

## Matter (*Pudgalāstikāya*) in Jain Philosophy

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### Abstract

*Pudgala* or *Pudgalāstikāya* is one of the six constituent *dravyas* of *loka* in Jainism and is the only substance that is sense perceptible. The sense attributes of *pudgala* are colour, taste, smell and touch properties which become the basis of its diversity of forms and structures. The smallest constituent of *pudgala* is *paramāṇu*, the other forms are its combinations. The combination of *paramāṇus* forms various states of the matter. The paper describes different types of combinations and modes, rules for combinations and properties of aggregates known as *vargaṇā*. Some *vargaṇās* associate with the soul and form various types of bodies of organisms and others exist as forms of matter in *loka* (universe). The *paramāṇu* defines the smallest units of energy, space, time and sense quality of *pudgala*.

*Pudgala* exists in visible and invisible forms but anything that is visible is definitely *pudgala*. *Pudgala* is classified in various ways, one of them is on the basis of touch property and there are *pudgalas* having two touches, four touches, and eight touches, each class having some specific character that differentiates them in respect of stability and motion. *Pudgala* is also classified as living, *prayoga-pariṇata*, and non-living, *visrasā-pariṇata*. The living matter existing as bodies of organisms exhibits some properties that are not found in non-living matter. Modern science has no such distinction which has become a cause of confusion in recognizing the

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existence of soul. The description of body remains incomplete without considering the presence of soul in the body.

In modern terminology, a *paramāṇu* is a vibrating and moving charge that is bosonic in character. The two-touch and four-touch *pudgalas* do not appear to follow the speed limits prescribed by Special Theory of Relativity. Jain canonical works

describe two types of motions *sprṣada* type and *asprṣada* type and these determine the motions of different class of *pudgalas*. Jain philosophy describes the dynamics and motion of *paramāṇu* in detail.

The paper describes the Jain concepts of matter in detail and compares them with the modern concepts to highlight the strength of Jain views. Modern science has explored the properties and behaviour of matter in great detail but still there are many concepts that Jain philosophy has to offer.

## 1. “Matter” in Jainism

Matter has been studied in Jain Philosophy and by every system of Indian Philosophy. According to Jain metaphysics one form of *Ajīva dravya* (Non-living substance) is *pudgalāstikāya* (matter substance) which exists in the Universe in various forms such as earth, water, fire, air, shadow, objects of four senses- hearing, smell, taste, and touch, physical mind, speech, bodies, etc. up to karmic matter and *paramāṇu* (ultimate particle). *Pudgala* is tangible reality within the sensuous and super sensuous experiences in perceptible and imperceptible conditions. *Pudgala* is permanent, non-living, non-conscious, extensive, physical, corporeal and concrete, active, disintegrating and integrating, and changeable substance [1]. It is characterized by origination, decay and permanence without giving up its essential nature of existence.

*Pudgala* is the only substance which is *mūrta* (corporeal) and perceivable. *Rūpatva* (form) /*mūrtatva* (corporeality) or sensory perceptibility is the sum total of the four sensuous qualities as follows [2].

- ❖ Colour- five types of primary colour: Black, blue, red, yellow, white
- ❖ Taste- five types of taste: Sweet, bitter, pungent, sour & astringent
- ❖ Smell- two types of odour: Good smell and bad smell.
- ❖ Touch- eight types of touch: Cold, hot, smooth (positive charge), rough (negative charge), light, heavy, soft and hard.

All colours, tastes and smells can vary in magnitude and range.

Based on the above qualities the matter substance in nature is of three types [3]:

- (i) Matter substance having one colour, one smell, one taste and two touches.

- (ii) Matter substance having five colours, two smells, five tastes and four touches.
- (iii) Matter substance having five colours, two smells, five tastes and eight touches.

