

Early Philosophical Atomism: Indian and Greek

by

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INTRODUCTION

This paper is a comparative study of the atomic theories of Kanada (ca. sixth to second century BCE) and Democritus (460 – 385 BCE).¹ The study does not include the Nyaya philosophy which is usually considered as an allied school of Vaisesika, forming the syncretic Nyaya-Vaisesika. Most Indologists agree that the two were once separate schools with distinct sutras, until their consolidation sometime during the tenth century CE. “The Vaisesika Sutra displays an awareness of Samkhya and Mimamsa ideas but shows no knowledge of Nyaya as a system of thought” (King 1999, 58). According to Chakrabarty (2003, 30), “The Vaisesika School changes much of its character once in contact with the followers of the Nyaya School”. Rather than Vaisesika, Nyaya has been the subject of academic research in India and in the West in the past decades. The study uses the framework developed by Emerita Quito (1991 and 1979) in her works on comparative philosophy. Without rejecting historical-descriptive approaches to East-West comparative studies, Quito argues that philosophy at its roots is one and universal, the so-called distinction between East and West is superficial and arbitrary. “Philosophy is human before it is Eastern or Western. This means that it is the human being and not the Chinese or Indian or Greek who philosophizes” (Quito 1991, 121). Although individuals are affected by historical and cultural circumstances, the unique attribute of the human mind is its ability to transcend temporal and spatial limits, for “Deeper than our quality of being oriental or occidental is our quality of being human” (Quito 1990, 415).² We are all confronted with

¹ Several studies suggest the possibility that the birth of Greek philosophy was due to Hindu influences (Woodcock 1996 and Doshi 1985). Almost all Presocratics, including Democritus, were reported to have traveled to the east. However, a direct link between the two philosophies cannot be conclusively established due to the lack of sufficient material evidence. Similar ideas in India and Greece could have originated and evolved simultaneously and independently. Even if ancient Greek thinkers came in contact with the Hindu sages, it would be hard to explain how communication and translations of philosophical teachings occurred. “All in all, we must be sober in our judgments on this exciting possibility of mutual East-West influence; repeated efforts by reputable scholars have found precious little to show any conscious borrowing” (Potter 1977, 17). See also McEvelley (2002, 536).

² “To every age belongs a *Zeitgeist* and in every locale there is an adjustment of thought, but after the peripheral coatings of time and space are removed, the pith of the original thought is manifest. We should not even be speaking of Oriental thought and Occidental thought, there are only human thoughts and humanistic thinking” (Quito 1990, 447).

similar needs and problems, ask similar questions, and while no uniform answer is given, there is at least a general pattern that can be gleaned from the responses given.³

Many ideas of ancient atomism anticipated the modern atomic theory. That atomistic tenets are found in both orthodox and heterodox schools in India beginning in the ninth century BCE suggests the presence of an extensive discussion on this topic during this period.⁴ Notwithstanding the early and expansive beginning of Indian atomism, modern scientific atomic theory traces its origin to Democritus.⁵ Through cross-cultural critical engagement of parallel ideas between Kanada and Democritus, the paper aims to discover the common problems that they dealt with in order to further our understanding of the early history of the atomic theory, to evaluate the relative merits and limitations of their proposed solutions, resolve some difficulties that each account faces by appealing to the other, and highlight their contributions to the emergence of atomic worldview.

EARLY PHILOSOPHICAL ATOMISM

Similar to other thinkers of orthodox schools, Kanada accepts the Vedic teachings on karma, *samsara*, *moksha* (*Vaisesika Sutra* V.2.18), and *dharma* (VI.2.2-9), but unlike the traditional Vedanta, the focus of Vaisesika is the individual and the particular and as such, it is analytic and pluralistic rather than synthetic or monistic. Vaisesika does not attempt to unify the different data of experience which it considers as the most general characteristics of things under a single principle. In the spirit of science, “its basic interest is the enumeration of irreducible elements and world constituents.” (Halbfass, 1992, 92). It systematizes reality, i.e. anything that can be recognized or designated with a specific name and be the object of cognition and language, under seven categories (*Vaisesika Sutra* I.1.5 – 8); substance, quality, activity, generality, particularity, inherence and *abhava* or absence/non-existence.⁶ These are not categories of thought or mere terms, the list is the classification of objectively existing things independent of our thoughts.⁷ All categories have the properties of factual identifiability, predicability, and intelligibility.

