

Scientific Evaluation of Jain Philosophy :Cosmology

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Abstract

The purpose of this article is to integrate the available information, given in various Jain scriptures, to obtain a comprehensive description of the universe, that is, its structure and contents. For this purpose we cite various shlokas, scattered in different scriptures and, based on them, we develop a framework of Jain cosmology. We find many similarities and differences between Jain cosmology and modern cosmology. These points are compared and an attempt is made to see if they can be reconciled. The modern and Jain cosmology together give us a deeper insight into the contents and functioning of the universe.

1.Introduction

Jainism, as a distinct religious tradition originated in ancient India, with some evidence suggesting that it was practiced in the Indus Valley Civilization, as far back as 3300-1300 BCE, (Proceedings of Jain Academy of Scholars, 2026). The Jain concepts have their origin from the time of Bhagawan Rishabhdev, the first Tirthankar, who pronounced the foundational principles of an organised civil society based on the concept of non-violence and introduced agricultural practices, warfare techniques, trade, architecture, and Brahmi script for writing etc. Archeological, anthropogenic, agricultural and climatic evidences, can be used to place the time frame of the reign of Rishabhdev around 12000 BCE, after the earth emerged from the last glacial maximum epoch. An agriculture based civilised society does not seem to be possible, when lakes are frozen and liquid water is not available. The Neolithic age also emerged from the Paleolithic (old stone age) period around this time.. *Bhagawan Rishabha is also widely mentioned in the vedic literature in the verses of Rigveda (6.16.47), Atharvaveda (9.4.14-15) and Taittiriya Brahmana (3.7.5.13 & 4.7.10.1)[2].* References to Bhagawan Rishabha can also be found by different names in various contexts in Shreemad Bhagavata Purana (5/7/3), Vishnu Purana (2/1/31), Agni Purana (10/10-11), Shiva Purana (37/57), Brahmand Purana (Part I and chapter14) and Markandey Purana (50/39-42). This assignment of the period of Rishabhadev matches the statements given in Hindu scriptures, such as Bhagavata Purana, in which Rishabha is considered to be the ninth incarnation of Vishnu [1]. Twenty three Tirthankars followed Bhagawan Rishabha. Historical and scriptural records show that, Bhagawan Parshvanath, the 23rd Tirthankara, possibly lived in the 9th century BCE, when Jain spiritualism became scientific. The Jain philosophy was again re-established by Bhagawan Mahavira (599 - 527 BCE), the 24th Tirthankara. Apart from Bhagwan Parshva and Mahavira, who are historical figures, there is evidence that Bhagawan Munisuvrat, the 20th Tirthankara, was contemporary of Lord Rama and Bhagawan Aristnemi, the 22nd Tirthankara, was contemporary of Lord Krishna.

Like all the Tirthankaras, Bhagawan Mahavira was omniscient, and had developed the capability of an absolute all-containing coherent experience of the whole reality by extra-sensory percetion. The principles promulgated by Bhagawan Mahavira were compiled as Jain Agama by *Sudharma Swami*, the fifth Gandhar (Chief disciple). Commentaries on Anga literature were systematically written by *Acharya Malaygiri* and *Acharya Abhaydev* between 8th to 12th centuries, which contain many concepts, discussed in scientific lieterature now a days. One such examaple is the concept of paramanu, the primary particle, out of which the whole material universe is made of, by aggregaition (Proceedings of JAS, 2025). Besides Jain philoosphy has many concepts, similar to modern physics (Bhandari, N, 2025).

In this article we discuss three aspects (i) existence, structure and content of the universe (cosmology), (ii) laws that govern various processes in the universe, and (iii) nature of matter in Jain philosophy.

We then compare them with the concepts in modern science, and identify similarities and differences between Jain philosophy and modern cosmology.

2. The Universe according to Jain Philosophy

Jain cosmology presents a unique and simple view of the Universe, called Loka. The finite loka is immersed in an infinite alokakash, or supra-cosmic space. The Loka contains six dravyas (or reals). These dravyas are space, time, matter (and energy), jiva, dharma (responsible for motion) and adharma (akin to inertia). None of them can be produced from any other, i.e. each of them has independent existence. The existence of six dravyas or Reals (entities) is consistent with their observations in nature as we see the activities of all the six entities, as existence of living and material bodies, space for accommodating them, things in state of rest and in motion, and the continuous change in them, which is measured with time. Their necessity is consistent with the law of conservation, because all attempts to experimentally produce any of them from the other has not met with any success. For example law of conservation of momentum, and Dharma and Adharma dravyas are consistent with Newton's first law of motion.

Two of these dravyas, i.e. matter and jiva are interactive, whereas the other are passive and act only as facilitators of interactions of jiva sentient beings and pudgal (matter). Except time, which is linear, every dravya has three dimensional extent (*kaya*).