*Paramāṇu* is the two-touch matter substance (*pudgala*); it has only one colour, one smell and one taste [4]. The four-touch *pudgala* comprise the subtle (*sūkṣma*) class of matter substance, as aggregates (*skandha*), which has substantial energy. This matter has five colours, two smells and five tastes. On the other hand the eight-touch matter constitutes the gross (*bādara*) class of aggregates comprising of energy and matter. These aggregates have the five colours, two smells and five tastes. Thus according to Jainism, all aggregates, containing a large number of *paramāṇus*, necessarily possess all colours, smells and tastes. Generally only one or a few of the colours, smells and tastes manifest in gross state at a time, the others remain unmanifest. The manifestation of colours etc. is dependent on the mode of the substance. Some attributes manifest in the natural mode while some other attributes manifest in the alienated modes. The manifestations are both intrinsic and extrinsic. For example, some colours, smells and tastes manifest in a fruit in the green state and other colours, smells and tastes manifest in the ripen state.

Cold, hot, smooth and rough are primary touch qualities of *pudgala*. The smooth touch is also regarded as positive charge and the rough touch is regarded as negative charge. The other four touch qualities viz. light, heavy, soft and hard are secondary touch qualities. These touch qualities are supposed to develop when bonding between infinite *paramāṇus* produces a gross aggregate. If number of negative *paramāṇus* is more in the bonding process, the aggregate contains light touch quality and if positive *paramāṇus* are more, than heavy touch is produced in the aggregate. When positive *paramāṇus* are in majority and they bond in cold condition, soft touch is produced and when a majority of negative *paramāṇus* bond in hot condition, hard touch is produced in the aggregate [5]. The weight (or mass?) of the aggregate is said to relate to the light and heavy touch qualities. The four touch aggregates and *paramāṇu* are weight-less. The weight is a property of gross aggregates having eight- touch [6]. This aspect is further discussed below.

In the true sense, the *paramāṇus* and their aggregates as a class have no origination; they have always been in existence. But a particular aggregate or *paramāṇu* has a beginning and a life time. The minimum lifetime of a *paramāṇu* as free *paramāṇu* and that of an aggregate can be one '*samaya*'<sup>1</sup> and maximum life duration can be innumerable '*samayas*' [7]. Thereafter they undergo change. The *pudgala* are of two types, subtle and gross, as mentioned earlier. The subtle does not

remain subtle and gross does not remain gross for all times. After innumerable 'samaya' the subtle changes to gross and gross splits into subtle form [8]. Similarly, the colour and other attributes of *pudgala* also change with time. A black colour of one degree can stay in the same condition for a minimum time of one 'samaya' and a maximum time of innumerable 'samaya'. Thereafter, one degree black shall change to innumerable degree black by the internal process of '*ṣaḍguṇa – hānī – vṛddhī*'. Intrinsic modification occurs in every substance every moment. Extrinsic modification of gross aggregates is also certain after innumerable 'samaya'. So, the *paramāṇu* has a dynamic character.

## 2. Integration (*Bandha*)

All physical matter is produced either by integration or association (*saṅghāta*) or by disintegration or dissociation (*bhedā*) process. The integration is of two types – (i) natural (*vaisrasika*) and (ii) by animate organisms (*prāyogika*) [9]. The natural kind is again of two types – (i) with a definite beginning and (ii) without a beginning. Some instances of natural integration, which have a beginning, are clouds, lightning, rainbow etc.

Integration made by living organisms necessarily has a definite beginning and can be divided into two kinds [10].

- (i) Integration of one kind of matter with another, e.g., production of chemical composites.
- (ii) Combination of matter with soul in worldly living beings.

The last one is again of two types – (i) karma-*bandha*, bondage of karma-*vargaṇā* (with soul), and (ii) *nokarma-bandha*, combination of other groups of *pudgala* with soul in vital functions and formation of gross body.

Jain philosophy provides elaborate rules for bonding among *paramāṇus*. The bonding takes place due to positive and negative charge of *paramāṇus* [11]. The charge of a *paramāṇu* varies in a range. Let  $q$  be the minimum indivisible unit charge, positive ( $q^+$ ) or negative ( $q^-$ ), and that the charge increases in multiples of 1, 2 or 3..... $n$  units. The *paramāṇu* can have a charge  $q, 2q, 3q, 4q, \dots, nq$ ,  $q$  being positive or negative.

