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Kannada's Atomism and Nanotechnology: A Comparative Analysis on the Ancient Indian Atom and Modern Science

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Abstract
The debate on Vaisheshika atomism with nanotechnology engages multidimensional arguments in relation to its existence at the level of the indivisible particles as well as to their nature of matter. Genetic, a traditional Indian philosophical position, postulating that each and every matter is aeon, made up of indestructible, imperceptible particles which are assumed to be eternal, and therefore collectively known as Paramāṇus Ātya. Modern scientific advancements, conversely, provided experiential evidence for the existence of atoms and subatomic particles. The contradiction, thus, raises the question if the paramāṇus that Vaisheshika posits correspond immediately to the atoms and to the subatomic particles in the way that modern physics describes, or whether they belong altogether to a different ontological category.

Nanotechnology, meanwhile, a representation of manipulations of matter at the level of atoms or molecules, lies between one and 100 nanometers. has an enormous scope, from medicine, electronics, through materials science, to the production of energy. This technology enables the design of new materials such as nanoelectronics, targeted drug delivery systems and what not. In this regard, the debate raises a train of thoughts related to epistemological issues concerning the nature of knowledge and the fit between the classical philosophical approaches on how knowledge should be acquired and the modern scientific approaches.

Ultimately, the debate between nanotechnology and Vaisheshika effectuate substantial queries about the nature of matter and matter in relation to the acquisition of knowledge and technological development from the philosophical perspective. The area is relatively complex and corresponds across the sciences and philosophies; for that matter, the discussion calls for an interdisciplinary approach and holistic understanding.

Keywords: Atomism, Nanotechnology, Vaisheshika, debate, modern science, Ancient Indian philosophy,

1. Introduction

The earliest theories of atomism were probably developed in classical Indian philosophy, embracing varied forms of minima, inseparable units or building blocks, whereas the term, in the modern period, derived from the Greek adjective atomos, meaning 'uncuttable.' The term ‘atomism’ can be understood by referring to the theories which delineate transformations in the physical world by the manipulation of minute particles of substance or the notion that each dimension is made up of indivisible elements. The statement of Swami Vivekanand Ji also support this argument when he stated-

"Every atom is trying to go and join itself to the next atom. Atoms after atoms combine, making huge balls, the earths, the suns, the moons, the stars, the planets. They, in their turn, are trying to rush towards each other, and at last, we know that the whole universe, mental and material, will be fused into one." (VivekaVani)

The ancient Greeks viewed atoms as eternal and indestructible entities that remain inviolate even while everything else in the world changes. Some of the Indian philosophical schools accept the Greek view of Atoms creation, destruction, or alteration, on the other hand, they view atoms as just transient features of experience. Monotheistic Atomists, such as the Middle Ages Islamic kalām philosophers and the 17th-century thinker Pierre Gassendi revised atomistic doctrines to make room for God's formation and dissolution of atoms. (Acharya)

Observable changes in the natural world are compellingly explained by the interactions of particles too small to perceive through the naked eyes. Even Aristotle left room for an adequate limit to the quantity for materials that could potentially establish particular attributes. Buddhist philosophers postulated phenomenal instants, negligibly extended in spatial and temporal terms, to parallel the transitory nature of moments of human experience. Atomist theories sometimes but not always have void spaces between atoms. (Ancient Atomism)

The number of these new Indian labels on the Greek atoms might account for the chemical law of combining proportions, but the so-called "valence," the tendency to combine, could not be accounted for unchangeable atoms as Quantity can be satisfied by labeled unchangeable atoms, but to understand matter and its manifestations, a changeable atom is needed. Here, the višesa of the vaiśesika atom can be regarded as the ancestor of the modern deformable structured atom which attempts to explain the behavior of matter and the interaction of light and heat. The study of matter has revealed that physical laws in the atomic domain are qualitatively distinct from the laws of everyday phenomena. A simplified description is that atoms of other species are unique, but mutable. (Purram, Rao, & Charanarur 2049-51)

