वस्तुधर्मः Vedic Concept of Quantum Numbers

Basudeba Mishra

Abstract

In modern physics, a total of four quantum numbers are used to describe the electron configuration of an atom and the probable location of the atom's electrons. Quantum numbers are also used to understand other characteristics of atoms, such as ionization energy and the atomic radius. The combination of all quantum numbers of all electrons in an atom is said to be described by a wave function that complies with the Schrödinger equation. Each electron in an atom has a unique set of quantum numbers. No one knows WHAT an electron is. The description that it is an excitation of – a ripple in the electric field - is as vague as the description of a field in QFT. It is said that a field is an invisible, continuous physical medium that stretches across all of space and time, and what we perceive as elementary particles are actually localized ripples, waves, or excitations in these underlying fields. Wherefrom the energy that creates the excitation or the ripples come? Since these fields are not visible, how do they count the number of these fields? They can only count the forces experienced by them. How do they know that it is not the same field? After all, different forces co-exist.

We know that air creates ripples in water. We can also cause ripples in water by our hand or by throwing a stone at it. Does that make the ripples different based on the energy that created it? Or does water become different based on the energy that caused the ripples? Does the wave created by a stone become a stone (like matter field), that created by air, air (like force field) and that created by hand, a hand etc. Or the water becomes three waters: air water, hand water and stone water? The wave is characterized by its wavelength, amplitude and frequency, and not by what created the wave. The Vedic science defines a field as the area of space where something exists and moves (क्षि निवासगत्योः). It accepts only two types of fields (स्थूलसूक्ष्मविभागेन द्विधा क्षेत्रमवस्थितम् । कार्यषोडशकं स्थूलं सूक्ष्मं बुद्ध्यादिमात्रजम्।। विष्णुसंहिता ४.४ ।।). There is one external field that is the universe (जगत् – that which is ever moving), which is common to all and is a variant in space and time. The other is the infinite numbers of the internal world (जीव) that is unique to everyone, is invariant in space and time and is a pictorial world of information only.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

Conduction is the heat transfer via direct physical contact and molecular collisions or free electron movement within an object. Convection is the heat transfer through the macroscopic movement of fluids (gases and liquids). Heated fluid expands, becomes less dense, and rises, while cooler, denser fluid sinks to take its place, forming a circulation loop called a convection current. In the case of an electron, when excess energy accumulates (heated fluid expands), it jumps to higher shells (becomes less dense, and rises). When it loses energy (while cooler), it jumps to lower orbits (denser fluid sinks to take its place) forming a circulation loop called a convection current. In conduction, there is no bulk movement of the material itself that is driven by a temperature difference between hotter and cooler regions. Convection involves actual physical flow and mass transport of the substance and is driven by density differences caused by temperature changes. Electron physically moves from one proton to another due to charge difference. Thus, electricity flow is convection and not conduction.

Everything in the universe is perceived only during the transition of its states or emission and absorption of energy. Unless the energy interacts with our eyes, we will not see it. We know electricity is a physical phenomenon caused by the presence and movement of objects with an electric charge, typically involving the flow of electrons through a medium. Electric current is the steady flow of electric charge carriers (such as electrons) moving through a convective path like a wire, measured in amperes. Electricity (विद्युत) behaves like a fluid. It passes on heat in the form of vibration, which behaves like convection – not conduction.

The energy radiated (अर्कः) by the proton in the nucleus (उक्थ) can go up to certain energy levels (पृष्ठ) only. Beyond that it loses energy and can't go further. Hence, it reverts back to the nucleus. This reverting energy that moves towards the nucleus, is called electron (उर्कः). It is neither a particle nor stationary. Hence, the modern scientists are talking of probability, because they are searching blindfolded in a dark room for a black cat that is not there.

Though no two electrons can share the same combination of four quantum numbers, it is not due to the Pauli Exclusion Principle (called स्थानावरोध in Vedic science), but due to its spin as described later. Also, according to Coulomb's law, the same charge repels. This is a wrong concept. If electrons repel each other, we will not get electricity. The wave-function is explained using a standing wave. But a standing wave requires two traveling waves of equal frequency, wavelength, and amplitude to travel through the same medium in opposite directions. While the electron can be one wave, what is the other wave to create the standing wave? Here is an attempt to reply to these questions from

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

the Vedic principles. Also, expand the concept by incorporating some missing parameters concerning its dynamics.

Keywords: *Quantum numbers, Wave-function, Principal Quantum number, Azimuthal quantum number, Magnetic quantum number, Spin quantum number, Electron, Spin, Standing wave, space quantization, Rydberg formula.*

Introduction

A total of four quantum numbers are used to describe completely the movement and trajectories of each electron within an atom. However, in advanced physics, a fifth value - the Total Angular Momentum Quantum Number akin to strangeness in particle physics - is often used depending upon the context. In particle physics, strangeness characterizes subatomic particles (hadrons) containing strange quarks. The combination of all quantum numbers of all electrons in an atom is described by a wave function that complies with the Schrödinger equation. But a wave-function has no physical meaning. Why should it be squared to have a physical meaning? Further, mathematics is the science of accumulation and reduction of numbers, where number is a property of all substances by which we differentiate between similar (संख्या सर्वस्य भेदिका). Hence mathematics is possible only between physical objects.

The concept behind quantum numbers developed based on atomic spectroscopy summarized in the Rydberg formula involving differences between two series of energies related by integer steps. The Bohr atomic model relied on a single quantum number. Sommerfeld added two more quantum numbers using space quantization in place of the quantized phase integrals to explain the Stark effect. The idea of space quantization was to quantize the electron's orbital interaction with an external magnetic field.