2.1 Principles of Jain Cosmology :-

Briefly, Jain cosmology is based on the following principles :-

(a) the Loka has no origination, i.e. it is not created. It is everlasting (*shashvat*) but its nature changes continuously (b) Loka is finite in size (c) Aloka is infinite (d) Loka has a structure characterised by some kind of symmetry, (e) The changes in Loka are cyclic and repetitive. Therefore the Jain Universe is eternal (*Anadi and Anant*). It does not need any support or external agency for its existence or functions and every thing occurs according to certain laws, which are also eternal. Nothing in the Universe is ever destroyed or created, only dravyas in the universe keep on changing one form to another form (modes). This occurs according to the Jain principle of, 'Sequential, predetermined transformation (*Krambaddha paryay*)'.

Spatial three dimensional extent in which living beings (conscious *Jiva*, containing soul) and non-living, physical entities (*Ajiva*) exist, is called *Loka*. Endless empty space, outside *Loka*, having only space (*Akash*) i.e. Trans-cosmic space or unoccupied space is *Aloka* (*Alokakash*) which is devoid of all other five substances (jiva, pudgal, dharma, adharma and kaal).

Loka consists of (a) *Jiva* (Sentient substance) and (b) *Ajiva* i.e. 5 insentient or non-living reals. Existence of *Aloka* is essential for the existence of *Loka*.

These conclusions are based on various shlokas scattered in different scriptures which we quote below.

As said in *Uttradhyayan Sutra*, 36/2 :-

जीवा चेव अजीवा य, एस लोए वियाहिए |

अजीवदेसमागासे, अलोए से वियाहिए ||

जीव और अजीव जहाँ हैं, वह लोक कहा गया है और अजीव का एक देश [विभाग या अंश] जो [मात्र] आकाश है, वह अलोक [अलोकाकाश] है |

Space in Jain philosophy provides accommodation to all sentient and non-sentient dravyas

The outer infinite unobservable space also possesses the property of providing accommodation and accommodates the Loka. it is an essential property of space as said in *Tattvarth Sutra* 5/18 :-

आकाशस्यावगाहः ||

Akashasyavagahah

The function or property of *Akash* substance is to provide accommodation (*avagaha*). An entity which provides place to exist to all substances is *Akash*. Thus *Akash* is a real which continues to exist within *Loka* (Cosmic space), as well as, out side it, into *Aloka* (trans-cosmic space).

2.2. Shape and structure of Jain Loka

As per Jain cosmology, Loka is three dimensional, its size is finite and its shape is fixed and it has a layered structure. Its height is fourteen *Rajjus* (*Rajju* is estimated to be $\sim 2 \times 10^{21}$ km, Muni Mahendra Kumar, Enigma of the Universe) and its width changes from top to bottom. This is smaller but comparable to , to the visible universe¹ which is estimated to be 93 billion light years in diameter, or $\sim 9 \times 10^{23}$ km. The actual (visible + invisible) universe is very large, may be infinitely large in some modern models. It is broadest at the bottom. It is some times depicted as a hexagon, with rounded corners, placed on an inverted cone. Some times it is also depicted as three bowls, placed one on the other. There is an inverted bowl at the bottom on which is located an upright bowl, on which there is another inverted bowl at the top, as shown in Figure 1. Between the lower two bowls is the *madhya Loka*, abode of humans, animals and other sentient beings like plants etc. All the lokas are connected with a *Trus nadi*, (probably a worm hole, see Bhandari, (2015), through which a soul can move from one loka to another. Some times the whole structure is picturised as a cosmic man standing with legs apart position and arms, bent and resting on the waist.

Jain Loka consists of four distinct parts[17]: *siddha shila*, *Urdhva loka*, *madhya loka* and *adholoka*, from top to bottom.

Urdhva Loka: The upper world or *Urdhvaloka* abode of dieties (*Devas*) and is called Heavens. At the top is located the *siddha shila*, the **abode of Siddhas or liberated souls**. As per *Uttradyayan Sutra* 36/67: -

लोएगदेसे ते सव्वे, नाणदंसणसन्निया |

संसारपारनिच्छिन्ना, सिद्धिं वरगइं गया ||

वे सभी सिद्ध जीव-ज्ञान-दर्शन से संपन्न (युक्त), संसार से पार पहुँचे हुए, परम गति-सिद्धि को प्राप्त लोक के एक देश (भाग) में अवस्थित हैं ||

The thin *Siddhasila* (45 yojan thick; Usually a yojan is estimated to be equal to 12 km) is depicted by a crescent moon on the Cosmic man's forehead:

The *Urdhva Loka* is divided into 7 heavens, one located above the other.

(b) *Madhya Loka* (Middle universe): *Madhya Loka* consists of many concentric continents, each of which is surrounded by Oceans, with *Jambu dvip* at the middle. The pairs of islands and oceans are named as: *Jambudvipa-Lavanoda* (Salt ocean), *Ghatki Khand-Kaloda*, *Puskarvardvipa-Puskaroda* (Lotus Ocean), *Varunvardvipa-Khiroda* (Ocean of Milk, or milky ocean), *Ghrutvardvipa-Ghrutoda* (Ghee or oily Ocean), *Ikshuwardvipa-Iksuvaroda* (Ocean of Sugarcane Juice), *Nandishwardvipa-Nandishwaroda* ocean etc. *Jambudvipa* is in the middle of *Madhya Loka* where humans reside (The set of *dvipa-ocean* pairs have been discussed in detail by Bhandari, in Proc. Jain Academy of scholars, 2022 and compared with modern data derived from space borne missions).

