(9)$$

$$7 = \frac{\varphi^8 + 1}{\varphi^4} \;(10) \rightarrow \sqrt{7} = \sqrt{\frac{\varphi^8 + 1}{\varphi^4}} \;(11)$$

$$8 = \frac{\varphi^8 + \varphi^4 + 1}{\varphi^4} \;(12) \quad \sqrt{8} = \sqrt{\frac{\varphi^8 + \varphi^4 + 1}{\varphi^4}} \;(13)$$

$$10 = \frac{\varphi^8 + 3\varphi^4 + 1}{\varphi^4} \;(14) \quad \sqrt{10} = \sqrt{\frac{\varphi^8 + 3\varphi^4 + 1}{\varphi^4}} \;(15)$$

$$11 = \frac{\varphi^8 + 4\varphi^4 + 1}{\varphi^4} \;(16) \quad \sqrt{11} = \sqrt{\frac{\varphi^8 + 4\varphi^4 + 1}{\varphi^4}} \;(17)$$

$$12 = \frac{\varphi^8 + 5\varphi^4 + 1}{\varphi^4} \;(18) \quad \sqrt{12} = \sqrt{\frac{\varphi^8 + 5\varphi^4 + 1}{\varphi^4}} \;(19)$$

Important for Mathematics & Physics : → The Mathematical Physical Triangle (MPT) defined by Phi

Albert Einstein was looking for **a universal theory based only on irrational constants like Pi** (π) **& e**, which are transparent constructions out of **number 1** (see **chapter 6**), and which all have values based on the logical base of the complete theory. **I.V.Volovich** said that **Albert Einstein tried to reduce all physics to algebraic geometry**. This means the reduction of physics to Number Theory.

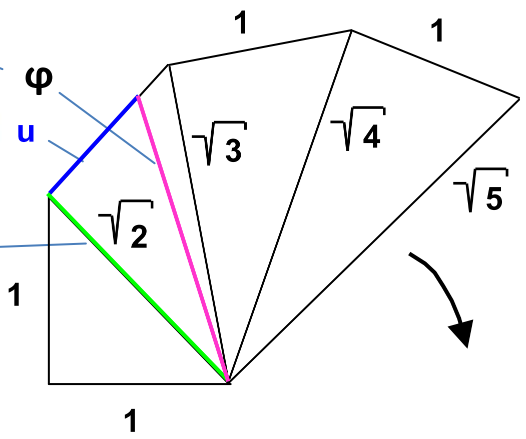
The Mathematical Physical Triangle (MPT) and the Square Root Spiral open the door to an Universal Theory !
With the algebraic term found by Peter Danenhower, all irrational square roots of natural numbers, constants like **Pi** & **e**, and Platonic Solids can be expressed with **constant φ** (Phi) and **1 !** → all transparent constructions of 1 !

The start of the square root spiral is shown with the constant φ drawn in :

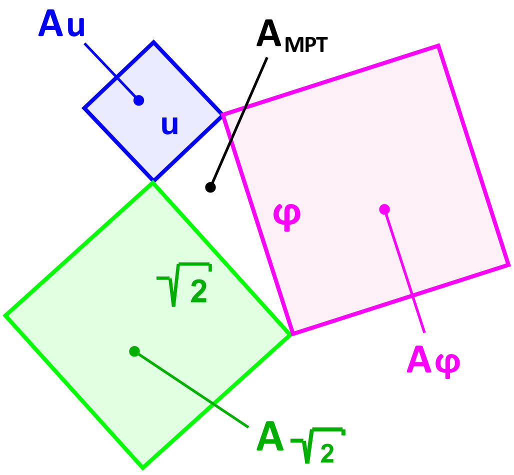
$$\varphi = \cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+..}}}$$

$$\frac{1}{\sqrt{\varphi}} = u$$

$$\sqrt{2} = 1 + \cfrac{1}{1+1+\cfrac{1}{1+1+\cfrac{1}{1+1+\cfrac{1}{1+1+\ddots}}}}$$



The Mathematical Physical Triangle (MPT) :