Wolfgang Pauli's solution to the Zeeman effect was to introduce another quantum number – spin - taking only two possible values. This would ultimately become the quantized values of the projection of spin, an intrinsic angular momentum quantum of the electron. The quantization in the Stern-Gerlach experiment was due to the magnetic moment associated with the electron spin rather than its orbital angular momentum. Pauli succeeded in developing the arguments for a spin quantum number without relying on classical models.

Wigner introduced isospin - the first internal quantum number unrelated to a symmetry in real spacetime. Yang developed a non-abelian gauge theory based on the conservation of the nuclear isospin quantum numbers. The tally of quantum numbers varies from system to system and has no universal answer. Hence these parameters

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

must be found for each system to be analysed. A quantized system requires at least one quantum number.

The above classification is like describing the parts distinguishing each from the whole and how it behaves, even though the same principle can be used to describe the whole and all of its functions. Vedic science does it for the whole, which can be applied to all atoms and their electrons and objects created out of them. There is a misconception that the quantum world is only probabilistic and totally different from the deterministic macro world. This is because quantum physics is yet to answer – What an electron is except a vague answer - it is a fundamental subatomic particle with a negative electric charge? For those who shun superstition and understand science, both micro and macro worlds replicate each other (यद्ब्रह्माण्डे तत्पिण्डे – Charaka Samhita – Shareera Sthana). We need to understand how to correlate both. This is explained from the Vedic perspective with fresh interpretations not available in the open sources.

Literature Survey

For nearly a century, quantum numbers occupied an important position in Quantum Mechanics. All textbooks on Quantum Physics discuss these in great detail (Quantum Numbers, Mark Fox, University of Sheffield). But there are many question marks on it. Why should the electrons be singled out to describe its probabilistic position, while everything in the universe possesses these characteristics? The Vedas apply the same laws of Physics to both the macro and the micro worlds. Here is an attempt to explain the characteristics of the quantum numbers to cover everything at large.

Problem Definition

Quantum numbers are said to be a set of numerical values that act as an electron's "address" in an atom. But it is incomplete without its spacetime position details except that it is around some undefined nucleus. The combination of all quantum numbers of all electrons in an atom is said to be described by a wave function that complies with the Schrödinger equation. But the wave-function itself is a mathematical object and has no physical significance. Mathematics is the quantitative aspect of physics only. It does not cover the whole of physics. There is more to physics than mathematics. A part does not define the whole like the leg of the elephant cannot be used to model the whole elephant. Why should it be squared to make it meaningful?

The orbitals are described by the analogy of a standing wave. A standing wave (or stationary wave) is generated when two identical traveling waves moving in opposite directions superpose (interfere) within a bounded medium. This interference traps the

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

wave energy, creating a stationary pattern of alternating points with maximum oscillation and zero movement, which only can create the peaks and troughs and the nodes. While the electron can be one such wave, what is the other wave to create the standing wave? No one speaks about it.

The quantum numbers are said to describe the energy level, orbital shape, spatial orientation, and spin of the electron. Everything in the universe has these properties to varying extents. Hence, why single out electrons only and describe those using numbers? They use Hamiltonians, which is the total of potential and kinetic energies of a system. But how do you measure potential energy without converting it to kinetic energy? If only kinetic energy is measured, what about potential energy? Joule (J) is the energy used to apply a force of one newton over a distance of one meter (1 J = 1 N · m). How do you apply potential energy unless you treat it as weight? It can only be interpreted by a scientific interpretation of यमेन॑ दत्तं त्रित एनमायुनगिन्द्र एणं प्रथमो अध्यतिष्ठत्। गन्धर्वो अस्य रशनामगृभ्णात्सूरादश्वं वसवो निरतष्ट ॥ऋग्वेदः - १.१६३.२॥ (no text defines it properly).

The modern classification of particles based on spin is unscientific. The Vedic entanglement (Chhanda – छन्दः that gave mass to everything and regulates all interactions) covers both the worlds, and is not restricted to quantum states only. It describes five properties of matter (वस्तुधर्मः). Quantum spin is an intrinsic angular momentum. Inertia is a part of the properties of matter (वस्तुधर्मः) which is part of the fifth quantum number (Sanchari Bhaava - सञ्चारीभावः – it includes spin, momentum, acceleration and elasticity) – everything related to the motion of an object.

Methodology/Approach

कासीत्प्रमा प्रतिमा किं निदानमाज्यं किमासीत्परिधिः क आसीत्।
छन्दः किमासीत्प्रउगं किमुक्थं यद्देवा देवयजन्त विश्वे॥ ऋग्वेद १०-१३०-३ ॥
मा छन्दः । प्रमा छन्दः । प्रतिमा छन्दः । ऽ अस्रीवयश्छन्दः (अपस्र स्त्री - अश्रशब्दार्थे कोणे अपश्रशब्दवत्समासान्तभाक् - असँ गत्यदीप्त्यदान्नेषुँ - चतुरस्रशोभीत्यादि) । पङ्क्तिश्छन्दः । ऽउष्णिक्छन्दः । बृहती छन्दः । ऽअनुष्टुप्छन्दः । विराट्छन्दः । गायत्री छन्दः । त्रिष्टुप्छन्दः । जगती छन्दः॥ शुक्लयजुर्वेदः – १४.१८ ॥
व्यक्त्याकृतिजातयः तु पदार्थः ।। न्यायसूत्राणि – २.२.६८ ।। {सिद्धान्तसूत्रम्}
क्रियागुणवत्समवायिकारणमिति द्रव्यलक्षणम् ।। वैशेषिकसूत्रम् -१,१.१५ ।।