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<sup>1</sup>*Samaya* is the smallest indivisible unit of time and is the time taken by a *paramāṇu* moving at slowest speed to move a distance of one *pradeśa*. A *pradeśa* is the space occupied by one *paramāṇu*.

The rules for bonding between *paramāṇus* are given in Table 1 [12, 13]. It is seen that there is some variation in the rules of bonding in *Śvetāmbara* and

*Digambara* traditions. In both traditions a *paramāṇu* having a minimum charge does not bond with other *paramāṇu*. If charge is more than the minimum value and differs by two units or more than the two *paramāṇus* can bond according to both traditions. These rules are also applicable to bonding between an aggregate and a *paramāṇu* or between two aggregates.

The qualities of the aggregate produced by bonding depend on the qualities of the constituent *paramāṇus* or aggregates. For instance one unit black *paramāṇu* on combining with higher degree white *paramāṇu* becomes white. When one degree black *paramāṇus* combine with one degree white *paramāṇus*, a grey colour is produced in the aggregate.

### 3. *Paramāṇu*

The canonical literature in general and the *Bhagavatī Sūtra* in particular defines *paramāṇu* in various ways from different perspectives. It is the basis (ultimate constituent) of the physical universe. It is indivisible, indestructible, impenetrable, incombustible and imperceptible to sense organs [14]. It cannot be split or destroyed by any means whatsoever. It has no half-portion, no middle portion and no *pradeśa*. It has no length, no breadth and no depth. It is dimensionless. It is truly infinitesimal.

**Table 1: Rules for Bonding of *paramāṇus***

	Value of charge of two <i>paramāṇus</i> ' bonding $q_1 + q_2$	<i>Śvetāmbara</i> Tradition		<i>Digambara</i> Tradition	
		Similar charge <i>paramāṇu</i>	Dissimilar charge <i>paramāṇu</i>	Similar charge <i>paramāṇu</i>	Dissimilar charge <i>paramāṇu</i>
1	$q + q$	No	No	No	No
2	$q + 2q$	No	No	No	No
3	$q + 3q$	No	No	No	No
4	$q + 4q$ and up to $nq$	No	No	No	No
5	$2q + 2q$	No	Yes	No	No
6	$2q + 3q$	No	Yes	No	No
7	$2q + 4q$	Yes	Yes	Yes	Yes
8	$2q + 5q$ and up to $nq$	Yes	Yes	Yes	Yes

*Paramāṇu* is the pure form of *pudgala* and possesses the intrinsic qualities of touch, taste, smell and colour. These qualities are attributed to a *paramāṇu* for a fundamental reason. It is the basic assumption in Jain philosophy that the fundamental properties of a substance are also eternal; they are neither created nor destroyed. Hence the basic properties observed in aggregates are also present in *paramāṇu*. A *paramāṇu* has one of the five primary colours, one of the two smells, one of the five tastes, two of the four primary touches i.e. either hot or cold and either smooth (positive charge) or rough (negative charge) [15]. Although the four qualities are permanently possessed by a *paramāṇu*, the intensity of the qualities does not remain constant. A *paramāṇu* possessing one unit of blackness at any moment may sometimes later possess two, three or many units of *blackness* [16]. In the *free-state* the mutation is only in the intensities of colour etc. i.e. x unit black changes to y unit black but black does not become white or red etc., however during and after union with other *paramāṇus* change in colour etc. may also take place. It follows from this that at any given moment there would be *paramāṇus* with different intensities of blackness etc. In the same way there would be *paramāṇus* with various degrees of other qualities.

A single free *paramāṇu* is invisible not only to the naked eyes but also to other physical instruments. Its existence is to be inferred by the collective action and reaction of aggregates of infinite *paramāṇus*. Only the omniscient (*kevalajñānī*) and those possessing superlative visual intuition (*paramāvadhi jñānī*) can perceive and cognize the nature of a free *paramāṇu*.