With this right triangle a simpler algebraic term for constant **u** can be calculated

$$\sqrt{2} = \sqrt{\frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}}$$

$$\sqrt{3} = \sqrt{\frac{\varphi^4 + 1}{\varphi^2}} \quad ; \quad \sqrt{5} = \frac{\varphi^4 - 1}{\varphi^2}$$

$$A\varphi = \varphi^2$$

$$A_{\sqrt{2}} = \frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}$$

$$Au = \frac{\varphi^2 - 1}{\varphi^2} = \frac{\varphi}{\varphi^2}$$

Pythagorean theorem :

$$; \quad Au = A\varphi - A_{\sqrt{2}}$$

$$\rightarrow A_{MPT} = \frac{\sqrt{2} \times u}{2} = \frac{\sqrt{\varphi}}{\sqrt{\varphi^4 - \varphi^2 + 1}}$$

$$\rightarrow u = \sqrt{\frac{\varphi}{\varphi^2}} = \frac{1}{\sqrt{\varphi}} = \frac{\sqrt{2\sqrt{5} - 2}}{2} = 0{,}786151377...$$

From the above shown equations (→ see last two pages) I have realized a general rule for all natural numbers > 10 :

Note : → **The expression (3+n) in the rule can be replaced by products and / or sums of the equations (3) to (13)**

$$\rightarrow (10 + n) = \frac{\varphi^8 + (3+n)\varphi^4 + 1}{\varphi^4} \quad (20) \text{ and } \sqrt{(10 + n)} = \sqrt{\frac{\varphi^8 + (3+n)\varphi^4 + 1}{\varphi^4}} \quad (30)$$

For $n \rightarrow \infty$

With this general formula we can express all natural numbers ≥ 10 and their square roots only with φ and 1 !
This statement is also valid for all rationals (fractions) and their square roots. This is a quite interesting discovery !!

5.1 Constant Pi (π) can also be expressed by only using constant φ and 1 !

Again to **Viete's formula from 1593 :**

→ It is also possible to derive from Viète's formula a related formula for π that still involves nested square roots of two, but uses only one multiplication :

$$\pi = \frac{2}{\sqrt{2}} \frac{2}{\sqrt{2+\sqrt{2}}} \frac{2}{\sqrt{2+\sqrt{2+\sqrt{2}}}} \cdots$$

$$\pi = \lim_{k\to\infty} 2^k \underbrace{\sqrt{2-\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\cdots+\sqrt{2}}}}}}}_{k\text{ square roots}}$$

If we replace the number 2 in the above shown formulas by the found equation (5) where number 2 can be expressed by constant φ and 1, then we can express constant Pi (π) also by only using the constant φ and 1 !

Replace Number 2 in the above shown formulas with this term.

$$\rightarrow \quad 2 = \frac{\varphi^4 + 1}{\varphi^2} - 1 \quad \rightarrow \quad \boxed{2 = \frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}} \ (5) \quad \text{and} \quad \sqrt{2} = \sqrt{\frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}} \quad (6)$$

It becomes clear that the irrationality of Pi (π) is also only based on the constant φ and 1, in the same way as the irrationality of all irrational square roots, is only based on constant φ & 1 ! Numbers don't exist ! Only φ & 1 exist !

Constant Pi (π) can now be expressed in this way, by only using constant φ and 1 :

$$\pi = \lim_{k\to\infty} \left[\frac{\varphi^4-\varphi^2+1}{\varphi^2}\right]^k \underbrace{\sqrt{\frac{\varphi^4-\varphi^2+1}{\varphi^2} - \sqrt{\frac{\varphi^4-\varphi^2+1}{\varphi^2} + \sqrt{\frac{\varphi^4-\varphi^2+1}{\varphi^2} + \cdots + \sqrt{\frac{\varphi^4-\varphi^2+1}{\varphi^2}}}}}}_{k\text{ square roots}}$$

It becomes clear that the irrationality of Pi (π) is also only based on the constant φ and 1, in the same way as the irrationality of all irrational square roots, is only based on constant φ & 1 !

Numbers don't seem to exist ! Natural Numbers, their square roots and irrational transcendental constants like Pi (π) can be expressed by only using constant φ and 1 !!

This is an interesting discovery because it allows to describe most (maybe all) geometrical objects only with φ & 1 !

The result of this discovery may lead to a new base of number theory. Not numbers like 1, 2, 3,….. and constants like Pi (π) etc. are the base of number theory ! Only the constant φ and the base unit 1 (which shouldn't be considered as a number) form the base of mathematics and geometry. This will certainly also have an impact on physics !