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

Objects (वस्तु) are a collective of its properties (गुणकूटो द्रव्यम् - गुण, धर्म, भाव समानार्थक). They are created when energy is confined and entangled with each other like threads are stitched (वयन) to create a cloth. Hence, objects are called Vayuna (वयुन). The amount of energy content (मात्रा) gives the object its relative spread (परिमाण - this is bigger or smaller than that), which is called mass (वयोनाध – नाध means spread), which is a class property (this is a mountain – that is a mole hill). The arrangement of energy layers (संस्था or अवयव-सन्निवेश-क्रम), gives it the name and form (नाम-रूप). It also generates a stress on its base, which is called weight (वय), which is an individual property. Kg, which is wrongly called the unit of mass, is really the weight of 1000 cc of pure water at 4 degrees centigrade. These two determine the properties of objects. There are a total of 17 inherent and 7 emergent universal properties. Objects possess some of these properties. Since the properties describe the characteristic of objects, they are called Dharma (धर्मः). The objects (वस्तु - वसतीति) appear and behave differently according to the different combinations of these properties. Hence, they are called Bhava (भावः). These properties can be classified into three inherent (आत्मभावः) and two emergent (अनात्मभावः) types. These are now called quantum numbers.

मा छन्दः is related to solids that are measurable by themselves. प्रमा छन्दः is its opposite – liquids and gases that are not measurable by themselves, but requires a container to be measured. प्रतिमा छन्दः is related to radiation that cannot be measured in isolation or otherwise, since they are ever mobile. We can measure their properties. But unlike solids and liquids, we can't measure them fully, since they are moving continuously till absorbed and lose identity. अस्रीवयश्छन्दः is not localized like these three, but is spread out everywhere, which leads to the perception of objects confined by them.

The perception of any object takes place in three ways: Its inherent individuality, its extensions through component parts and its specific constitution that makes it different from others as a class (द्रव्य विकास). These define its individuality, utility and class (व्यक्तिः–आकृतिः-जातिः). These three are inherent properties (आत्मभावः) of everything. The external perception of the object is related to its space-time position and its state of its motion. These are emergent properties (अनात्मभावः). These five can describe everything about every object – not just the electron.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

अधिष्ठानं तथा कर्ता करणं च पृथग्विधम्।
विविधाश्च पृथक्चेष्टा दैवं चैवात्र पञ्चमम्॥ गीता १८-१४॥
शरीरवाङ्मनोभिर्यत्कर्म प्रारभते नरः ।
न्याय्यं वा विपरीतं वा पञ्चैते तस्य हेतवः॥ १८-१५॥

The base, the operator, the instrumentalities, energy content, and environmental effects are the agencies regulating all actions. Whether macro or micro, whether physical or mental or in speech form, whenever any operation is conducted, these five are the determinants to describe the final states of everything. Such states relating to the electron only, in a very restricted and misleading sense, are called quantum numbers in modern physics.

One example is the so-called quantum numbers (वस्तुधर्मः), which are responsible (हेतवः) for describing not only quantum systems, but also every object and every function – be they material (physical - कायिकम्), speech form (वाचिकम्) or mental functions (मानसिकम्). They are not four, but five (त्रयो अग्नयः. द्वे सोमौ - अग्निर्जागार तमयं सोम आह तवाहमस्मि सख्ये न्योकाः॥ ऋग्वेदः ५.४४.१५॥), as the totality can be described only in five ways (पञ्च वृता सङ्ख्या).

These are universally applicable – not specific to describe the trajectory and movement of an electron in an atom, but also everything in the universe that are conserved through its dynamics (एको बहूनां यो विदधाति कामान्). In fact, since the universe (जगत्) is all about motion (everything in it is ever moving – गच्छतीति जगत्), it can be described as the fundamental theory of motion – all about position and energy of everything.

The first three quantum numbers are principal (n), orbital angular momentum or azimuthal (l\, and magnetic (m) quantum numbers (आश्रयभावः, प्रयोजकभावः, स्थायीभावः). These are said to describe the size, shape, and orientation in space of the orbitals of an atom in a limited sense. Quantum spin is an intrinsic angular momentum, but is not the only mobile state of the object. The fourth (व्यञ्जकभावः) is the perception of objects due to confinement by space, time, and described by number, etc. Mass (वयोनाधः), weight (गुरुत्व) and dimension (विस्तारः) are part of the fourth quantum number (व्यञ्जकभावः).

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

Results & Discussion

1. THE PRINCIPAL QUANTUM NUMBER (अधिष्ठानं or आश्रयभावः – उक्थम् - व्यक्तिः)

The property that describes the base, on which everything else rests and without which the object will not remain as it is (like the nucleus of an atom), is called Ashraya Bhavah (आश्रयभावः or अधिष्ठानम्). This is the principal quantum number. The Vedic entanglement (Chhanda - छन्दः) covers everything, and is not restricted to quantum states or prosody only.

Inertia (संस्कारः) is a part of the properties of matter (वस्तुधर्मः – so-called quantum numbers) which is part of the fifth quantum number (सञ्चारीभावः – it includes all mobile properties like spin, momentum, acceleration and elasticity). Momentum (दोषापनोदनम्), acceleration (अतिशयाधानम्) and elasticity (स्थितिस्थापकः called हीनाङ्गपूर्णत्तः) are parts of inertia, as they do not change unless some force is used to break the state of motion or rest. Spin (आवर्तः) is a subset of this fifth quantum number (सञ्चारीभावः).

Every object can be described by its characteristic base, shape and class as different from other classes (व्यक्त्याकृतिजातयः). In the case of electrons, the principal quantum number (n) is said to describe the most probable distance of the electrons from the nucleus arranged in shells starting from the ground state, or the lowest energy state. The nucleus is the base (आश्रयः) for the electron shells.