The *paramāṇu* is the direct unit of physical substance (*pudgala*) and also the indirect unit of space, time and quality magnitude of attributes [17]. The quantitative and qualitative difference in the various form of the matter (aggregates/*pudgala*) in space and time domain ultimately depends on the action/reaction of attributes of *paramāṇu*. Thus, being the fundamental constituent of physical composite bodies, it may be considered to be the determinant of the difference of aggregates, and for the same reason it is also their substantial cause. By its own motion it becomes the measure of time unit '*samaya*'.

The *paramāṇus* have the innate capacity of uniting with one another to form composite bodies. The composite bodies are liable to the process of disintegration and the united *paramāṇus* may become free *paramāṇus* and thus the process of association and dissociation goes on eternally [18]. *Paramāṇu* is capable of being dynamically active (*kriyāvān*). When dynamic, it may have spin, vibratory and migratory motions [19]. The activity of a *paramāṇu* is not continuous, rather it is in quanta. The dynamics of *paramāṇu* in some respect follow certain rules but it also follows some rules of uncertainty. *Paramāṇu* generally cannot be stopped or hindered

by any object (*apratighāti*) and at the same time it does not cause hindrance to others [20].

A *paramāṇu* in a given space-time domain has various energy states: potential, electro-thermal, kinetic etc. in view of their embedded attributes and their variation as a consequence of change in energy states, which reveals that a *paramāṇu* is a vibrating and moving charge. It has also been said that infinite number of *paramāṇus* can occupy one space point [21]. This means that *paramāṇu* is bosonic in character. As the *paramāṇu* is indivisible, the energy of a *paramāṇu* is the smallest amount of energy that can exist in Free State and therefore it can be regarded as a quantum of energy.

It should be mentioned that the *paramāṇu* described by modern science is not the same as *paramāṇu*. The *paramāṇu* is weightless (it has infinitesimal mass and energy) and has one colour, one taste, one smell and two touches whereas an *paramāṇu* has mass and belongs to the class (iii) matter, mentioned above; it has five colours, five tastes, two smells and eight-touches. According to Jainism each of the elementary particles contains infinite number of *paramāṇus* as described below. These *paramāṇus* may have positive or negative charge and bond together according to the prescribed rules. That is, there is bonding between positive and positive, positive and negative, and negative and negative *paramāṇus*. The particle formed in this manner has a net charge depending on the majority population of a particularly charged *paramāṇus*. For example an electron has majority population of negative *paramāṇus* and a proton has a majority population of positive *paramāṇus*. The total negative charge of electrons is equal to the total positive charge of protons for a stable structure. Jainism does not rule out formation of particles having fractional or multiple charge of electron or proton, but such particles are known not to form a stable structure and have no practical value.

#### 4. *Vargaṇā* (Energy Fields and Aggregates)

*Vargaṇā* is an important concept to understand nature particularly at subtle level. *Vargaṇā* has been defined as *pudgala* aggregate made up of similar *paramāṇus* or as a cluster of *paramāṇus* [22]. There are infinite numbers and types of *vargaṇās* according to *Bhagavatī Sūtra* but eight types are important from the point of view of their association with the soul [23]. *Gommaṭasāra Jīvakāṇḍa* provides another type of classification of *vargaṇās* on the basis of number of *paramāṇus* present in the cluster [24]. According to this, there are 23 types of main *vargaṇās* found all over *loka*. The *vargaṇās* fall into two broad categories, one has four- touch and the other has eight-touch. The 2<sup>nd</sup> to 14<sup>th</sup> order *vargaṇās* are four-touch type and weight less. The 16<sup>th</sup> to

23rd order *vargaṇās* are eight-touch type and have weight. The 15<sup>th</sup> order *vargaṇā* falls in between the two categories and its nature is uncertain [25].