The most basic category is substance. It exists in itself and serves as the substratum of action and attribute or quality. Substances may be simple or compound. Unlike compound substances that are subject to production and destruction, simple substances are ultimate and

³ See Quito (1990, 447).

⁴ Charvaka, Samkya, Jainist and Buddhist schools developed atomistic theories of their own. There are early forms of atomistic ideas in *Chandogya Upanishad*.

⁵ See Simonyi (2012, 60-63); Myers (2006, 7, 175-176); Chown (2001, 5-7); Schrodinger (1996, 117); Capra (1991, 291); Amaldi (1961, 20-24).

⁶ There are only six *padarthas* in *Vaisesika Sutra*. *Abhava* was adapted as the 7th *padartha* by subsequent commentators. Kanada mentions *abhava* as a form of *prameya* or object of knowledge and gives considerable attention to it and its subdivision. Following tradition, I maintain it as one of the categories or *padartha* while limiting its analysis on the basis of Kanada's sutra.

⁷ In as much as the focus of this study is ancient atomism, it does not give a comprehensive account of the categories of Kanada.

eternal. “The eternal is that which is existent and uncaused” (*Vaisesika Sutra* IV.1.1). Action is the dynamic feature of substance while attribute is its static feature. “The characteristics of an attribute is that it naturally inheres in substances, does not contain an attribute itself, and is not an independent cause of conjunction and disjunction” (V.S. I.1.16). There are nine kinds of substances: earth, fire, air, water (the ultimate and partless atomic elements that make up the gross compounds),⁸ void (*akasa*), time, direction (*dik*), self (or soul/*atman*) and mind (*manas*). The first five are physical and with the exception of *akasa* which has no qualities, they are distinguishable by their primary qualities such as color, taste, smell, and touch (V.S. II.1.1-5). “The void (*akasa*) is understood through an inference about the nature of sound.” (Bales 1987, 188)⁹ The last four are non-corporeal substances. The mind is non-corporeal but atomic. Particularity, generality, and inherence, though no less real, are not directly perceived but logically inferred. *Visesa* or particularity refers to specificities that individuate the immaterial substances and the atoms (V.S. I.2.6). Atoms (*paramanus*) are the fundamental indivisible constituent particles of matter.¹⁰ Since atoms and the immaterial substances are imperceptible, particularity or *visesa* must be logically inferred (V.S. I.2.6). Gross matter is formed by the conjunction of atoms (V.S. I.1.27). Physical change is due to the combination and dissolution of such conjunctions. Generality pertains to the common characteristics of things that are grouped under one class while inference is the relationship between things that are usually regarded as inseparable such as cause and effect or the whole and its parts.

The philosophy of Democritus, on the other hand, is the logical conclusion of the Presocratic search for the unifying *arche*.¹¹ By the use of deductive reasoning, Parmenides demonstrates what seems to be a self-evident truth for his Milesian predecessors: there is no transition from being to non-being or vice-versa – nothing is absolutely generated or

⁸ “Whereas all nine substances (or classes of substances) are essentially irreducible, indestructible constituents of the world, the elemental substances (i.e. earth, water, fire, and air) occur not only in their eternal, irreducible form as atoms (*anu*, *paramanu*), but also as destructible compounds of such atoms, as concrete empirical objects of our daily practical acquaintance. ...The noneternal substances are not theoretically irreducible cosmic substrates, but things with which we deal in our ordinary linguistic and practical behavior. They cannot be listed or enumerated in the same sense as the elements. Noneternal substances are transitory constellations. They come and go. They cannot be codified in a permanent list.” (Halbfass 1993, 93)

⁹ *Akasa* is the substratum of sound.