But what is an electron (उर्कः) and its shell (पृष्ठ्य)? Like the Sun, the proton radiates out energy (प्राणः). These energies radiate out as radiation (अर्कः,). Such radiation always moves in waves going up or down (तिरश्चीनो विततो रश्मिरेषामधः स्विदासी३दुपरि स्विदासी३त्। - ऋग्वेदः १०.१२९.५). The only difference is, like a magnet or a pulsar, the proton radiates from both its poles. This generates the spin (आवर्तः). Depending upon the energy level, the energy moves up to discrete levels and from there, it reverts due to spin reversal (भ्रमि). We see this in the case of convection (धर्त्र).

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

The point from which the radiation (अर्कः) reverts is called the shell (पृष्ठ्य or अशिति) and the returning radiation in waves is called the electron (उर्कः). These appear as the absorption and emission spectra. These two waves generate the standing wave. Often the quantum numbers are explained by likening it to the perturbations of standing waves.

To generate a wave, we need a source of disturbance (energy input) and a medium (for mechanical waves). The source transfers energy to the medium's particles, causing them to oscillate - these particles then pass the energy to adjacent particles to propagate the disturbance. Standing waves are mechanical waves that require two waves with the same frequency and amplitude traveling in opposite directions within a constrained or bounded medium, allowing them to interfere constructively and destructively to generate peaks and nodes. But modern science does not explain how these standing waves are generated. If the electron returns (like in convection) as the wave, its energy can explain the standing wave, as there is a source (उक्थम्) and radiation returned from a shell (अशिति - रेतोधा आसन्महिमान आसन्त्स्वधा अवस्तात्प्रयतिः परस्तात्॥ - ऋग्वेदः १०.१२९.५). Thus, the Principal quantum number is the individual (व्यक्तिः) base (अधिष्ठानम्) part of the Ashraya Bhava (आश्रयभावः). Though the principal quantum number is said to have any value, nothing beyond n=7 has been observed. Vedic science restricts it to n=7 (सप्तलोकाः).

The principal quantum number (n) corresponds to the electron orbits in the Bohr model and atomic energy levels in the Rydberg model. But for fixing the orbit, we must first fix the central point without which nothing can exist as a structure (उक्थम् – यतो उत्तिष्ठन्ति सर्वाणि भूतानि). Further, the number of radiations (अर्कः) that determine the number of electrons that return from the boundary (अशिति) depends not only upon the number of protons in the nucleus, but also the pulsation emitted by them. For this reason, the position of an electron can't be predicted (it is not an independent particle and scientists are looking for it from the wrong direction), though the probability of finding an electron in a region can be predicted (because of the radiating proton).

Also, like pulsars, the protons pulsate in two opposite directions. This is because moving electric charge creates magnetic fields that are scattered all around within two poles. But electric charge flows in a straight line within the two poles. It is like a gas being released through a pipe. Once the gas comes out from the ends of the pipe, it turns its direction of flow, though it itself does not spin. That appears as the electron's opposite spin directions. The protons and neutrons are bound states of quarks, which themselves are bound states of energy. What makes them bound to that locality? Vedic science calls

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

the central point around which all energies are bound and from which the distances of the electron shells are measured, as the principal point called Adhisthanam (अधिष्ठानम्), which has ten characteristics not being discussed now. Since everything from the atom to the universe rests around one central point, it is called the principal base (आश्रयभावः) for that system.

विराट्छन्दस्तद्वाग्वरुणो देवता॥ ५ ॥ गायत्री छन्दः, तज्ज्जा, बृहस्पतिर्देवता ।। ६ ।। त्रिष्टुप्छन्दः, तद्धिरण्यम्, इन्द्रो देवता ॥ ७ ॥ जगती छन्दः, तद्द्यौः, प्रजापतिर्देवता ॥ ८ ॥ अनुष्टुप्छन्दः, तद्वायुः, मित्रा देवता ।। ९ ।। उष्णिहा छन्दः, तच्चक्षुः, पूषा देवता॥ १० ॥ पङ्क्तिश्छन्दः, तत्कृषिः, पर्जन्यो देवता॥ ११ ॥ बृहती छन्दः, तद्विश्वः, परमेष्ठी देवता ॥ १२ ॥

These describe the arrangement of energy within its confinement and should not be interpreted literally and will be discussed separately. Though only a point, the principal base may appear differently in different extensions, without essentially changing itself. It is like the Self in humans and animals and the central point of quarks in protons and neutrons. We can consider the Self as the equivalent of the principal base (नभ्य) for the human body.

2. AZIMUTHAL QUANTUM NUMBER (कर्ता or प्रयोजकभावः, ब्रह्म, प्राणः आकृतिः)

An electron shell is a broad energy level where electrons are expected to be found. An orbital is a specific region within that shell where an electron is most likely to be found. Multiple orbitals exist within a single shell. While the shell can hold multiple electrons (up to 8 in the second shell, 18 in the third, 32 in the fourth) depending on its principal quantum number, an individual orbital can hold a maximum of only two electrons.

The orbital angular momentum quantum number determines the shape (आकृतिः) of an orbital, and therefore the angular distribution. The number of angular nodes is equal to the value of the angular momentum quantum number. It is like our main limbs (two hands and two legs or four legs).

Azimuth is the horizontal angle or direction of a target from a central point or observer, measured in a 360-degree circle clockwise from true north, which is considered as 0 degrees for reference. It is like our hands and legs that are in different angular

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

directions from the body. These are the instruments through which we perform measurable functions. Their arrangement describes our form (आकृतिः).