Finally, quantum theory smashed the distinction between substance and process using the most promising approach to the physics of the cosmos by considering a manifold theory of D transformation groups. Today the atom can be understood more easily as a composite of a central nucleus with an electronic envelope around the nucleus held by electric forces according to quantum theory. But the different attitude between Vaisheshika authors and contemporary scientists is a hindrance for due and fair critical appreciation of Indian tradition of atomism. The understanding that physical science occurs separated from ethics and metaphysics make the task more difficult, henceforth, such systems should be presented in a more systematic, unbiased, and accurate fashion. (Mahato 701-02)

In a nutshell, the Indian atomic tradition of atomism was able to realize qualities of contemporary physical sciences which the Greek atomic tradition was not able to actualize. Quantity is lacking in essence, but quality is fully functional in both višesa and valence along with the inclusion of Karma as a category. Hence, one has to be careful about the components available in respect of a quantitative physicochemical tradition in ancient Indian science. (Purram, Rao & Charanarur 2050-51)

2. Vaiśeşika's Atomism and its Role in Contemporary Scientific World

2600 years ago Acharya Kanad, an ancient Indian Physicist born in Gujarat, probably around 600-800 BC, discovered atomic structure, atomic theory and laws of motion. Kashyap, since childhood, was fascinated by the ritual of scattering grains along the street. He observed and was fascinated by the view of ants eating rice, which could be a proper meal for small creatures like ants, but humans. He was very curious about the universe but his curiosity was directed towards the smallest particle and the thought of the smallest particle, "Anu" sparked his interest, and the journey from Kashyap to Kanad and the Vaisheshika school began. He imagined and documented the idea of the

smallest particle and explained his ideas to people, which earned him the revered name of Acharya Kanad. (Walunj Aishwarya Barku pp. 207-08)

The Vaiśeṣika School posits that universe is made up of transareṇu, the smallest mahat particle and tryaṇukas (composed three parts, all dvyaṇuka (dyad)). Dvyaṇukas comprises two parts, both are paramāṇu (atom) indivisible and eternal. The Vaisheshika school evolved independently of the Nyaya school, but it differed from the latter profoundly. It acknowledged only two means of gaining valid knowledge, namely, perception and inference; and maintain that every paramāṇu (atom) has its viśeṣa (individuality); and assumes atomistic pluralism and 'difference' as the categories. Categories, which are objects of knowledge or reals, are also known as Padarthas, and the whole universe is reduced into 6 or 7 Padarthas. Therefore, Padartha is that which is thinkable (Jneya) and nameable (Abhidheya). The Vaisesika categories[i] differ from those of Aristotle, Kant, and Hegel. ("Atomism in Vaiśeṣika Philosophy: A Critical Analysis | The Cho.in")

The Vaisesika had originally six classifications, the 7th, abhaava or negation, is an afterward addition. This is a classification of all the reals that exist into two classes: Bhava, existence, which has the six categories, and abhaava, non-existence. Vaisesika is a system that is more of physics and metaphysics, much akin to the Nyaya in principles like nature, self-qualities, and the atomic theory of the universe, but with a special interest in the categorization and characterization of categories and the evolution of the conceptual framework of atoms. Vaisheshika proposes that the universe is composed of the following elements: air, earth, water, fire and space. These are substances comprised of two kinds, viz., paramāṇu (indestructible, incomprehensible and minute) and composite (divisible into products produced by paramāṇu). The smallest possible form of composite entity is conceived as a "triad" of three components, each of which is a 'dyad' (dyaṇuka) of two units, each an atom. The dimensions, shape, facts, and all that is witnessed is an expression of the parmanus, its quantity and spatial configuration. The Vaisheshika held that human lived experiences could be composed of dravya (substance), guna (quality), karma (activity), samanya (commonality), vishesha (specificity), and samavaya (the inherent, integrated connection of all that exists). (Pal 78-80)(PM)