And constant φ and the base unit 1 must be considered as fundamental „Matter (energy) structure constants" of the real physical world ! With constant φ and 1 all geometrical objects including the Platonic Solids can be expressed !

There probably isn't something like a base unit if we consider a „wave model" as the base of physics and if we see the universe as one oscillating unit. In the universe everyting is connected with everything. see : Quantum Entanglement

6 Referring to my discovery regarding constant Phi (φ) , I have defined these 12 Conjectures :

Conjectures : (→ you can call them **Harry K. Hahn's conjectures**)

1.) All Natural Numbers and their square roots can be expressed (calculated) by only using the mathematical constant Phi (golden mean = 1.618..) and number 1. This statement is also valid for all rationals (fractions) and their square roots

2.) All existing irrational numbers seem to be constructions out of Phi and 1.
For example the irrational transcendental constant Pi (3.1415926....) can also be expressed by only using Phi and 1 !

3.) Phi and 1 are the base units of Mathematics ! Numbers and number-systems don't exist ! They are manmade and therefore can be eliminated. In principle Mathematical Science can be carried out by only using Phi and 1, as base units.

4.) All geometrical objects, including the Platonic Solids can also be described by only using constant Phi and 1.
Because all natural numbers, their square roots, rationals (fractions) and probably all irrational and all transcendental numbers too, can be expressed by only using Phi and 1.

5.) Point 4.) leads me to the conclusion that in the physical world the geometries of all possible crystal-lattice-structures are fundamentally based on Phi and 1. The more fundamental the lattice the simpler it can be expressed by Phi and 1.

6.) Point 4.) 5.) & 7.) lead me to the conclusion that on the molecular- and atomic-level, as well as on the macroscopic (cosmic) level the distribution and structure of matter (=energy), is fundamentally based on constant Phi and 1.
→ **Therefore Constant Phi (φ) must be a fundamental "Energy (Matter) Structure Constant"**
Because at the beginning of the universe (Big-Bang) matter formed out of pure energy, the property to form matter with defined structure must be a property of energy, from the logical point of view ! Without energy no matter could have formed, and without energy & matter no space would exist ! → Energy must store the structural information !
Together with Point 7.) this indicates that the curvature of spacetime at the molecular level (crystals) , at the atomic level and on the macroscopic level is caused by energy and defined by the "Energy Structure Constant" Phi & base unit 1 which may represent a base energy/wave element → This idea will help to unify General Relativity & Quantum Physics !
If the gravitational singularity (maximum) in M87 really has a dodecahedral structure, then there is strong indication that gravitation, like matter, is defined by the same constant duo : Phi and 1 in Quantum Mechanics and at the cosmic level !

7.) The structure of the M87 black hole (→ **EHT2017**) indicates a dodecahedral structure. Therefore the distribution of matter in gravitational singularities (maxima) seems to be defined essentially by constant Phi & base unit 1 ! The largescale distribution of matter in the universe seems to be predominantly based on an order-5 dodecahedral honeycomb or "Poincare-Dodecahedral-Space" (see **: "EHT2017 may provide evidence for a Poincare Dodecahedral Space Universe"**)

8.) The natural numbers can be assigned to a defined infinite set of Fibonacci-Number Sequences.

9.) This infinite set of Fibonacci-Number Sequences , and the numbers contained in these sequences, are connected to each other by a complex precisely defined spatial network based on constant Phi.
For the progressing Fibonacci-Sequences towards infinity the connections between the numbers approach constant Phi.
→ see my study : **"Creation of an infinite Fibonacci Number Sequence Table"**

10.) Constant Phi (golden mean = 1.618..) must be a fundamental constant of the final equation(s) of the universal mathematical and physical theory. (→ It may be the only irrational constant that appears in the(se) equation(s))

11.) The number-5-oscillation (→ the numbers divisible by 5) in the two number sequences 6n+5 (Sequence 1) and 6n+1 (Sequence 2), with n=(0,1,2,3,...) , defines the distribution of the prime numbers and non-prime-numbers. The number-5-oscillation defines the starting point and the wave length of defined non-prime-number-oscillations in these Sequences 1+2 (SQ1 & SQ2). (Note : the combination of the two sequences SQ1 & SQ2 is considered here)
→ weblink to my study : **https://arxiv.org/abs/0801.4049** (or alternatively here : **http://vixra.org/abs/1907.0355**)
→ For a quick overview please see the **Chapter 8.5** of this study (**"EHT2017 may provide evidence..."**)