The lower order weightless *vargaṇās* can be divided in two groups –

1. **Associable *vargaṇās*** – *vargaṇās* that associate with the soul and form various kinds of subtle bodies and other structures that assist the soul in its worldly functioning.
2. **Non associable *vargaṇās*** – *vargaṇās* that do not associate with the soul.

The following are the associable *vargaṇās*:

- 1) *Āhāravargaṇā*: This *vargaṇā* constitutes the gross, protean (*vaikriya*) and migratory (*āhāraka*) bodies of organisms.
- 2) Fiery (*Tejasa*) *Vargaṇā*: These *vargaṇā* constitute the fiery body of organisms.
- 3) Sound (*Bhāṣā*) *vargaṇā*: The sound *vargaṇā* is suitable for producing all kinds of sound including the sound produced by inanimate objects like musical instruments and natural phenomena like thundering of clouds and sound produced by living organisms including speech by humans.
- 4) Mind (*Mano*) *Vargaṇā*: This *vargaṇā* constitutes the physical mind (*dravya manaḥ*) of organisms.
- 5) *Kārmaṇa Vargaṇā*: This *vargaṇā* constitutes the karma bodies of organisms.

The higher order *vargaṇās* can be divided in three groups –

- 1) *Vargaṇās* that are helpful in formation of gross bodies of plants and small microorganisms (*nigodas*), belonging to category of non-mobile (*Sthāvara jīvas*). These *vargaṇās* assist in formation of plant bodies and bodies of small microorganisms. The *vargaṇā* that assists in formation of plant body compares with sun light (photons).
- 2) Permanent Nil (*Śūnya*) *Vargaṇās*: Detailed information about these *vargaṇās* is not available in scriptures.
- 3) Gross Matter (*Mahāskandha*) *Vargaṇā* (GMV): This *vargaṇā* is supposed to constitute all ordinary matter, visible and invisible, in the universe including bodies of mobile beings.



The charge in *vargaṇā* produces an electric field. A moving electric charge in *vargaṇā* also produces a magnetic field. In view of modern science, a field is nothing but a charge in the space-time continuum. All fields, magnetic, electrical and gravitational, are physical realities. A *vargaṇā* contains a bundle or packet of energy. The energy density or energy intensity increases with the order of *vargaṇā*. As mentioned above, *vargaṇās* of 15th and higher order are supposed to have eight-touch i.e. in addition to four basic touches, namely cold, hot, positive and negative charge, and other four secondary touches - light, heavy, soft and hard are also present. These additional touch properties are supposed to come in existence due to bonding between *paramāṇus*. The light and heavy touches are supposed to produce the property of weight. In the lower order *vargaṇās* of four touch types the *paramāṇus* cluster but do not bond.

The act of bonding between *paramāṇus*, i.e. interaction, requires energy. When two *paramāṇus* bond, a part of their energy (potential energy) is used up in bonding, reducing the free energy of the *vargaṇā* that exists as kinetic energy of motion and vibration. Therefore, the maximum velocity of a two-*paramāṇu* bonded *vargaṇā* will be less than the maximum velocity of a single *paramāṇu* or a two *paramāṇu* unbound *vargaṇā*. We thus see that lower order *vargaṇās* having four-touch must have higher maximum velocity than eight touch *vargaṇās* of higher order. The *paramāṇu* having two-touch has the highest maximum velocity. The lower order *vargaṇā* are weightless and must be free of gravitational effect. The higher order *vargaṇā* have gravitational property.

#### 4.1 Gross Matter *Vargaṇā* (GMV) and Matter

All ordinary matter (visible or invisible) is made up of GMV according to Jain view as mentioned above. We examine now how the subatomic particles may be produced from GMV [26]. Consider the case of leptons first. The neutrino is the smallest lepton having negligible mass and no charge. If neutrino is made of GMV then it must be a combination of at least two GMV, one having positive charge and the other a negative charge. This will be the case when the two GMV have equal and opposite charge. As *vargaṇās* exist with differing charges it is very likely that more than two GMV combine to produce a neutral charge in neutrino. So a neutrino of negligible mass should be made up of many GMV. There are three types of neutrinos. The mass of all three types is negligible but still there is a minor difference between them. Such minor variation in mass is obtained by variation in number of GMV in the three types of neutrinos. It may be noted that when the mass of a neutrino is considered to be negligible, the mass of GMV is still less.