Vaisheshika, one of ancient India's six orthodox schools of Hindu philosophy, was initially an autonomous philosophy with its very own principles of epistemology, ethics, metaphysics, logic, and soteriology. Vaiśeṣika school advanced to be very much similar to the system developed by the Nyāya school but kept differences with the other in epistemology and metaphysics. Only two are considered to be the reliable means to knowledge, that of perception and inference. The school, well known for its understanding of naturalism, shaping atomic structure in naturalistic philosophy, assumed that all objects are resolvable into paramāṇu, and experiences are caused via interaction of substance, quality, activity, particularity, commonness, and inherence. Vaiśeṣika Darshana held the view that knowledge and liberation resulted from the total knowledge of the world experience. (Gupta and Bankura Zilla Saradamani Mahila Mahavidyapith 68-70)

Vaiśeşika philosophy deeply focuses that knowledge of physical quantities with their properties precedes knowledge of self, though generally, it is a philosophy, based on the idea of the atomic and molecular nature of change of states of matter. The process of Pilupaka essentially makes the very same assertion as that which Dalton believed at the time stating the substances consist of the molecules which are ultimate particles capable of individual existence. The molecules of a particular substance are identical to one another and possess the same properties and mass, but molecules of different substances are altogether different. The size of an atom, as defined by Vaiśeşika, is nearly the same as that of an atom in physics. The language of the original aphorisms of Vaiśeşika is so very concise and pregnant in meaning that, with those who think or meditate upon them, what is implied is fully realized. Thus, in Vaiśeşika, as in Saṅkhya darśana, "mahābhūta" and "tanmatra" refer to the ideal states of matter respectively. Although Vaiseshika Darshana deals with fundamental science concerning matter-energy, ātman, manas, its category, transformations, interactions and properties, it does not give quantitative concepts and

measurements, and most of the concepts and descriptions are fairly close to the physics of today. (Krishnaji pp. 28-29)

The Indian conception of the atom, possibly prior to the Greco-Roman world, is abstract and rooted in philosophy, based on logic rather than personal experience or experimentation lacking an empirical base. However, A.L. Basham, an Australian Indologist, praised them as-

"They were brilliant imaginative explanations of the physical structure of the world, and in a large measure, agreed with the discoveries of modern physics." (Sanatansinhnaad)

According to author Dilip M. Salwi-

"If Kanada's sutras are analysed, one would find that his atomic theory was far more advanced than those forwarded later by the Greek philosophers, Leucippus and Democritus." (Sanatansinhnaad)

3. Nanotechnology

A Japanese production engineer Norio Taniguchi from the Tokyo Science University, who was devoted to accuracy and precision, introduced the term nanotechnology[ii] in 1974. Taniguchi stated-

"Nanotechnology is the production technology to get the extra high accuracy and ultra-fine dimensions, i.e., the preciseness and fineness of the order of 1 nm (nanometer), 10^{-9} m in length. With materials, the smallest bit size of stock removal, flow, or design is one atom (generally about 1/5th of a nanometer), so the limit of fineness of materials is on the order of one nanometer." (Taniguchi)

Though the term was coined by Norio Taniguchi, the conceptual foundation was laid by Richard Feynman in his famous lecture on "There's Plenty of Room at the Bottom," at Caltech on December 29, 1959. In this lecture, Richard Feynman articulated that-

"I would like to describe a field, in which little has been done, but in which an enormous amount can be done in principle. This field is not quite the same as the others in that it will not tell us much of fundamental physics but it is more like solid-state physics[iii] in the sense that it might tell us much of great interest about the strange phenomena that occur in complex situations. Furthermore, the most important point is that it would have an enormous number of technical applications. What I want to talk about is the problem of manipulating and controlling things on a small scale." (Richard Feynman)