12.) The importance of the number-5-oscillation for the distribution of primes and non-primes is a further indication for the conjecture that the largescale structure of the universe seems to be predominantly (mainly) based on an order-5 Poincare-Dodecahedral-Space structure. → The space structure of the universe seems to be based essentially on the **5.Platonic Solid : the Dodecahedron** (→ consisting of 12 regular pentagonal faces, three faces meeting at each vertex)

Time will show if my Conjectures are correct !

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The golden ratio Phi (φ) in Platonic Solids : http://www.sacred-geometry.es/?q=en/content/phi-sacred-solids

Appendix 1 : → **Here the calculations from Chapter 5**

With the algebraic term of constant u we can calculate all square roots of all natural numbers expressed only by constant φ and 1 :

$$\sqrt{\varphi^2 - 2} = \frac{\sqrt{2\sqrt{5} - 2}}{2}$$; we equate the two algebraic terms which represent the same constant !

$$\rightarrow \quad 4\varphi^2 - 8 = 2\sqrt{5} - 2$$; we square both sides and transform

$$\varphi^2 = \frac{\sqrt{5} + 3}{2}$$; (1) we solve for φ^2

$$\sqrt{5} = 2\varphi^2 - 3$$; (2) we solve for $\sqrt{5}$

Now we go back to the square root spiral and use the following right triangle :

$$(\sqrt{6})^2 = (\sqrt{5})^2 + 1^2$$; application of the Pythagorean theorem

$$6 = (2\varphi^2 - 3)^2 + 1$$; we replace $\sqrt{5}$ by equation (2) and transform

$$\rightarrow \quad 3 = \frac{\varphi^4 + 1}{\varphi^2} \quad (3) \quad \rightarrow \quad \sqrt{3} = \sqrt{\frac{\varphi^4 + 1}{\varphi^2}} \quad (4)$$; square root 3 expressed by φ and 1

Now we use the following right triangle :

$$(\sqrt{3})^2 = (\sqrt{2})^2 + 1^2$$; application of the Pythagorean theorem & inserting equation (3)

$$\rightarrow \quad 2 = \frac{\varphi^4 + 1}{\varphi^2} - 1 \quad \rightarrow \quad 2 = \frac{\varphi^4 - \varphi^2 + 1}{\varphi^2} \quad (5) \quad \text{and} \quad \sqrt{2} = \sqrt{\frac{\varphi^4 - \varphi^2 + 1}{\varphi^2}} \quad (6)$$

Now we insert equation (3) in equation (2) : ; square root 2 expressed by φ and 1

$$\rightarrow \quad \sqrt{5} = 2\varphi^2 - \frac{\varphi^4 + 1}{\varphi^2} \quad \rightarrow \quad \sqrt{5} = \frac{\varphi^4 - 1}{\varphi^2}$$; (7) ;

$$\rightarrow \quad 5 = \left(\varphi^2 - \frac{1}{\varphi^2} \right)^2$$

square root 5 expressed by φ and 1

Now we use the following right triangle :

$$(\sqrt{6})^2 = (\sqrt{5})^2 + 1^2$$; application of the Pythagorean theorem & inserting equation (7)

$$\rightarrow \quad 6 = \left(\frac{\varphi^4 - 1}{\varphi^2} \right)^2 + 1 \quad \rightarrow \quad 6 = \frac{\varphi^8 - \varphi^4 + 1}{\varphi^4} \quad (8) \quad \text{and} \quad \sqrt{6} = \sqrt{\frac{\varphi^8 - \varphi^4 + 1}{\varphi^4}} \quad (9)$$

We can now continue and use the following right triangles of the square root spiral :

$(\sqrt{7})^2 = (\sqrt{6})^2 + 1^2$; application of the Pythagorean theorem & inserting equation (8)

$$\rightarrow \quad 7 = \frac{\varphi^8 + 1}{\varphi^4} \quad (10) \qquad \rightarrow \quad \sqrt{7} = \sqrt{\frac{\varphi^8 + 1}{\varphi^4}} \quad (11) \qquad \rightarrow \quad 7 = \varphi^4 + \frac{1}{\varphi^4}$$