(c) *Adholoka*: The broad Bottom part of this structure is *Adholoka*, the hell, abode of infernal beings (*Narakis*).

¹ The size of the visible universe is derived from the age of the Big Bang universe (13.8 billion years and the finite speed of light, i.e ~ 300 million meters per second.



Figure 1. Pictorial depiction of Jain Loka. The Urdhva Loka (upper, shaped like one inverted bowl place on another upright bowl)), Madhya Loka (middle, shaped like a disc) and Adholoka (lower, like an inverted bowl, together are termed as Triloka.

Although much of the sky has been surveyed by modern telescopes and other instruments, such structures have not been found in the universe and are known to be physically unstable.

As mentioned in the Jain Scriptures, souls of humans, tiryanch, narakis and Devas move from one loka to another, as determined by their karma, through Trasnadi instantly. In this way *Trasanadi* (T) can be viewed as a *wormhole* as visualized in the *General Theory of Relativity* (GTR) (Bhandari, 2015).

2.3 Content of Jain Universe

धम्मो अधम्मो आगासं, कालो पुग्गल-जन्तवो ।

एस लोगो ति पन्नत्तो, जिणेहिं वरदंसिहिं ॥

धर्म, अधर्म, आकाश, काल, पुद्गल और जीव—ये छह द्रव्य हैं, इनसे युक्त द्रव्यात्मक लोक है ।

As mentioned above (Uttaradhyayan Sutra 28/7), *Jiva*, *Pudgal*, *Dharma*, *Adharma*, *Akash*, and *Kaal*, are considered as the fundamental *substances* which exist within the occupied space and make up *Loka* as a unitary entity. These six dravyas together are termed as *shatdravya*. The same description is given in *Panchastikaya Verse-22*:

जीवाः पुद्गलकाया आकाशमस्तिकामौ शेषौ ।

अमया अस्तित्वमयाः कारणभूता हि लोकस्य ॥

जीव, पुद्गलकाय, आकाश और शेष दो अस्तिकाय (धर्म तथा अधर्म) अकृत (uncreated) हैं, अस्तित्वमय हैं, और वास्तव में लोक के कारणभूत हैं। लोक छह द्रव्यों के अनेक विध (उत्पाद, व्यय, धौव्य) परणामरूप है, इसलिये छह द्रव्य सचमुच लोक के कारण हैं।

Infinite Jivas, Infinite Pudgalastikayas, One Akash and the remaining two Astikayas (Dharma and Adharma) are uncreated, existentially real, and as such, these five Astikayas are certainly the cause of the evolving Universe which is a combination of five Astikayas and the substance of Time, making a total of six substances.

2.3 Characteristics of Dravya(i) A dravya is clearly defined in *Panchastikaya Gatha* – 10 :-

द्रव्यं सल्लक्षणकं उत्पादव्ययध्रुवत्वसंयुक्तम्।

गुणपर्यायाश्रयं वा यत्तदभणन्ति सर्वज्ञाः ॥

जो सत् लक्षणवाला है, जो उत्पाद, व्यय, ध्रौव्यसंयुक्त है अथवा जो गुणपर्यायों का आश्रय है उसे सर्वज्ञ द्रव्य कहते हैं। 'सत्' द्रव्यका लक्षण है। उत्पादव्ययध्रौव्य द्रव्यका लक्षण है। अथवा, गुणपर्यायें द्रव्यका लक्षण हैं। अनेकान्तात्मक वस्तुके अन्वयी विशेष वे गुण हैं और व्यतिरेकी विशेष वे पर्याय हैं। वे गुण और पर्याय जो कि द्रव्यमे एक ही साथ तथा क्रमशः प्रवर्तत हैं, द्रव्यसे कथंचित् भिन्न और कथंचित् अभिन्न हैं तथा स्वभावभूत है - द्रव्यका लक्षण है।

The characteristics of a substance are: (1) *Sat* (existence), (2) *Utpada-Vyaya-Dhrauvyam* (production, destruction, and permanence), and (3) *Guna-Paryaya* (qualities and modes) which are innate and inseparable from the dravya itself. *Guna-Paryaya* is the characteristic of a substance that is characterized by *qualities* and *modes*. For every dravya which exists, its qualities and modes always remain associated with it, although modes keep on changing all the time. Thus a dravya, 'D' is made of two components E, the Essence, and M the Mode, which continuously changes with time t. The 'Essence, E' of the dravya, however, is indestructible and unchangeable and always remains the same.

Thus $D=E+M(t)$

'*Utpada-Vyaya-Dhrauvyam, yut sat*'; called the *Tripadi*, defines *sat* (existence) and process of change, in which the previous state, or mode, is destroyed and is replaced by a new mode, by itself, according to *Krambaddhaparyay*, the law of sequential change of modes. This process is continuous and inherent to the substance.