Since Vedic science treats the principal base as universal for everything, it is defined in four different ways, all meaning the same thing:

1. That which exists by itself naturally, while being instrumental for the existence of others (अधिकृत्य जगत्सर्वं वर्तते यत्स्वभावतः).
2. That which fills everything without being full itself (यद्विभर्ति जगत्सर्वं जगद्यन्न बिभर्ति हि).
3. That which generates a temporary confinement to confine and control energy while retaining self-identity, getting confined to hold and energize everything together inwardly (यत्स्वमायोपाधिशक्त्या जगदेतच्चराचरम्। सृष्ट्वा तदन्तरे विशात्तदन्तर्यामितया स्वयम्। स्थित्वा सञ्चार्यते सर्वमसङ्गत्वेन केवलम्).
4. The material and catalytic cause for the structure independent of others, but containing everything to project a separate identity (निमित्तत्वमुपादानत्त्वमात्मत्वं तथैवह। निराधारस्वभावत्त्वं सर्वाधारत्त्वमेव च। सर्वावभासकत्त्वं च यस्यास्ति सततं स्वतः। तमेवाधिष्ठानमित्यवदन्मुनीषिणः।). These appear as four sub-shells now called s, p, d, f. Though in modern classification, the alphabet continues in order for higher energy levels (g, h, i, k...), nothing has been physically found.

These letters come from early spectroscopy classifications of spectral lines from alkali metals: s = Sharp (spherical shape), p = Principal (dumbbell shape), d = Diffuse (cloverleaf/complex shape), Fundamental (multi-lobed complex shape), correspond to the azimuthal (angular momentum) quantum number. They hold a maximum of 2, 6, 10 and 14 numbers of electrons.

There are four orbitals called in an atomic structure following the principle: everything can be described in a four-fold way (चतुष्टयं वा इदं सर्वम्). In modern physics, these are not physical, but mathematical functions depicting the wave nature of electrons in an atom and are supposed to determine the shape of atomic orbitals. But in Vedic Physics, these are real and carry out specific functions relating to perception (अन्तःकरणम्). Being beyond quantum, they are not physically perceptible, but only inferred from their functions.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

These subshells describe the periodic table, which is a tabular arrangement of all 118 known chemical elements ordered by increasing atomic number (the number of protons in an atom's nucleus). It has 7 horizontal rows called periods and 18 vertical columns called groups. Elements in the same group share similar valence electron configurations and chemical properties. In the periodic table, metals are found on the left and centre of the table. These are typically shiny, malleable, ductile, and good conductors. Non-metals are found on the right side and include essential life-sustaining elements (carbon, nitrogen, oxygen) and halogens. Metalloids are found along the zigzag dividing line between metals and non-metals and exhibit intermediate properties. Noble Gases – are found in Group 18 on the far right. These are unreactive gases with complete outer electron shells.

Since first period elements can contain only 2 electrons in their outermost sub-shells subshell, they have been arranged in the first period. Since the second and third period elements can contain maximum 8 (2+6) electrons in their outermost subshell – p subshell, they have been arranged in the second and third periods. Since fourth and fifth period elements can contain maximum 18 (2+6+10) electrons in their outermost subshell – d subshell, they have been arranged in the fourth and fifth periods. Since sixth and seventh period elements can contain a maximum 32 electrons in their outermost subshell – f subshell, they should have been arranged in the sixth and seventh periods. However, since that will be too long, the lanthanoids and actinoids are divided into s-block, p-block, d-block, and f-block and placed separately. Thus, the sixth and seventh periods contain 18 elements only.

Since these determine the utility of the elements, they are called प्रयोजकभावः. These also describe the structure of the atomic orbital (आकृतिः).

According to modern physics, the azimuthal quantum number (l) depicts the angular measurements in a spherical coordinate system, which represents the horizontal angle from a cardinal direction to depict the shape of the orbitals in an atom. But how does it function? While the Principal quantum number is a non-interactive point base, the so-called azimuthal quantum number is the prime functional base. Hence, in Vedic science, it is called the principal operator, which determines the utility value (कर्ता or प्रयोजकभावः).

If we compare the principal quantum number to the vital energy functioning through the respiratory system (उदानवायुः), the azimuthal quantum number is like the functional

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

mechanism: सोमस्य त्वा द्युम्नेनाभिषिञ्चामि अग्नेस्तेजसा सूर्यस्य वर्चसा इन्द्रस्येन्द्रियेण मित्रावरुणयोर्वीर्येण मरुतामोजसा आपि तैत्तिरीय मन्त्रेण.

All life forms evolve inside the analog Conscious Sea that pervades everything like the electromagnetic field whose strength determines the nature of the atom that evolves inside a negatively charged magnetic sea. Structures form and perish - the sea is unaffected. It is like the natural sea that pervades coral, seaweed, and fish. Since it is analog like space and time and contains everything, it is called Brahman (Brhhattwaat - बृहत्त्वात् and Brhhanattwaat - बृंहणत्त्वात्) and Mahaan (महान् – सविकारात्प्रधानात्तु महत्तत्त्वं प्रजायते). Since it is present in the smallest of particles though imperceptible, by virtue of such temporary decoration (उपाधिः), it is called Anu (अणु). We are inside the sea, but being ignorant, are searching for the sea.

Something similar happens at the quantum level. Everything can be perceived directly (भावप्रत्यय) or inferred indirectly (उपायप्रत्यय) from direct observation of its effect (like time, which is inferred from the sequence of events). Those not directly perceptible belong to two different categories: quantum particles (देवाः) and beyond quantum (प्रकृतिलयाः). Perception occurs at the beyond quantum level.