Now consider another lepton, the electron. The mass of electron is 0.511 MeV, which is millions of times greater than the mass of a neutrino. This means that an electron is made of millions of GMV. In an electron the number of negative charge GMV exceeds the positive charge GMVs giving a net negative charge of  $-1.6022 \times 10^{-9}$  coulomb. This also shows that the charge of one GMV is millions of times smaller the charge of an electron. And since a GMV contains infinite *paramāṇus*, the quantum charge of a *paramāṇu* is really unimaginably small. The lepton muon is more than 200 times heavier, and tau is about 3500 times heavier than electron and therefore, they must contain more GMV in the same proportion.

Next consider the stable baryon particles proton and neutron. These particles are supposed to be made up of quarks. The mass of a proton is 1836.12 times greater than that of the electron and neutron is very slightly heavier than proton. The mass of a quark is uncertain but it is many times more than that of the electron. So a quark is made of that many times more GMV than an electron. There are six types of quarks having fractional charges, both positive and negative, and masses ranging from 2 MeV to 18000 MeV. According to Jain view the fractional charges of quarks are possible by appropriate combination of positive and negative GMV. Another thing we observe is that the charges of up quark, charm quark and top quark are the same but their masses vary considerably. Similar is the case with down quark, strange quark and bottom quark. Formation of these quarks is clearly possible with suitable combination of GMV. So, in Jain view quarks and leptons are composite particles and subject to gravity. Many more types of particles can be formed, including those not discovered so far.

Mass of matter is nothing but transformation of energy, that is, both matter and energy are but two modifications of a single entity, as has been only recently realized in science. Jain physics has identified all forms of matter and energy as modification of the same substance *pudgala*. Intra-convertibility of various forms of energy - mechanical into electrical, electrical into heat, light, sound etc., - which is the basis of modern technology - has been recognized by Jain philosophers as the basic attributes of *pudgala*, since all forms of energy are fundamentally the modification of the same substance, *paramāṇupudgala*.

## 5. Dark Energy and Dark Matter

There is no direct mention of dark energy and dark matter in Jain scriptures. The existence of dark energy in science has been postulated to satisfy the condition of expanding and accelerating universe and it is supposed to have anti-gravity property. The non-associable *vargaṇās* described above are weightless and gravity free. These

*vargaṇās* may comprise a good fraction of the total mass present in the *loka* that is gravity free but do not possess anti-gravity property as postulated by modern science. The Permanent Nil *Vargaṇās* may be considered to constitute the dark matter as they are not detected by ordinary means. These *vargaṇās* may constitute a significant portion of mass present in the *loka*. The matter formed by these *vargaṇās* could be non-baryonic as the baryonic matter is formed by higher Gross Matter *Vargaṇā* (GMV). Jainism supports the scientific view that mass is not the exclusive property of ordinary matter. According to Jainism even photons have mass.

Jain canon *Bhagavatī Sūtra* describes existence of dark structures in space comparable to black holes. These structures are of two types, one *Tamaskāya*, Mass of Darkness, and two *Kṛṣṇarājī*, Black Streaks [27]. Both are pitch dark structures containing no parts like stars, sun, moon, planet etc. and no life. Both have rains meaning thereby that they attract neighbouring matter that appears as showers on the surface. The light of other stars and moons becomes dim as they approach these structures. *Tamaskāya* is a huge structure extending from a location far away from *Jambūdvīpa* (supposed to be our Earth), and going up to fifth heaven in the upper *loka*. This is said to have been formed by transformation of water bodies of organisms and other matter. The *Kṛṣṇarājī*, eight in number in a closed loop structure located in fifth heaven in upper *loka*, is said to have been formed by transformation of earth (bodied beings) and other matter. This indicates that dark holes (or dark matter) can be formed in two ways, one from water source i.e. fluidic matter and the other from earth like solid matter.