Modes and qualities of Substance

(i) As per *Uttaradhyayan sutra chapter 28/6* :-

गुणाणमासओ दत्वं, एगदव्वस्सिया गुणा।

लक्खणं पज्जवाणं तु, उभओ अस्सिया भवे ॥

गुणों का आश्रय-आधार द्रव्य है। द्रव्य के आश्रित रहना गुण हैं। द्रव्य और गुण-दोनों के आश्रित रहना, पर्यायों का लक्षण है।

Every Substance is the basis of **its qualities**. Similarly, *modes* depend on both, *substance* and its qualities.

(ii) one *Dravya* does not convert into another *Dravya*, although *Prayays* (modes) of every dravya undergoes continuous change, as per *Panchastikaya Gatha-11*, :-

उत्पत्तिर्वा विनाशो द्रव्यस्य च नास्त्यस्ति सद्भावः।

विगमोत्पादध्रुवत्वं कुर्वन्ति तस्यैव पर्यायाः ॥

द्रव्य का उत्पाद या विनाश नहीं होता है, सद्भाव है। उसी की पर्यायें विनाश, उत्पाद और ध्रुवता करती हैं।

The Universe is continuously evolving with the transformation of substances present in it, This change is described as *Utpada-Vyaya-Dhrauvyam*. This means that a new *Prayay* of substance is produced only after the destruction of previous *Prayay*. Jainism believes that every substance remains eternal within its *qualities* (*Gunas*), but its *Prayays* go on changing or transforming.

Jiva is eternal with qualities of consciousness etc, discussed above, while it also changes its *Prayay* as human (male, female etc) or other realms (*Gatis*) i.e. Animals, Plants, Dev or Narki etc. However, previous prayay is destroyed or terminated before the new *Prayay* is adopted. Just as water, after evaporation forms clouds and then, on condensation, it converts into rain. During these processes of transformation, H₂O continues to exist all the time, and retains its existence while it undergo

changes in its *Prayays* and forms as steam and rain, every substance behaves in the same way. Thus the basic nature of the content is conserved in all types of physical and chemical transformations.

The properties of dravya are mentioned in *Pravachansar* (Gyey Tattwadhikar), Gatha - 3, in the following way :-

अपरित्यक्तस्वभावेनोत्पादव्ययध्रुवत्वसंयुक्तम् ।

गुणवच्च सपर्यायं यतद्रव्यमिति ब्रुवन्ति ॥

जो अपने अस्तित्व स्वभाव को कभी नहीं छोड़ता, और जो उत्पाद, व्यय तथा ध्रौव्य से संयुक्त है, और अनंत गुणात्मक है, पर्याय सहित है; उसे द्रव्य कहते हैं। जिसका अपना अस्तित्व है, और जो किसी से उत्पन्न नहीं हो सकता, उसे द्रव्य कहते हैं। द्रव्य के दो लक्षण हैं। एक उत्पाद - व्यय - ध्रौव्य (शाश्वत), और दूसरा गुण पर्याय। गुण दो प्रकार के होते हैं, सामान्य और विशेष।

A substance is Characterized by Origination, destruction and permanence without ever abandoning its own nature and every substance possesses various *Qualities* and *Modes*. Every substance has qualities which are inseparable from it. Further, every substance is an aggregate of various co-existing *Qualities* and of continually changing *Modes*. Material i.e. non-living (*Ajiva*, *Pudgal Dravya*) and living-beings (*Jiva*) are interactive, continuously interacting with each other and changing their forms and modes

Qualities (attributes) are of two types- common (*Samanya*) and distinguishing (*Vishesh*). *Samanya Gunas*, common to all substances are as follows [19] :-

(i) *Astitva* (Eternal existence or being) : Due to this attribute, the substance is never destroyed or created.

(ii) *Vastutva* (substantiality or Functionality) : By virtue of this quality, the substance performs its own functions by itself.

(iii) *Dravyatva* (Substance hood): In spite of continuous and uninterrupted modification of a substance and its transformation every moment (*samay*), its essential nature does not change.

(iv) *Prameyatva* (knowability) : Due to this attribute, every dravya and its characteristics can be known completely and thus a dravya is a subject of knowledge.

(v) *Pradeshatva* (Spatial extent) : Due to this quality every dravya has a form or shape with a spatial extent and occupies *pradeshas* (or space quanta). This can be easily visualised in case of *jiva* which has *atmapradeshas*, *spudgal* which occupies 3-Dimensional space. In case of space, *dharma* and *adharma*, they extend throughout the *loka*, and thus have the form, same as *loka*. In case of time, which is normally considered to be linear (past, present and future), Jain philosophy conceives it to be made of *kalanu's* (time atoms).

{These statements need to be verified by experts}.

(vi) *Aguru-laghutva* (eternal persistence of its qualities) : It implies that a substance never loses its essential attributes or converts into another substance. An attribute does not change into another attribute and also the infinite attributes of a substance do not scatter or split into separate entities. By virtue of this quality, no substance becomes less or more by losing or adding anything to it and it always remains wholesome.

The above six characteristics are common to all dravyas. Apart from these, some dravyas have special characteristics.

Special (*vishesh*) characteristics

Jiva has one more attributes of Consciousness (*Cetanatva*) which provides power of distinction between self and others.

Jiva and pudgal have one special characteristics of visibility (Murtatva i.e. they are *roopi*), identified by attributes of touch, taste, smell and optical characteristics (shape, structure, size, colour etc.), whereas other dravyas are not *roopi*.