When water flows from a higher position to lower down, if it faces an obstruction, it takes whatever channel is available and goes until its surface balance is maintained. On the other side (the side facing Earth), it acquires the shape of the Earth's surface. It is like casting a die or using a mould to create a shape. Similarly, all impulses carried by the mind are mixed and presented through reflection by intellect (बुद्धिः) in the brain for comparison with memory (चित्त). These provide the organisms a strong sense of self-recognition and self-identity (अहङ्कारः – अहमिति ज्ञानं क्रियतेऽनेन), and play a significant role during their lifetime. They purposefully utilize physical laws to carry out their biological functions.

These four are responsible for all cognitive functions (kriyaa – क्रिया or Shakti - शक्तिः), and are the apparent consciousness (अन्तःकरणम् - kartaa – कर्ता, क्रियानुकुलकृतिवत्त्वम् or shaktimaan - शक्तिमान्). They are energy in various forms; hence, they do not die when the material body dies.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

Chitta (चित्त) is the repository – hence memory - of all concepts received from our past experience (मनोबुद्ध्यहङ्कारचित्तं करणमान्तरम्। संशयो निश्चयो गर्बः स्मरणं विषया अमी). After the external impulse is compared with the data bank (memory – स्मृतिः - स्वात्माश्रितक्रियाजन्यसंस्कारजन्यज्ञानम्) of concepts, we cognize it as 'I know this (the object) is like that (the concept)' - जानाम्यहम्. That 'Knower - ज्ञाता' or 'Observer' - द्रष्टा is only a Witness (साक्षी) to these transactions. The four agencies: mind, intellect, memory, and Ego are beyond quantum. While five divisions of the vital energy (पञ्चप्राणाः) function from the principal base (अधिष्ठानम्), these four (\(n - 1\)) shape the nature of the interaction. These are the azimuthal quantum numbers that shape all actions.

3. Magnetic Quantum Number (करणं or स्थायीभावः, साम, अशिति, जाति)

The magnetic quantum number (\(m_{l}\) or \(m\)) is said to describe the orientation of the region in space occupied by an electron with respect to an applied magnetic field. In the macro sense, it includes the circulatory and other systems that function as fixed channels (like veins and arteries) and the full extent of the body that describes it as a species different from other species. These are the material causes that channelize the energy in fixed pathways in a compact manner to determine the various limits of growth and define the class of objects. Hence, they are called Sthayi Bhava (स्थायीभावः).

In quantum physics, the magnetic quantum number determines the number of orbitals and their orientation within a subshell. Consequently, its value depends on the orbital angular momentum quantum number.

Each wavefunction, with an allowed combination of the first three quantum number values describes an atomic orbital (actually, nucleus - आत्मभावः) and a particular spatial distribution for an electron (based on the nucleus - आकृति) like the vital circulatory systems. For a given set of quantum numbers, each principal shell has a fixed number of subshells, and each subshell has a fixed number of orbitals. Without these, the atom cannot be sustained. While the energy flows through them perpetually, they regulate the orientation of the system with reference to the body, which is oriented and aligned with the magnetic poles of Earth. They have values ranging from \(-l\) to \(l\) depending upon the north or south pole.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

In the macro world, we find the energy flow in plants is bottom-up (ऊर्ध्वस्रोता). In animals and birds, it is in variously slanted directions (तिर्यक्स्रोता). They cannot mate facing each other in their natural position; they have to bend (तिर्यक्योनि). Only in humans, it is downwards (अर्वाक्स्रोता). These are due to this property.

The nature of Agni (अग्निः - अङ्गयन्ति अग्रिंजनं राियन्ति इति) is to enter objects and try to disperse the atoms and create an electric field. When they disperse, they create a void. Since nature avoids a vacuum, energy from outside the boundary rushes in to fill the void creating a magnetic field. This incoming energy that contracts and confines everything – thus forming structures – is called Soma (सोमः - सुरसवे). These two are the driving forces in the universe.

When they act from and towards the center of mass (हृद्य), it generates the strong nuclear interaction (अन्तर्यामः - आत्मस्पृद् - हृद्य – सहचरसम्बन्धः निबन्धन; स्वरूपप्राप्तिः). Hence, if you want to separate two objects like quarks, they become stronger, because an equal force rushes in to fill the void. The universe is electromagnetic (अग्निसोमात्मकं जगत् - बृहज्जाबालोपनिषत्). When Agni starts to separate atoms into further hadrons and leptons, it is called Aditya (आदित्यः – आदानां यन्ति – बृहदारण्यकोपनिषत्). That powers the stars when they fuse.

4. The Fourth Quantum Number (व्यञ्जकभावः - दैवम्)

The dynamics (spacetime evolution) of any quantum system are described by a quantum operator in the form of a Hamiltonian. The Hamiltonian is a mathematical "operator" (a set of instructions - a mathematical rule or entity that transforms one quantum state or wave function into another) that represents the total energy of a particle or system, which combines both kinetic and potential energies. When the Hamiltonian operator is applied to a quantum state, it yields the possible energy values (eigenvalues) of that state - how a system will change over time. But how do you measure the potential energy? It is impossible. Only kinetic energy can be measured due to its effects. Hence, the Hamiltonian is unscientific.

In quantum mechanics, we cannot calculate the arrival time of a particle in a detector. There is no time operator in quantum mechanics. This is one of the big gaps in quantum mechanics. But nothing exists outside of spacetime. Everything exists in a

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

specific space and time. Further, the nucleus has a fixed measurable position, but the quantum numbers do not describe these. In Vedic science, this is described as the fourth quantum number – the environment that reveals the object (व्यञ्जकभावः).