But If we look for the origin of nanotechnology then we have to understand the journey that started with microtechnology and then leads to nanotechnology. The earliest roots of microtechnology are recorded 2600 years ago in the form of atomism. Different philosophical schools have their view on the theory. Vaisheshika School, the founder of the atomistic theory, described atoms as eternal, indivisible, infinitesimal, and the ultimate parts of matter. In his research "Law of multiple Proportions", John Dalton stated that each matter is composed of indestructible atoms, and since the atoms of a particular element are analogous to their counterparts in masses and properties and different from atoms of other substances, the atoms have the ability to form the compounds by combining two or more atoms of other elements, the atoms are rearranged in the chemical reaction and so cannot be divided or destroyed and this is the beginning of modern chemistry or nanotechnology. (Gillan & Gillan)

Nanotechnology generates materials with new designs and developments with novel, amusing, and useful properties. As a result, these materials can demonstrate novel electric, magnetic, and mechanical properties and are used in a wide variety of domains in many aspects of life on a daily basis. For example, in the food sector, in preservatives and standardized packaging, to improve durability and insulating properties; in a component of polymer-based materials, for example, tennis rackets, and automobile bumpers, to reduce weight and enhance strength; in cosmetic products, for example, sunscreens, lotions, make-up, to improve functionality and to add antibacterial activity; In the surface treatment of textiles to boost resistance to wrinkles, stains, and microorganism growth; in coatings for windows, lenses and displays to make them hydrophobic,

anti-reflective or self-cleaning; in sustainable energy applications like solar panels, catalyst production and electronic equipment; in medicine for targeted drug delivery and functional enhancement of medical devices including imaging technologies; and in information technology applications such as accelerated transistors, improved memory devices and better display technologies. These materials, although used effectively, have characteristics and inherent physical and chemical properties that result in a unique interaction with biological and environmental systems. (Westra 15-17) (Hornyak et al. 18-24)

There is a belief that the advent of many new items and the transformation of most current products that use conventional engineering materials will be brought about by nanoscience and nanotechnology. This will be a period of transformation, and not only will several traditional skills be undermined, but also there will be significant displacement of people and their economic worth. Thus the development of nanotechnology is an investment and a protection against possible future losses of economic, industrial, military and scientific significance. One major concern is the lack of awareness of the implications of nanotechnology on the environment, health and society. Initial ethical concerns about nanotechnology focused on Drexler's idea that the core of nanotechnology would be self-replicating assemblers that could manipulate chemical reactions to create any atomic configuration we wanted; in effect, we could grow spaceships out of soil, air, and sunlight. (Litton 22-24) Hence, there is a need for scientific investigation in this field because of numerous reasons and to overcome the negative impacts or problems. Researchers provided suggestions, for example, Goueva et al. (2012) consider an ethical environment (ethics of individual researchers) to be related to higher levels of patent and product introductions-i.e., a race-to-the-top rather than related to pure and applied research, i.e., a race-to-the-bottom. Fink et al. (2012) proposes, Researchers should evaluate the implications of their work during its execution, since self-reflection will facilitate the discovery of certain dangers, such as uncertainty, and the potential linked to advancements in nanotechnology; failure to do so may result in adverse consequences. Lu et al. (2012) propose recognizing the nascent yet established aspects of literature, including Failure Mode Effect Analysis and Road-mapping, aimed at reducing risk and enhancing potential presented by nanotechnologies. (Linton & Walsh 547-8)

Philip J. Bond, Former undersecretary for technology, U.S. Department of Commerce (2003) stated-

"Addressing societal and ethical issues is the right thing to do and the necessary thing to do. It is the right thing to do because as ethically responsible leaders we must ensure that technology advances human well-being and does not detract from it. It is the necessary thing to do because it is essential for speeding technology adoption, broadening the economic and societal benefits, and accelerating and increasing our return on investment." (Roco & Bainbridge)