## 6. The Laws of Subtle Cosmos

Modern science has discovered that as we go down from the macro to the micro state of matter, new attributes of matter come in action and the number of attributes increase. The macro world is deterministic and follows the laws of classical mechanics. The micro world follows the laws of quantum mechanics. Some laws of classical mechanics are not valid in the micro world. It may be noted that macro and micro world of science are comprised of 8-touch gross aggregates possessing mass, which consists of higher-order *vargaṇās* in bonded form. The weightless four-touch *vargaṇā* subtle aggregates which exist only in energy form is a different class of matter. The weightless, four-touch *vargaṇās* do not carry the fundamental forces as their *paramāṇus* are supposed to be in unbound state. Their behaviour, therefore, must not be governed by known laws of science. On extrapolating, we expect that at subtle level of the physical world e.g. weightless four-touch *vargaṇā*, there may be yet another set of principles in operation, which is still not discovered by science.

## 7. Organic and Inorganic Matter

The *pudgala* can be classified into three types in respect of the cause of transformation [28] viz. –

- (i) *Prayoga–Pariṇata* (Living organic matter). The *pudgala* (matter), which is taken in and transformed into body form by vital processes of living beings, falls in this category.
- (ii) *Miśra–pariṇata* (Past living matter, dead organic). The *pudgala* (matter), which was associated with living beings in the past, but is now abandoned by it, and therefore, is no longer being transformed by the agency of vital processes, but undergoes self-transformation, is *miśra* (mixed)–*pariṇata*. Shoe-leather, meat, etc. are instances of this type.
- (iii) *Visrasā-pariṇata* (Non-living matter, inorganic). Matter, which undergoes natural transformation i.e. without interaction with living beings, is *visrasā-pariṇata*. Clouds, rainbows, meteors, etc. are instances of this class.

Subtle changes take place in every substance every moment. Gross changes occur in soul and *pudgala* only. In this respect, both the soul and *pudgala*, are similar but as far as the total changes are concerned *pudgala* far exceeds soul. Changes in *pudgala* make the world change. Everything from the beginning to end in the world is governed by the natural changes taking place in *pudgala* and soul. The universe is self-managed from this point of view. The universe is governed by extrinsic changes as well, caused by union and separation of soul and *pudgala*. Soul and *pudgala* influence each other and both experience self-generated and extrinsic modifications.

The living matter exhibits some properties that are not found in non-living inorganic matter. Modern science does not differentiate between these two types of matter and considers them to be made up of the chemical elements and applies similar rules to both. Jain philosophy says that living body is a combination of soul and *pudgala* and exhibits the properties of both the components and just not the chemical elements. For example a living body shows the property of consciousness which is the property of the soul and not of matter. Modern science is trying hard to explain consciousness as an emergent property, reducible to the properties of matter, and this has become a subject of controversy even amongst the scientists. The behaviour of body parts is also influenced by soul through karma. For example the behaviour of genes cannot be explained purely on the basis of material properties, they are also influenced by karma. Thus complete explanation of behaviour of organisms needs consideration of existence of both the soul and the matter.

Taking a comparative view, the amount of *prayoga-pariṇata* (body matter) is least of all, the *miśra-pariṇata pudgala* is infinite times more and the *visrasā-pariṇata pudgala* is still infinite times more than this.

## 8. Motion

Two types of motions are described in Jainism [29]:

1. *Spr̥ṣad gati* – motion under the action of touch properties. This applies to the motion of *pudgala*.
2. *Aspr̥ṣad gati* – motion without the action of touch properties. This applies to the motion of pure soul.