¹⁰ Although the term *paramanu* is never mentioned by Kanada in his text, most Indologists use this word to refer to the most fundamental particles of matter in *Vaisesika*. “The *Vaisesikasutras*, the basic text of this tradition (codified around the first century of the Common Era) mentions the atoms quite optionally, incidentally as though we have affair with something obvious and self-evident. One may have an impression that in Ancient India the atomistic ideas were so universally known that there was no need to prove or explain them.” (Lysenko 2007b, 15)

¹¹ Some of the fragments attributed to Democritus concern ethical matters. They have naturalistic tendencies that give emphasis on cheerfulness and simplicity that we attain by regulating our desire for pleasure. Since the authenticity of these fragments is disputable (Mckirahan 2010, 337), they are excluded from the scope of this paper.

annihilated.¹² Empedocles modifies the position of Parmenides in order to maintain the validity of sense-experience. He explains the phenomenon of change, which is perceived by our senses, in terms of combination and disbanding of four basic elements (water, earth, wind, fire) but the elements themselves are not created. For his part, Democritus claims that change is not a *creatio ex-nihilo* of something new, but due to the changes in the configuration of the building blocks of matter. Atoms are the ultimate constitutive particles of matter, infinite in number, varying in size and shape, but are made up of the same stuff. They are scattered in an infinite or boundless void where they are in perpetual motion as they strike each other and are “tossed about”, causing them to move in different directions. In fragment 554 in Kirk and Raven (1957, 407):

He thinks they are so small as to elude our senses, but they have all sorts of forms and shapes and differences in size. So he is already enabled from them, as from elements, to create by aggregation bulks that are perceptible to sight and the other senses.

Their shapes, combinations, and their relative positions or distance from each other, as “A differs from N in shape, AN from NA in arrangement, and Z from N in position” are sufficient to explain all phenomena in this variegated world. For instance, while large and round atoms cause sweetness, atoms that are small and sharp cause sour flavor. Solid things are made up of atoms that are closely packed; those that are soft are composed of atoms that are wider apart. Democritus says that they have hooks and indentations that enable them to cling to each other. As they move in an infinite open space, they collide and rebound and in the process, some atoms come in close contact with others, some atoms are pushed away, while others get entangled and cling together forming a mutual hold – this is how compound bodies are made. There is no real coalescence or intermingling of atoms since there is always a void or a separator between them no matter how close they are to each other.

Ultimate reality is attributed by Kanada and Democritus to the atoms which are the smallest, immutable, indivisible and indestructible entities. “Any atomistic theory can be interpreted as an attempt to reconcile the thesis of the unity and immutability of being with the fact that the senses observe multiplicity and change.” (Lysenko 2007b, 21) This is accomplished, however, not by denying permanence – this is the approach taken by early Buddhism and Heraclitus. More than a counter-reaction against monism, ancient atomism is a compromise between the extreme positions of the metaphysics of permanence of Vedanta and Parmenides on the one hand, and the process metaphysics of the Buddha and Heraclitus on the other. It gives a rational account for both change and permanence by attributing change to the activities of atoms/*paramanus* which nature is eternal and invariable. Change is not negated for the sake of permanence or vice versa, but rather the changing aspects of experience are traced to the non-eternal, and permanent aspects to eternal ones. (Radhakrishnan 1969, 238) Plurality and unity are not seen as mutually exclusive.

¹² “One should both say and think that Being Is; for To Be is possible, and Nothingness is not possible. This I command to consider; for from the latter way of search first of all I debar you” (*Parmenides* no. 6 in Freeman, 1977, 43).

In contrast to his predecessors, Democritus did not posit a unitary principle or *arche*, yet his atomism still presupposes the idea of unity, for his atoms are made up of the same substance. He makes no qualitative distinction between atoms – they differ from each other only in terms of size and shape. Qualities which are not in the atoms are produced through the combinations and structure of the latter. Considering that atoms are responsible for the production of compound objects that have different qualities, it becomes clear why Democritus gives them geometrical and not perceptible qualities, for this facilitates the explanation as to why different things are produced by the same atoms since their differences will be attributed only to one reason – the structure or arrangements of atoms. Other qualities such as color, sound, texture are “secondary qualities which arise in virtue of the interaction of certain kinds of physical objects (such as eyes and ears) with others (such as table and hairs)” (Allen 1985, 15). On the other side, atoms for Kanada are essentially of four kinds (earth, water, fire, and air). They are quantitatively and qualitatively different possessing the qualities of taste, smell, color, and touch that compound objects have. “The reason why Vaisesika says that atoms themselves have qualities is that otherwise we would not be able to explain qualitative differences between objects – for example, between water and earth” (Puligandla 2007, 149). Although Kanada falls short in articulating the relationship between plurality and unity, he considers both generality and particularity as *padarthas*, and accepts certain dependence and subordination among the latter.