Furthermore, as per *Uttradhyayan sutra 28/11*:-

नाणं च दंसणं चेव, चरितं च तवो तहो |

वीरियं उवओगो य, एयं जीवस्स लक्खणं ||

ज्ञान, दर्शन, चारित्र, तप, वीर्य और उपयोग- ये जीव के लक्षण हैं ||

Jiva dravya is characterised by the distinguishing Qualities of Knowledge (*Samyag Gyan*), Perception/faith (*Samyag Darshan/Drishti*), Conduct (*Samyag Charitra/Achar*), Penance/ Austerities (*Samyag Tap*), Energy/Potency/ dynamic nature (*kriyavati shakti*) and *conation* (desire, *icchashakti*, capability of doing something which are absent in Ajiva or Matter (Non-living).

As far as pudgal (matter is concerned, it has a few additional special characteristics described in *Uttradhyayan Sutra 28/12*:-

सदुन्धयार- उज्जोओ, पहा छायास्सत्वे इ वा |

वण्ण- रस- गन्ध – फासा, पुग्गलाणं तु लक्खणं ||

शब्द, अन्धकार, उद्योत, प्रभा, छाया, आतप आदि तथा वर्ण, रस, गन्ध और स्पर्श- ये पुद्गल के लक्षण हैं ||

The characteristics of Pudgal or Matter-entity include sound, darkness, light, glow (lustre of jewels etc.), shadow and heat (thermal energy) and power of interaction (*kriyavati shakti*) as also optical, taste, smell and touch properties.

The Distinguishing Qualities of the five ajiva substances are as follows[20] :-

(i) Pudgal – Touch, taste, smell, optical properties (shape, size, colour), and interaction.

(ii) Dharma (facilitator of motion) – to provide passive help to soul and matter in their movement.

(iii) Adharma (facilitator of Rest) – to provide passive help to soul and matter to acquire the state of rest and stay at rest.

(iv) Space (Akash) – to give accommodation to all other five substances.

(v) Time (Kāl) – Time brings about transformation in all substances and provides a mechanism to measure change in them.

Jain Universe as beginningless, endless and eternal, without origination :-

The Universe is everlasting due to the presence of Dharmastikaya, Adharmastikaya and Akash as three substances are beginningless, endless, and eternal as per *Uttradhyayan Sutra, 36/8* :-

धम्माधम्मागासा, तिन्नी वि एए अणाइया |

अपज्जवसिया चेव, सव्वध्दं तु वियाहिया ||

धर्मास्तिकाय, अधर्मास्तिकाय और आकाशास्तिकाय- ये तीनों ही द्रव्य अनादि, अनन्त तथा सर्व काल स्थायी [नित्य] हैं |

Jain Universe with Movement of Substances (Dharma and Adharma)

According to *Uttradhyayan Sutra -28/9*:-

गइ लक्खणो उधम्मो, अहम्मो ठाणलक्खण |

भायणं सव्वदव्वाणं, नहं ओगाहलक्खणं ||

गति धर्म द्रव्य का लक्षण है, स्थिर रहना अधर्म द्रव्य का लक्षण है aur vahi uska आधार है, अवगाह देना आकाश द्रव्य का लक्षण है |

Dharma has the characteristics of enabling motion and is the unprompted cause to facilitate various types of movement and *Adharma* has the characteristic of rest and is the unprompted cause to facilitate stationary position. *Akash* has the characteristic and is the basis of providing space to all substances and their *Paryayas*.

Jain Universe with concept of Time as an instrument of change

Time (kaal) and its function is defined in *Tattvarth Sutra* 5/22 :-

वर्तना परिणामः क्रिया परत्वापरत्वे च कालस्य ।

Parinaman (transformation) or vartana (change) i.e. Becoming, changing, motion and concepts of before and after (sequentiality or simultaneity of events) are the functions of Time, termed as *upkar*. *Pudgal* and *jiva* are continuously and instantaneously transforming from one state to another eternally, incessantly, spontaneously, by themselves. This continuous changing of *Pudgal* or *jiva* is accompanied with simultaneous and continuous flow of time. It is not caused by any external agency but is the innate property of matter and *jiva*.

Jainism postulates that *Jiva* and *Ajiva*. are two separate, independent *dravyas*.and *Pudgal* (matter) in the Universe exists either as *Parmanu* or its *Skandhas* (aggregates) and as aggregates become larger, they develop shape and properties of *mass*.

(i) *Pudgals* can be classified in four types, according to **Uttaradhyayan sutra- 36/10** :-

खन्धा य खन्धदेसा य, तप्पएसा तहेव य ।

परमाणुणो य बोद्धव्वा, रुविणो य चउव्विहा ॥

(a) स्कन्ध, (b) स्कन्ध के देश, (c) उस स्कन्ध के प्रदेश, और (d) परमाणु- इस प्रकार रूपी अजीव द्रव्य के चार भेद हैं।

Skandh (aggregate), *desh* (a part of *skandh*), *Pradesh* (unit *skandh*), and *Paramanu* (the primary particle) are four groups of matter.