The fourth (व्यञ्जकभावः) is the perception of objects due to confinement by space, time, and described by number, etc. Mass (वयोनाधः), weight (वय - गुरुत्व) and dimension (विस्तारः) are part of the fourth quantum number (व्यञ्जकभावः). We perceive objects only when the radiation (ज्योति) released by them or reflected by them reaches our eyes. This is a transformation in different units (मात्रा विकास). Our perception depends on the respective position depending upon space-time-position (दिग्-देश-काल). Without these, we cannot describe any object, including the electron. It limits our degrees of freedom; hence, it should be a quantum number. Since these are beyond our control, it is called Daiva (दैवम् - दैवात् नियतादागतम्) – providence.

5. The Fifth Quantum Number - Spin (सञ्चारीभावः - विविधाश्च पृथक्चेष्टा)

Spin (आवर्त) is a subset of the fifth quantum number (सञ्चारीभावः), which describes all types of motion of the object including momentum (दोषोन्नोदनम्), acceleration (अतिशयाधानम्), and elasticity (स्थितिस्थापकः called हीनाङ्गपूर्णतः). These are parts of inertia, as they do not change unless some force is used to break their state of rest (दोष) or uniform motion.

All materials exhibit magnetism to different degrees. Magnetism is said to be the force experienced in magnetic fields generated as a reaction to moving electric charges:

सोमः - सौति अमृतमिति। सुरसवे + “अस्मिन् तु सुहुसृपति

Their polarity determines electron spins (आवर्तः) - that allows materials to attract or repel each other.

It is said that the generation of spin generally refers to inducing a spin current (a flow of electron spins angular momentum without charge transfer) or orienting a system's spins to a specific state. It is primarily achieved through spin-orbit coupling, spin pumping, or spin-rotation coupling, forming the basis for spintronics. One mechanism for generating and manipulating spin is passing an electric charge current through certain materials (like

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

heavy metals or semiconductors like Platinum or Gallium Arsenide). The spin-orbit coupling naturally deflects spin-up and spin-down electrons in opposite directions.

According to Vedic science:

दिग्वक्रावाहिक वातानां निरुद्धो यत्र वा भवेत्। तत्र चित्रगतिर्वायुः चित्रको नाम जायते।

आवर्तगतिवेगाद्यास्तत्स्वरूपमिति स्मृतः। तत्समीपस्थवस्तूनां तद्वेगादपकर्षणम् । शक्तितन्त्र।

Energy flows in all directions. When it is restricted from moving freely and directed to flow in certain directions only (like smoke flowing through a tube or between the two poles of a magnet), after the restriction ends, it moves in restricted directions (usually downwards - दक्षिणः सरलावारिच्छन्दानुपरिक्षेषु। अपसव्यम्). Such curved energy flow is called Chitraka (चित्रक - चित्र चित्रीकरणे। कदाचिद्दर्शने।). The form of such energy flow is called Spin (आवर्त). The objects near such energy flow are also affected by it and are dragged along with it creating a transverse pure spin current without any external magnetic field (भ्रमि). This motion transfers angular momentum into an adjacent non-magnetic material, continuously injecting a pure spin current into the adjacent layer.

"त्रिताय त्वा, द्विताय त्वा, एकताय त्वा" यजु० १, २, ३ । (also शत० ब्रा० १,२, ३, १)।

The agency that consolidates the magnetic field (गन्धर्वः सोमरक्षकः) is called Gandharva (गन्धर्वः - गन्धा अदनने, अदं हिंसायाम्, अग्निषोमाभ्यामर्वति प्राप्नोतीति। अर्वगतौ + अण्). The nature of Agni (अग्निः) is to enter every object and try to disperse its content from within the confinement of solids (निबिडावयव - ध्रुव) and is called Ekata (एकत). All materials are charge neutral. Since Agni does not break the atomic bond, heating something expands it without any change in its charge.

The heat energy that flows (तरलावयव - धत्र) is called Dwita (द्वीत) or Vidyut (विद्युत्) or electricity - there is a flow of electrons, which requires a suitable conductor. That part of Agni which disperses the electric and magnetic fields where it is in a plasma state – a collection of ions and leptons without any conductor (विरलावयव - धरुण), is called Trita (त्रित) or Aditya (आदित्य – आदानां यन्ति).

Hence, whenever any object is heated sufficiently, it releases its signature electromagnetic spectrum in the above sequence. Every object heats up in a band. Take the water for example. Below 0 degree centigrade, it remains in one form as ice. From

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

above zero degree to 100 degree centigrade, it remains as water. Above that, it transforms into steam. Similarly, when a piece of iron is heated, it does not start radiating till it reaches a certain level. After that it emits red to violate. Then it emits white light. Below zero degree and above 100 degrees centigrade, it has no other effect on water. It remains as it is. This explains the ultra-violate catastrophe.

Every motion in the universe, be it macro or micro, takes place in four steps:

1. क्रिया (Action/Movement) action starts due to either of the four factors: weight, fluidity, application of force or interaction (गुरुत्व, द्रवत्व, प्रयत्न संयोगजम्).
2. क्रियात् विभागः (Separation due to action): This leads to motion of the object from its position.
3. विभागात् पूर्वसंयोग नाशः (Destruction of the previous connection): This leads to the decoupling of the object from its position.
4. ततो उत्तरसंयोगः (Then, the subsequent connection): Then the object couples to the next position in space. This chain continues due to inertia.

The above principle is applicable to everything that moves including radiation. Energy is quantized infinitely. It has no surface area. Hence, has imperceptible dimension (अणुपरिमाण). Thus, it can move to the least possible distance in one step. This is now called the Planck scale.

The energy which stops both Agni and Aditya (static energy) is called Yama (यम - यम उपरमे - यमो वै अवसानस्य इष्टि). Due to conservation laws, Agnim (अग्निः) generates an equal and opposite reaction (स्पर्शवद्द्रव्यसंयोगविशेषविरोधी, which was stolen by Newton as his third law), which starts from the other end (periphery अपशिति or पृष्ठ) and contracts everything to create structures. The Sun is one example of this.