ON CAUSALITY

Ancient philosophical activity in India and Greece arises from speculations on the origin of the complex and dynamic universe. Nothing is completely the result of pure chance or accident. All observable events are caused. Cosmic cycle in Vaisesika is a transition from a complete state of rest or inactivity to one of movement, rather than the emergence of order out of chaos. In both traditions, all processes in the visible world are dependent on the activities of invisible atoms. “The universe thus consists of 1) a primary one that subsists always...; and 2) a derivative one which is dependent on it and which is the world we ordinarily know.” (Halbfass 1993, 93) Two levels of reality are distinguished: the macroscopic or phenomenal, i.e. the world of compound matter, and the microscopic or the world of imperceptible entities. In the macroscopic level, everything is determined by the movements of atoms through their mutual collisions or rebound so that “everything happens by necessity” – a statement made by Democritus according to Diogenes Laertius.¹³ Kirk calls this derived motion in order to distinguish it from the original motion in the microscopic level where there are only atoms/*paramanus* moving non-deterministically in all directions. The complex, phenomenal, macroscopic world is explained through the simple microscopic, and atomic realm.¹⁴

¹³ “Everything happens according to necessity for the cause of the coming-into-being of all things in the whirl, which calls necessity. (Diogenes Laertius ix 45)” (Allen 1985, 54). See also Kirk and Raven (1957, 412).

¹⁴I find useful the critically important distinction in phenomenology between phenomenon as common-sense reality representing first-order knowledge, the noumenon as the “essential” or deeper reality, which represents second-order knowledge. This does not mean, however, that the two orders of knowledge are disconnected from each other. In the atomism of Kanada or Democritus, there is no phenomenon that is set over and above the unknowable noumenon

Mutations happen in the phenomenal level but not in the atomic level where nothing comes to be or passes away. The former is grasped by sensation, the latter is known by reasoning.

Everything that comes into being must have a prior cause and while the cause and its effect are logically distinct, a certain relationship exists between them. In Indian atomism, to cause an effect is to “be its immediate (and unconditioned) antecedent” (Matilal 1975, 42). Causality is a subject of deep reflection and discussion among the Hindu *darsanas* and this leads to the development of a wider understanding of cause and more complex theories on causation, in comparison to the Presocratics who do not articulate the relationship between cause and effect nor distinguish the different kinds of cause. It seems that causation for the early Greek thinkers is by “synonyms, he who breeds fat oxen must himself be fat. The fire warms me only if it is in itself warm” (Barnes 1982, 119). Simply put, the cause cannot produce what it does not naturally have. For example, if the universe is living or dynamic, the originative substance (*arche*) must be intrinsically dynamic and alive too, as most Presocratics argue. Being the source of all things, the originative substance must contain as much as possible whatever qualities they considered as the fundamental characteristic of everything. For such reason, through the knowledge of the *arche*, everything else is known. This implies that the effect is similar to and pre-existed in the cause. The cause and effect are essentially the same (in Indian Philosophy, this is called the *satkaryavada* theory) because the cause cannot produce an effect that is not already existent *in potentia* within it. (The common example of Samkhya is ‘the pot is the clay’, thus maintaining that the effect is in the cause) Since the effect is not a new being but is already present in the cause in a certain fashion, there is no real effect (i.e. a distinct entity) that is produced. Instead, there is only a singular original being with changing manifestations or appearances.