Paramanu is the basic substance which cannot be divided further. Two or more *Paramanus* combine to form *Skandh* which can further aggregate to form *Mahaskandh*. As per concept of Jain Philosophy, a *skandha* (aggregate) of matter attains mass when it reaches the stage of an *octon* (8 Touch matter), or *Anant-Anant-Pradeshi Skandh* as per the following stages :-

Parmanu (*Dion*, 2 Touch *pudgal*): The fundamental, indivisible, and massless particle of matter. A *parmanu* has two of the four primary "touches" (electric and thermal properties), but does not have the "heavy/light" and hard/soft attributes that constitute mass and viscosity respectively (Bhandari,2024).

Bahu-Pradeshi Skandh (*Quadon*, 4Touch *pudgal*): When two or more *parmanus* combine, they form a 4-touch aggregate (*Quadon*), or *Bahu-Pradeshi Skandh*. These clusters can have all four primary touches, but they are still considered subtle and massless, capable of moving at infinite speed (Bhandari, 2024).

Anantanant-Pradeshi Skandh (*Octon*, 8 Touch *pudgal*): This is a more complex stage of matter aggregation. At this point, the *pudgal* gains four secondary touches—including mass, and can be heavy or mass-less (light). *Octons* are considered "macro" matter and is same as the luminous matter made of atoms in modern science, capable of being perceived by the senses (see Jain Theory of Matter by N.Bhandari, Proceedings of JAS,202).

Thus, mass is not an innate property of the individual *parmanu* but, may be a latent, unmanifested potential property, a quality that emerges as these particles combine into larger, more complex aggregates, specifically at the stage of the *octon*.

(ii) This is also substantiated by *Uttaradhyayan sutra- 36/19* describing that the matter changes or develops by attribute of touch which are said to be of eight kinds-(1) positively charged, i.e. electrical (2) kinetic (3) massive and (4) viscous and their opposites:-

फासओ परिणया जे उ, अट्ठहा ते पकितिया ।

कक्खडा मउया चेव, गरुया लहुया तहा ॥

जो (पुद्गल) स्पर्श से परिणत होते हैं, वे आठ प्रकार के (4 युगल) कहे गये हैं-(1) स्निग्ध और रुक्ष, (2) गरम और ठंडा (3) कर्कश, और कोमल, (4) भारी और ठंडा ॥

Chatursparshiya-sukshma-pudgalas have either 1. snigdha (positive charge) or ruksha (negative charge) 2. cold or hot, 3. Rough, or soft 4. heavy or light tactility. Paramanus can execute more than 10 types of motions (linear, spin, circular, oscillatory, vibratory, wobble, etc.) and emits radiations including heat, and light. As per Jain theory of atoms [22], *Paramanus* can travel at *incredible speeds* from one part of the Universe to another which may be in a matter of moments (samaya). Various *permutations* and *combinations of paramanus*, result in pudgal diversity of the Universe.

Paramanu is a unit pudgal. All material objects and phenomena are believed to be composed of *Pudgal* and hence of *paramnus*. The *Paramanus*, being a form of *pudgal*, possess all the characteristics of *pudgal* like optical and tactile properties and taste, odour, , though they remain unmanifested, till they form suitably large aggregates.. Paramanu can travel at incredible speeds from one part of the universe to entire Universe in a matter of moments and even exist in multiple locations simultaneously, similar to certain aspects of quantum mechanics.

Since, *Paramanu* executes different types of motions or activities, as described above, they create heat, light, darkness, glow etc.

This evolutionary sequence from invisible to visible matter is described in Panchastikaya gatha-78 as follows:-

आदेशमात्रमूर्तः धातुचतुष्कस्य कारणं यस्तु ।

स ज्ञेयः परमाणुः परिणामगुणः स्वयमशब्दः ॥

परमाणु, जो केवल 'आदेशमात्र' से मूर्त है अर्थात् मात्र भेद विवक्षा से मूर्तत्व वाला कहलाता है, पर पृथ्वी, जल, अग्नि और वायु रूपी चार धातुओं के परिणाम का कारक है (अर्थात् परमाणु एक ही जाति के होने पर भी वे परिणाम के द्वारा चार धातुओं के कारण बनते हैं ।

Paramanu is the consequential cause of the four states of matter' that is solid, liquid, *gaseous* and , energetic due to the various qualities of the Paramanu and its transformation. Their combination sometimes assumes a varied outcome through the manifestation or non-manifestation of one of the qualities of smell, touch, taste and optical properties, which are present in an unmanifest form in the Paramanu.

Structure and Extent of Substances in the Jain universe

Jain Loka has a structure made of three main parts: Upper (*Urdhva*), middle (*Madhya*), and Lower (*Adho*). Each of them is made up of many distinct parts, as shown in Fig 1. and contains five Astikayas which are composed of collection of numerable, innumerable or Infinite *Pradeshas* of each substance. Thus each substance is *bahu-pradeshi*, as described in *Tattvarth Sutra – 5/7 to 5/11 :-*

असङ्ख्येयाः प्रदेशा धर्माधर्मयोः |5/7|,

जीवस्य च |5/8|,

आकाशस्यानन्ताः |5/9|

संख्येयासंख्येयाश्च पुद्गलानाम् |5/10|,

नाणोः |5/11|

Jiva, *Dharma* and *Adharma* are made of innumerable *Pradeshas* (units); *Akash* occupies infinite space *Pradeshas*. *Pudgal* can occupy numerable as well as innumerable *Pradeshas*.