In the same way we can now calculate all square roots of all natural numbers with the next right triangles :

$$\rightarrow \quad 8 = \frac{\varphi^8 + \varphi^4 + 1}{\varphi^4} \quad (12) \text{ and } \sqrt{8} = \sqrt{\frac{\varphi^8 + \varphi^4 + 1}{\varphi^4}} \quad (13)$$

$$\rightarrow \quad 10 = \frac{\varphi^8 + 3\varphi^4 + 1}{\varphi^4} \quad (14) \text{ and } \sqrt{10} = \sqrt{\frac{\varphi^8 + 3\varphi^4 + 1}{\varphi^4}} \quad (15)$$

$$\rightarrow \quad 11 = \frac{\varphi^8 + 4\varphi^4 + 1}{\varphi^4} \quad (16) \text{ and } \sqrt{11} = \sqrt{\frac{\varphi^8 + 4\varphi^4 + 1}{\varphi^4}} \quad (17)$$

$$\rightarrow \quad 12 = \frac{\varphi^8 + 5\varphi^4 + 1}{\varphi^4} \quad (18) \text{ and } \sqrt{12} = \sqrt{\frac{\varphi^8 + 5\varphi^4 + 1}{\varphi^4}} \quad (19)$$

From the above shown formulas (equations 3 to 19) we can read a general rule for all natural numbers > 10 :

Note : → The expression (3+n) in the rule can be replaced by products or sums of the equations (3) to (13)

$$\rightarrow \quad (10 + n) = \frac{\varphi^8 + (3+n)\varphi^4 + 1}{\varphi^4} \quad (20) \text{ and } \sqrt{(10 + n)} = \sqrt{\frac{\varphi^8 + (3+n)\varphi^4 + 1}{\varphi^4}} \quad (30)$$

For $n \rightarrow \infty$

With these formulas we can express all natural numbers and their square roots only with φ and 1 ! This is a very interesting discovery, because it allows to describe probably most (if not all) geometrical objects only with φ and 1 !

If we transfom the equations (3) to (19) into the standard-form for polynomials then we get the following equations :

$$0 = \varphi^4 - 3\varphi^2 + 1 \quad (40) \qquad \text{or} \qquad 0 = \varphi^8 - 7\varphi^4 + 1 \quad (50)$$