4. Aggregating the two

According to K L Sebastian-

"The concept that all matter is made up of atoms was suggested by Dalton in 1803. It was a very useful concept, which could explain many of the experimental observations, but people were sceptical and considered atoms to be hypothetical objects until the beginning of the 20th century. By the end of the 20th century, advances in science and technology led to imaging of atoms and molecules. Now we are in a position to actually 'see' them using the scanning probe microscopies." (Sebastian 8)

However, atoms, the concept of matter, has continued for millennia. This theory is already flawed as it was put forth for the first time by In the 2nd century BC the Hindu sage and philosopher Kanada developed ideas that were later extended into a more comprehensive atomic theory of how atoms combine to develop more sophisticated objects. The English word 'kanam' has etymological bases in a particle or small object. (Baxter)

According to the Greek philosopher Democritus, it is understood that all matter consists of minuscule, imperceptible particles known as atomos. Atomos determine the nature of the substance, depending on their shape and size which can be varied. In the year 1803, Dalton gave The concept of atoms was articulated in a straightforward and scientific manner, elucidating how his experimental findings enabled him to deduce that gasses, water, ice, and water vapor all comprise the same type of minuscule constituents of similar particles, all uniform in nature. He logically contended that if this is to be relevant to water it must be true for other stuff as well, since there would be nothing special about the water. (Sebastian 8-10)

In a way, John Dalton may be the first founding father of atomic theory purely on empirical basis. He took the ideas of other scientists and consolidated them into a workable, measurable, and testable theory through analysis and experimentation. His theory was enmeshed with philosophy and predicated upon logic. Kanad, a Persian polymath and poet, posited that every entity in creation is constituted of atoms that interlink to form molecules. Although his theories were abstract and based on logic, they offered imaginative explanations of the physical structure of the world and were largely in line with modern physics discoveries. (Gillan and Gillan)

Nanotechnology and Vaisheshika's atomism, proposing fundamental units like nanoparticles or nanomaterials and atoms with the unique properties of high surface area-to-volume ratio and unpredictable behavior at small size, are approaches to understand and interact with matter at its most fundamental level. Nanotechnology encompasses the creation, characterization, and manipulation of nanoparticles in order to develop new substances, devices, and systems with novel and distinctive properties. The field of Atomism in Vaisheshika puts forward that the properties at the macroscopic level are the result of the combination and arrangement of the atoms along with the inherent properties of an atom. Both the fields of science are in agreement for the existence of distinctive properties at different levels, where nanotechnology depends upon the size and Atomism in Vaisheshika explains that properties at the macroscopic levels are derived from the combination of atoms. Both the fields of science are directed towards unravelling the basic nature of reality for the upgradation of technology and for gaining enlightenment by following the path of spirituality. ("Atomic Theory in Indian Philosophy | Encyclopedia.com") (Litton 23-24)

There exist few instances that illustrate the relation between the two:

1. Nanoparticles, tiny nanometer-sized particles, can be prepared in a manner so that they serve as carriers for drug molecules right to the site in the body where the drug is needed, and thereby a selective action in the spirit of svabhava according to Kannada can be achieved.
2. The fact of the matter is that the concept of nanotechnology is really the functioning at atomic and molecular level in such a manner that electronic equipment is generated exactly as per the pattern that Kanada works through the concept of matter particles which cohere to form larger universe formations.
3. Nanotechnology is capable of yielding nanomaterials that are handy in agriculture, for example, nano pesticides and nano fertilizers, which not only encourage the growth of plants but also discourage pests, which cover the atomistic pursuit of Kannada.
4. Nanotechnology fabricates sensitive sensors which are capable of detecting molecules at low concentration and thereby provide a reinforcement to Kanada atomism that also advises giving a lot of emphasis to individual particles in sensory experiences. (Mahato 702-03) (Pal 80-82)