We know that there are eight touch properties. These are divided in four groups:

- (a) **Heat** – cold and hot touch
- (b) **Electric Charge** – *snigdha* and *rūkṣa* touch
- (c) **Stress/Strain** – *mṛdu* and *karkaśa* touch
- (d) **Gravity (Weight)** – light and heavy touch

This implies that motion may take place due to (i) heat e.g. convection currents in fluids, (ii) electric force (and also magnetic force) e.g. propagation of photons and radiations, electric motor, etc., (iii) stress and strain e.g. stretching of solids, viscous action in liquids, etc., and (iv) gravity e.g. motion of falling objects, motion of astronomical objects, etc. The *asparṣadgati* does not involve any of these forces.

We now consider motion of different types of *pudgala* objects –

- (a) **Motion of a *paramāṇu*:** The motion of a *paramāṇu* is *apratighāti*, i.e. unobstructed. It does not get obstructed by any other object. Hence, there is no external influence of any kind on the motion of a *paramāṇu*. A *paramāṇu* moves due to its intrinsic characteristic of dynamism. Its motion is hindered only when it collides with another *paramāṇu*, a very rare possibility. It may be noted that the laws of motion of science and the limit imposed by Special Theory of Relativity does not apply to *paramāṇu* as the forces on which these laws and theories are based are absent in this case. The dynamic activity of a *paramāṇu* has some uncertainty as described before and it may move with low, medium or high velocity as determined by the property of *ṣadguṇa-hānī-*

*vṛddhi*. In the extreme case of highest velocity the *paramāṇu* can travel from one end to another end of loka in one *samaya*, if not hindered by another *paramāṇu*.

- (b) **Motion of four-touch *Vargaṇā***: A four – touch *vargaṇā* may contain two to infinite number of *paramāṇus*. The fundamental forces are still absent in this type of *vargaṇā* and its motion is not governed by known laws of science and the Special Theory of Relativity. However, there is affinity between *paramāṇus* in a *vargaṇā* and so the maximum velocity of this *vargaṇā* would be less than the maximum velocity of a *paramāṇu* as explained above. Due to large number of *paramāṇus* the chances of its colliding with other *vargaṇā* are significant. On collision the two *vargaṇās* may merge and form a bigger *vargaṇā* of the same kind or a *vargaṇā* of another kind.
- (c) **Motion of eight–touch *Vargaṇā***: Eight–touch *vargaṇā* contains *paramāṇus* in the bound state and all the fundamental forces must be present in it. All electromagnetic radiations fall in this category. This eight–touch type of *vargaṇās*, therefore, are expected to obey the known laws of science and the limit on speed imposed by the Special Theory of Relativity may apply. On account of small mass the gravitational force must be negligible and the motion is largely governed by electromagnetic force e.g. in the case of a photon and small microorganisms (*nigodas*).
- (d) **Motion of particles (made of *Mahāskandha Vargaṇā*)**: In the case of matter formed of GMV, at the level of subatomic particles and *paramāṇus* the gravitational force is still very small and other forces determine the motion. As the aggregates grow in size the gravitational force increases and the effect of electromagnetic force diminishes because the number of *paramāṇus* having positive and negative charge in the aggregate is likely to be of the same order canceling the effect of each other. Thus the motion of large particles and objects is governed mainly by gravitational force.

## 9. Conclusion

The *paramāṇu* of Jain philosophy is the smallest indivisible entity, the quantum of energy. The Jain *paramāṇu*, the real energy quanta, is far too smaller than the quantum of energy, photon, assumed by science. Science has discovered particles like quarks but it still remains a mystery what makes the quark. The journey of science has been from gross to fine and it has gone to the level of quark. Jain philosophy starts from the ultimate particle *paramāṇu* and proceeds up to the gross form of matter. Jain philosophy says that the fundamental constituent of nature is energy and *paramāṇu* is its ultimate unit. *Paramāṇu* makes up *vargaṇā* and *vargaṇā*

make up photon and the gross particles like quark, electron, etc. Jain philosophy presents the subtler form of matter which science has not discovered so far. The story of matter from quark and electron onward is known to science. Jain philosophy also offers some plausible explanation to puzzling questions like what is the nature of matter other than the ordinary matter postulated by science. Thus Jain philosophy and science together reveal more complete picture of the physical reality.

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