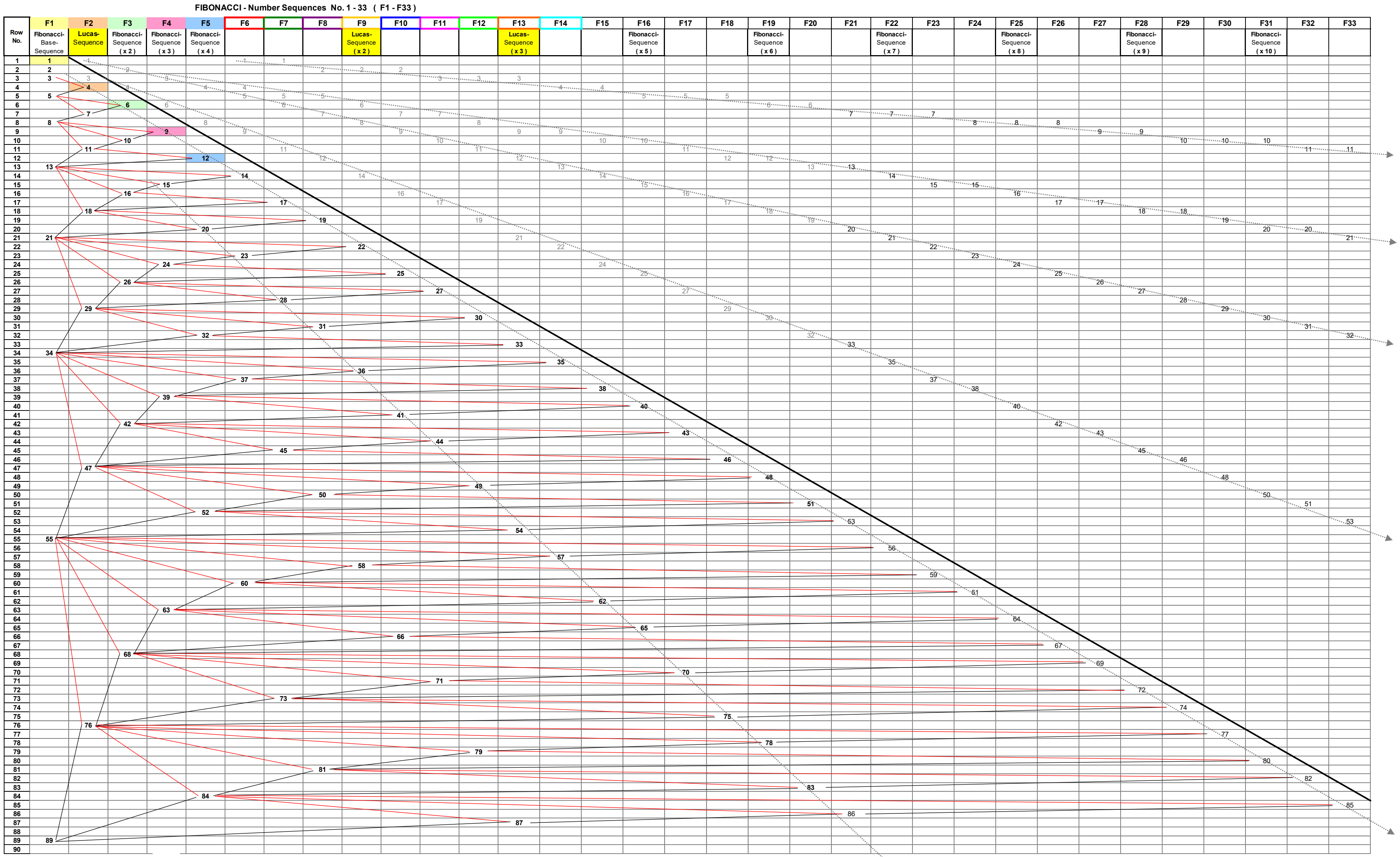
Appendix 2 : Infinite Fibonacci Number Sequence Table : Sequences No. 1 to 33 shown (F1 – F33) : → Weblink to the explanatory Study - by Dipl. Ing.(FH) Harry K. Hahn

(→ Note : Fibonacci Number Sequences are defined by Constant Phi)

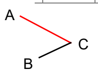
Abstract :

A Fibonacci-Number-Sequences-Table was developed, which contains infinite Fibonacci-Sequences. This was achieved with the help of research results from an extensive botanical study. This study examined the phyllotactic patterns (Fibonacci-Sequences) which appear in the tree-species "Pinus mugo" at different altitudes (from 550m up to 2500m) With the increase of altitude above around 2000m the phyllotactic patterns change considerably, the number of patterns (different Fibonacci Sequences) grows from 3 to 12, and the relative frequency of the main Fibonacci Sequence decreases from 88 % to 38 % The appearance of more Fibonacci-Sequences in the plant clearly is linked to environmental (physical) factors changing with altitude. Especially changes in temperature- / radiation- conditions seem to be the main cause which defines which Fibonnacci-Patterns appear in which frequency.

The developed (natural) Fibonacci-Sequence-Table shows interesting spatial dependencies between numbers of different Fibonacci-Sequences, which are connected to each other, by the golden ratio (constant Phi). In botany Phyllotaxis describes the arrangement of leaves on spiral paths on a plant's stem. Phyllotactic spirals form a distinctive class of patterns in nature. But the true cause of these phyllotactic spirals , which appear everywhere in nature, still isn't found yet ! → Please read my own **hypothesis** : → **Microscope Images indicate that Water Clusters are the cause of Phyllotaxis** (Weblink 2)



Meaning of the line colors :



For 3 numbers A, B and C in the shown arrangement the following is true :

The ratio of the difference (C-A) indicated by a "red line" to the difference (B-C) indiated by a "black line" is approaching the golden ratio φ for the further progressing number sequences (which contain these numbers) towards infinity (->downwards).

$$\frac{C - A}{B - C} \longrightarrow \varphi \quad \text{for} \quad A, B, C \rightarrow \infty$$