But Nano science and technology is huge, developing so rapidly, offering new possibilities to the materials currently used and could largely replace and undermine existing materials and the production economics of things made from them. Also, the development of nanotechnology is

perceived as an investment, in the economic, industrial, military, and technological industries, in the future. However, there are still underlying problems regarding the environmental, health, and societal implications. (Westra 15-17)(Roco & Bainbridge)

Atomism as per the Vaisheshika theory of achetana dravya, indivisible parts, can contribute philosophic knowledge to nanotechnology, offering a great level of manipulation of matter in the nanoscale, and its atomic interconnectivity is most valuable in the design of nanomaterials. The emergent properties hypothesized in the application of nanotechnology can offer an innovative technology. The application of Vaisheshika insights into the discourse of nanotechnology can strengthen the discussion, optimize the benefits, moderate the risk, foster responsible innovation, and navigate the expansion of ethical reasoning, provoking more integral scientific methodologies. Maharishi Kanad believes all things can be divided into still smaller things, the infinitely smallest particles being parmanu. These particles are indivisible and cannot be further broken down, which is the reason why they are immortal and indestructible as well, the basic cause of all material existence and possess an unusual identity of their own along with a property of their own. On the contrary, Greek philosophers Leucippus and Democritus laid down the concept of atomic theory in Greece and with the development came Dalton's theory. Dalton's theory that all matter is composed of small atoms, which are further indestructible, indivisible, identical in mass, and identical in properties, and combine to form compounds of any two types or more different atoms. The chemical reaction is nothing but the reshuffling of these atoms. (Walunj Aishwarya Barku 207-09) (Pal 76-77)

5. Conclusion

India, a land of theories and concepts, come with facts, is most commonly overlooked for its contributions to modern technology. Indian scientists, ranging from the likes of Shankar Abaji Bhisey, Gopalswamy Doraiswamy Naidu, Anna Modayil Mani, and Narinder Singh Kapany, delivered phenomenal works back in their homeland. Bhisey, a 14-year-old, invented a coal-gas generator indoors, invented electrical bicycle contraptions, and revolutionized the printing industry. Naidu, the "Thomas Edison of India," invented the first-ever electric motor and invented a number of inventions. Anna Modayil Mani, a meteorologist and physicist, invented the Ozonesonde, which measured the atmospheric ozone a day prior to the world being able to describe its functioning. Narinder Singh Kapany invented communication via the medium of optical fibres, as a result of which the internet and medical miracles based on laser surgeries and endoscopic imaging are made possible. Early Indians, ranging from sages, philosophers, astronomers, mathematicians, and scholars, to the likes of Aryabhatta, Charaka, Sushruta, Bhaskaracharya, Bramhagupta, Varahamihira, and Budhayan, delivered phenomenal works in mathematics, science, and medical science but have never been identified. Their works deserve worldwide recognition and prominence.

The Vaisheshika school of Kanada, one of the six orthodox schools of Vedic philosophy of ancient India, postulated the atomistic theory of existence and creation of the universe. It is one of the earliest known examples in human history of a systematic realist ontology. The subject matter of the same is nature and existence of beings and entities, their grouping and hierarchy, subdivision and the related paraphernalia. According to Maharishi Kanad’s atomic theory, all things are divisible, and an ongoing process, resulting in the accumulation of parmanu (atoms), the primary smallest object of matter. These parmanu cannot be divided, are eternal, and indestructible and the basis of all material existence and are capable of existence in two states- A state of motion or otherwise, and A state of absolute rest.

Leucippus and Democritus, Greek philosophers, elaborated the idea, upon which the theory of Dalton was subsequently based. Kanad's theory, however, is superior to that of Dalton. Dalton's atomic theory asserts that all matter is composed of very small particles called atoms, which are indestructible, indivisible, identical in mass and properties, combines to form compounds by the

combination of two or more different kinds of atoms, and to a reaction of chemicals is an arrangement of atoms.