Earlier, atom was considered indivisible by Scientists. Later on, it was found that an Atom is made up of sub-atomic particles like, neutrons, protons and electrons. Neutrons and Protons are made of Quarks. As per Jainism, *Paramanu* is the smallest part of *Pudgal* which is indivisible and considered to be much finer than a sub-atomic particle. *Akash* has infinite or endless *Pradeshas* but these space points of *Akash* can not get separated from *Akash* and these *Pradeshas* of *Akash* are different from *Pradeshas* of *Pudgala (Matter)*[23]. Since, Loka (Universe) is nothing but only Lokakash which

consists of innumerable/or endless Pradeshas of Panchastikayas and therefore, Universe is called "Bahu-Pradeshi".

Repetitive Cyclical stages in Jain Loka:-

In Jainism, *Time* is linear and moves from . past to present to future but time cycle (Kaal Chakra) is *cyclical* which is like a series of deteriorating (avarsarpini) and improving (utsarpini) periods, making a full cycle. Each half cycle consists of or is divided into 6 eras of progressively deteriorating and improving conditions.

According to Jain cosmology, since time is eternal , infinite Kala chakras have elapsed and will occur in future. Every cycle is similar and the history also repeats itself. For example, illustrious Tirthankaras have appeared in the past and will appear in the future to establish order and religion in their respective eras of *Time* [24].

Role of time is described in *Panchastikaya gatha-3*, as follows :-

समवादः समवायो वा पंचानां समय इति जिनोत्तमैः प्रज्ञप्तम् ।

स च एव भवति लोकस्ततोऽमितोऽलोकः खम् ॥

पाँच अस्तिकाय का समभावपूर्वक निरूपण अथवा समवाय (पंचास्तिकाय का सम्यक बोध अथवा समूह), वह समय है, वही

लोक है (पाँच अस्तिकाय के समूह जितना ही लोक है); उससे आगे अमाप अलोक आकाशस्वरूप है ।

Samaya (Time) here is defined as the group of five *Astikayas*. *Loka* is upto the extent of five *Astikayas* , *Soul*, *Pudgal*, *Dharma*, *Adharma* and *Akash* occupying extensive space, i.e., and beyond it, there is infinite *Aloka* with only *Akashastikaya*.

Time as Perception of Jain Loka

As per *Uttradhyan Sutra-36/7* :-

धम्माध्मे य दोऽवेए, लोगमिता वियाहिया ।

लोगालोगे य आगासे, समए समयखेतिए ॥

धर्मास्तिकाय और अधर्मास्तिकाय- ये दोनों ही लोकप्रमाण-सम्पूर्ण लोक में व्याप्त बताये गये हैं । आकाशास्तिकाय लोक

और अलोक दोनों में व्याप्त है तथा समय (काल) समय-क्षेत्रिक में ही है ॥

Dharmastikaya and *Adharmastikaya* exist only in the *Loka*. But *Akashastikaya* exists in the *Loka* as well as in *Aloka*. However, *Time* does not exist every where; Time exists only in the space where some one is present who is aware of changes, i.e. where living beings (*jiva*) exist. This is called *Samaya Kshetra*. This time is *vyavahar* time (celestial time). absolute time (निश्चय काल) exists everywhere in the *Loka*.

This statement implies that time is a construct of mind (see Prasanna, in Scientific perspectives).

The Atoms of Time or Kalanu

Time is the most enigmatic of all dravyas. It can be understood from nischaya (definitive) or practical (vyavahar) point of view.

Time is said to be made of *kalanus*, which is 'unit time', equivalent to Planck time in quantum physics. the *samay* or a time instant is defined as the time taken to move one *paramanu* from one *space point* (*pradesha*) to its adjacent *space point*, at the lowest speed. The lowest speed can be taken as the speed of a moving *paramanu* just before it comes to rest, at the fag end of its journey.

,

The time -Atom (*Kalanu*) or 'samay' occupies a unit of the world-space (pradesha). Past becomes present and present becomes future by the flow of Time [25]. *Tattvarthasutra* 5/40, mentions that *Samaya* is a *Time-instant* and *Conventional Time* or practical Time consists of *infinite instants*. Present is one time-instant where as the past and the future are made of Infinite time instants which figuratively establish continuity.

Mathematical foundation of Jain Cosmology

Jain cosmology is based on a profound mathematical foundation with detailed calculations and well described geometrical shapes of different parts of the Loka. Starting with the smallest part of each of the six dravyas mentioned above, for example the smallest unit of matter (paramanu), Time (samaya) and space (pradesha), all the contents of the the Jain universe have been explained.

The small numbers are expresses with high degree of precision and large numbers are expressed as numerable, innumerable and infinite and also there is a concept of infinitely-infinite (anantānant). Some features are expressed statistically, probably because it is difficult to visualise all the features of the huge universe (J.R.Jain, Proc. JAS, 2020).