यमेन दत्तं त्रित एनमायुनगिन्द्र एणं प्रथमो अध्यतिष्ठत्।
गन्धर्वो अस्य रशनामगृभ्णात्सूर्राद्विश्वं वसवो निरतष्ट॥ ऋग्वेदः - १.१६३.२॥

The agency which acts as a fuel to trigger sending out of the electromagnetic spectrum from a static position (नग) is called Indra (इन्द्र - प्राणां न्यत इन्द्रियेणैन्द्ध यद्वैन्द्ध तस्मादिन्ध इन्धो ह वै तमिन्द्र इत्याचक्षते परोऽक्षं - शतपथब्राह्मणम् ६.१.१.२). The expanding sphere of radiation is called Ashwa (अश्वम् - अशू व्याप्तौ सङ्घाते च). Without Indra, nothing

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

in the universe will move (नेन्द्रादृते पवते धाम किञ्चन ॥ ऋग्वेदः ९/६९/६॥). Yama (static energy) controls the time period (आयु) before releasing it in select directions. For example, the core properties that define how magnets interact with their environment include polarity, directionality, inseparability of the poles, and concentrated strength: magnetic force is strongest at the poles and weakest in the middle of the magnet. These are controlled by Yama.

Once energy comes out of confinement, it spreads out picking up directionality. If it is released at two opposite ends like in a pulsar or a magnet, it creates spin. Spin is the rapid rotation of an object around its own internal axis, like a top or a planet. Precession is the secondary, slower wobble or circular motion of the entire spin axis when a force (torque) is applied. In other words, spin is the rotation itself, and precession is the wobbling of the axis of that rotation due to the gravitational effect of other bodies.

द्वाविंशदुत्तरशतवायुवर्गा इति ईरिताः। तेणवावर्तवातवर्गस्सप्तषष्टीतः स्मृतः।
आवर्तवायवस्तस्मिन्द्वाविंशति इति ईरिता। सप्तमश्चित्रको नाम वायुस्तेपणवति विनिर्मितः।
वायुतत्त्वप्रकरणम्।

Motion is possible due to weight, fluidity, application of force or interaction with other bodies (गुरुत्वद्रवत्त्वप्रयत्नसंयोगजम् - प्रशस्तपादभाष्यम्). Of this, the last two require two bodies with force to interact. When energy moves a body as a whole (without entering inside it like Agni), it is called Vayu (वायु). Since space (आकाश) is inert, the other four states: solid, liquid, heat, and Vayu (पृथ्वी-अप्-तेज-वायु) can combine with each other in 10 different ways. They can all interact simultaneously, making for 11 types of interaction.

The participants of each interaction can behave as a container or a contained:

अथ वायोरेकादशपुरुषस्यैकादशस्त्रीकस्य, इति। प्रभ्राजमाना व्यवदाताः। याश्च वासुकेवैद्युताः। रजताः पुरुषाः श्यामाः। कपिला अतिलोहिताः। ऊर्ध्वा अवतन्ताश्च। वैद्यत इत्येकादश, इति। - तैत्तिरीयारण्यकम् १.९

This makes for a possible 121 types of interaction. The forces can act all at the same time, making for a total of 122 types of possible motions. Of these, the 67th type is called Spin (आवर्त). Spin could be of 22 types. The spin called Chitraka is the seventh of the lot. The spin of the Moon around the Earth is an integer spin. The Sun's apparent motion in the two hemispheres is a half-integer spin. The spin of Mercury, Venus, Neptune, and the Pluto-Charon System are all different, and so on.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

The Stern-Gerlach experiment only proves that electrons have spin-1/2. These have only two possible spin angular momentum values measured along any axis, (+hbar/2) or (-hbar/2). In the experiment, they fired silver atoms through a magnetic field and found that while an ordinary magnet could end up anywhere (depending on its strength and orientation), the atoms only showed up at two discrete spots. They concluded spin is an intrinsic property of all quantum particles - not just neutrons and electrons.

They used it as a way to categorize quantum particles, but they could not correlate it to macro-objects or find a suitable analogy. But the result is expected, as magnets have two opposite poles only to channelize the energy. And as explained earlier, the energy after being released from confinement spins.

Spin is not a function of loft and friction. Quantum spin is an intrinsic property of subatomic particles, a built-in angular momentum (आवर्तः) that every particle - with or without internal structures - carries from the moment it is created. It is one of the so-called quantum numbers (सञ्चारीभावः). Like inertia, you cannot speed it up or slow it down, though the direction of angular momentum can reverse during the transition between specific lattice vibrations – spin reversal.

Spin is one mobile property of the particle. Generation of spin generally refers to inducing a spin current, which is the application of energy or interaction with another body. Application of energy or interaction with another body also generates inertia; hence, that should form part of this quantum number.

Conclusion

Quantum numbers do not exhibit any exclusive quantum property. These are universal properties. It is incomplete. It does not include space-time-position, without which nothing can be described fully.

References

The following books were referred to while writing the essay. The references have been quoted, wherever they are used. However, the translations and interpretations are exclusively mine.

1. Quantum Numbers, Mark Fox, University of Sheffield.
2. ORBITALS: QUANTUM NUMBERS (CHEMISTRY Book 4), by HIMANSHU GARG.
3. Rigveda.
4. Yajurveda.
5. Shrimat Bhagavat Gita.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in

6. Nirukta and Nighantu.
7. Nyaya sootram.
8. Prashastapada Bhashyam.

© 2023 The Author(s). Published by Institute of Philosophy of Nature. https://philosophyofnature.org.in