Kanad's explanations are philosophical, while Dalton's is in chemistry. The discovery of atomic theory is controversial. Ancient India was home to numerous brilliant thinkers, philosophers, scientists, and mathematicians, who made significant scientific contributions which were ahead of their western counterparts. Their innovative ideas, which still influence modern science, were rewarded and benefited society, making Ancient India great and influencing modern science.

Finally, it can be said, the idea of an atom was extrapolated out of thought by Kanada and Democritus, later suggested by Dalton to explain experimental results. At first, the atom was considered by physicists to be fictional, but Einstein suggested oblique observation by the use of Brownian motion. At the end of the nineteenth century, atoms could be seen and handled as an outcome of intense mind work by a flurry of scientists.

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1. Dravya (substance): The substances are conceived as 9 in number. They are, pṛthvī (earth), ap (water), tejas (fire), vāyu (air), ākaśa (ether), kāla (time), dik (space) , ātman(self or soul) and manas (mind). The first five are called bhūtas, the substances having some specific qualities so that they could be perceived by one or the other external senses.

2. Guṇa (quality): The Vaiśeṣika Sūtra mentions 17 guṇas (qualities), to which Praśastapāda added another 7. While a substance is capable of existing independently by itself, a guṇa(quality) cannot exist so. The original 17 guṇas (characteristics) are, rūpa (color), rasa (taste), gandha (odor), sparśa (touch), saṁkhyā (number), parimāṇa (size/dimension/quantity), pṛthaktva (individuality), saṁyoga (conjunction/accompaniments), vibhāga (disjunction), paratva (prioritization), aparatva (posterior aspect), buddhi (knowledge), sukha (pleasure), duḥkha (pain), icchā (desire), dveṣa (aversion) and prayatna (deliberation). Praśastapāda added gurutva (heaviness), dravatva (fluidness), sneha (velocity), dharma (gratification), adharma (demerit), śabda (sound) and saṁskāra (faculty) to these attributes.

3. Karma (action): Karmas (actions or activities) are like guṇas (characteristics); they do not possess a distinct existence; instead, they are associated with the substances. However an attribute is an enduring aspect of a matter, while an activity can be a fleeting kind. Ākāśa (ether), kāla (time), dik (space) and ātman (self) although materials lack karma (activeness).

4. Sāmānya (generality): Because there currently are many elements, there will exist connections between one another. Whenever a property is peculiar to numerous different substances, it is labeled sāmānya.

5. Viśeṣa (particularity): By means of viśeṣa, we are able to perceive substances as different from one another. As the ultimate atoms are innumerable, so are the viśeṣas.

6. Samavāya (inherence): Kaṇāda defined samavāya as the relation between the cause and the effect. Praśastapāda defined it as the relationship existing between the substances that are inseparable, standing to one another in the relation of the container and the contained. The relation of samavāya is not perceivable but only inferable from the inseparable connection of the substances.

[i] According to the Vaisheshika school, Everything in existence of experience is potentially divided into six classifications. These are: dravya (substance), guṇa (quality), karma (activity), sāmānya (generality), viśeṣa (particularity), and samavāya (inherence). Following Vaiśeṣikas (Śrīdhara and Udayana and Śivāditya) introduced another category abhāva (non-existence). The initial three categories are called as artha (that is, they are capable of being perceived) and therefore they have real objective existence. The next three divisions are called budhyapekṣam (product of cognitive differences) and these are the rational categories.

[ii] The record of his statement is mentioned in the Proceedings of the International Conference of Production Engineering, On the Basic Concept of NanoTechnology, 1976 (Hornyak et al., 2008 p. 10)

[iii] The branch of condensed matter physics that deals with the physical properties of solids, especially the electromagnetic, thermodynamic, and structural properties of crystalline solids, such as semiconductors. (The American Heritage Dictionary of the English Language, 2011); the branch of physics concerned with experimental

and theoretical investigations of the properties of solids, such as superconductivity, photoconductivity, and ferromagnetism (https://www.dictionary.com/browse/solid-state-physics)

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