Conceptual Similarities between the Scientific and Jain Theories of the Universe

Observable and Invisible space:

The universe is large and expanding, but only a small portion of it (a sphere of about 46.5 light years) is observable by us, because of the finite speed of light (~300million meters/second) and finite age of the Big Bang universe (13.8 billion years), restricting the signal which we can receive. The features of the early universe are inferred either theoretically or by decoding the universe when it was small, as has been done by using the space borne James Webb telescope and other instruments.

Eternal/Everlasting Universe:

Science indicates that the observable universe has a finite age (around 13.8 billion years). But, there is no definitive answer to whether the Universe is finite or infinite as discussed by modern scientific theories (like the *multiverse theory*) suggesting the universe has always existed, eternal or has no clear beginning similar to Jainism as said in *Uttradhyayan Sutra*, 36/8.

This is also further supported by *Tattawarth Sutra* 5/4 :-

नित्यावस्थितान्यरूपाणि ।

वे नित्य, अवस्थित, अरूपी हैं। वस्तु का सदा काल धुरूप होना नित्य है। वस्तु का कभी भी अपनी संख्या को नहीं छोड़ना, अवस्थित है। रूप से रहित होना, अरूपी है। सभी द्रव्यों का स्वभाव, ध्रुव जानना। द्रव्य के स्वभाव का कभी नाश नहीं होता है। यदि स्वभाव का ही नाश हो जाए तो द्रव्य का ही नाश हो जाएगा। वस्तु का स्वभाव, नित्य है।

Jiva, Dharma, Adharma and *Akash* are everlasting, immutable and formless. *Pudgals* have forms. Universe consisting of above five substances is eternal, constant and exists forever. Jain Universe as beginningless, endless and eternal, without origination is further supported by the following verse in *uttaradhyayan sutra* 36/8:-

धम्माधम्मागासा, तिन्नी वि एए अणाइया ।

अपज्जवसिया चेव, सव्वध्दं तु वियाहिया ॥

धर्मास्तिकाय, अधर्मास्तिकाय और आकाशास्तिकाय- ये तीनों ही द्रव्य अनादि, अनन्त तथा सर्व काल स्थायी [नित्य] हैं। The Universe is everlasting due to the presence of Dharmastikaya, Adharmastikaya and Akash as three substances are beginningless, endless, and eternal.

Having described the six components of Loka and their nature according to the various Jain scriptures, we now compare these concepts with modern scientific views.

Scientific views about the universe:

There is no unanimity among the astrophysicists whether there is only one universe or our universe is one among many universes, as envisaged in the Multiverse theory. Many theories have been proposed

for our universe, such as cyclic universe, oscillating universe, Steady State theory (see Narlikar, xxxxx) and the Big Bang theory. This is still a developing field of research but the last two, Viz, the steady State and the Big Bang theories have been much debated and discussed in modern cosmology. The experimental evidence, primarily of Black body radiation and Red shift due to receding galaxies support the Big Bang theory (see Bhandari, JASP 2020). We therefore briefly mention some salient features of the Big Bang theory here:

Big Bang Theory: The universe

{To write More}

2. We now come to the second topic of our article, that is, related to the mechanism by which various natural processes are governed.

No creator God :

Jainism and Modern Science reject the idea of a creator God responsible for the Universe's Existence.

Natural Laws :

Both Jain cosmology as well as Modern Science agree that the universe operates according to inherent natural laws, rather than divine intervention. But, Jainism emphasizes *cosmic laws* and science emphasizes *physical laws*. Although these laws are called by different names, but few of these principles form the backbone of Jain thought as compared in table below[26, 27].

Science (material world)	Jainism (living and non-living)
Causality: cause and effect relation	<i>Karmavād</i>
Law of Conservation	<i>Tripadi, Eternal nature of Dravyas</i>
Complementarity	<i>Anantdharmitā (Anekāntavād)</i>
Determinism	<i>Krambaddha paryāy</i>
Entanglement	<i>Parasparopagraho jivānām</i>

Universal Law of Conservation

Jain Scripture describes The Law of Conservation of three basic constituents (i.e. Akash, Jiva and Pudgal) of the Universe as “*Upneiva-Vigneiva-Dhruveiva*”. The Science of six Dravyas can be explained based on this Law of Conservation of Mass and Energy stating the knowledge of creation and Evolution of the Universe. An existing reality in order to maintain its permanence and continued existence must, necessarily undergo change in the form of origination and destruction. As described in *Tattvarth Sutra-5/37*, every substance is an aggregate of various qualities and of continually changing modes and changing of modes is also imbibed in the matter but contents are conserved in all types of physical and chemical transformations :-

गुणपर्यायवदद्रव्यम् ।

In any chemical reaction, amount of chemicals consumed are always conserved; nothing gets destroyed or created. Mass and energy, and charge etc. are conserved in all physical interactions. In all the interactions of quantum mechanics, the quantum numbers of particles are also conserved. In Jainism, *Dravyas* are never created or destroyed while the modes are changing which explains the concept of eternal nature of *Atma* and the concept of rebirth. In biological06/07/26