Contrary to the position of Samkhya, Kanada does not affirm the pre-existence of the effect in the cause. The effect is numerically and essentially different from its cause, i.e. the effect has an essence not imparted to it by the cause (*asatkaryavada*). This is proven by the fact that the non-existence of the effect follows from the non-existence of the cause, but the non-existence of the cause does not follow from the non-existence of the effect. “In the absence of cause is the absence of effect. But in the absence of effect there is no absence of cause” (V.S. I.2. 1-2).¹⁵ The powers of *paramanus* in the material cause (clay), combined with those of auxiliary causes (wheel and stick), destroy the cause in the production of the effect. True to the spirit of empiricism, the so-called causal relation is a kind of inherence or *samavaya* (V.S. VII.2.26) – an imperceptible relation which is the result of intellectual inference (a sequence of cognition) from the ‘non-simultaneous’ and sequential coming into being of the effect in relation to its cause. (VIII.2.8) But even if the pre-existence of the effect in its cause is denied, it does not follow that the effect is produced from absolute nothingness. “[T]he prior non-existence of an effect is not merely void or unreal, but it is a reality called antecedent negation” (Shastri 1976, 127). The prior absence of an effect (i.e. the produced substance) is a necessary condition of the effect to come to be, but the effect is not made ‘out of’ anything, but rather in the right sorts of simple substances (this being explained by the very nature of those substances and by the action of the

¹⁵ The pot is not the clay. If the pot (effect) is the clay (cause), when the pot (effect) disappears the clay (cause) must also disappear, but it does not.

efficient and instrumental causes working on them). Simultaneously with the effect's coming to be, its prior absence is destroyed. Indeed, the coming to be of the effect is in reality identical with its prior absence being destroyed, thus, the effect does not come from its prior absence as if it were made from void or nothing.

Democritus denies *creatio ex-nihilo* and maintains that any substantial intermingling or unity between atoms is impossible, otherwise, they “would become one, (or alternatively, the two atoms will have perished and a new atom will have come to be). Either way the fundamental principle that atoms neither come to be nor perish is violated” (Mckirahan 323). Since the different kinds of compound objects are the results of the configuration of atoms and such configuration does not pre-exist the atoms, and since the compounds have certain characteristics that are not in the atoms (e.g. divisibility, contingency, perceptibility), it follows that the effect is not identical with the cause. A further consideration in this regard is the Democritean treatment of sense perception, to which contemporary authors apply the Lockean distinction between primary and secondary qualities. Secondary qualities “of gross bodies with its color, odor, taste, and – presumably – sound is the effect of atoms possessing only primary qualities” (Organ 1975, 211). The secondary qualities that compounds have cannot be found in the atoms that generate them, for atoms only possess size and shape. From this perspective, one can say that “the effect is not in the cause. Therefore, this is a non-pre-existent-effect theory” (Organ 1975, 211) or *asatkaryavada*.¹⁶

THE CONCEPT OF VOID, NON-BEING OR ABHAVA

The Eleatic conception of the being-that-excludes-non-being results in affirming reality as one and unchanging. Similar idea is expressed in some passages in the Upanishads.¹⁷ The reason why Parmenides underscores reality as unmoved is because it is all-encompassing, there is nothing outside of it that it could occupy. Since the void is a non-being (outside of what-is), it does not exist. For this, the response of Democritus is that “not-being exists as much as being, and the two are equally the causes of things coming-into-being.” (frag. 546 Kirk and Raven 1957, 400) This seems to be a contradiction and a departure from Parmenides who says that non-being “is-not”, but what is being meant by Democritus is that atoms are not the only things that exist, empty space exists too, and the two are necessary in order to explain the occurrence

¹⁶ “Admittedly, the Greek atomists did not work out the theory. They may not even have thought of it as a theory of cause and effect. The problem of change and permanence, not of cause and effect, was paramount in their minds. They did not think of the atoms as ceasing to exist upon the formation of the gross bodies, so we must note that properties, not substances, fit the pattern of the Nyaya-Vaisesika *asatkaryavada*” (Organ 1975, 211).

¹⁷ “‘Before, O good looking one, this was a state of being (*sat*), only one with a second. Others say before this was non-being, one alone, without a second; from non-being proceeds the state of being.’ He continued, ‘O good looking one, by what logic can being verily come out of non-being? But surely, O good looking one, in the beginning all this was Existence (*sat*), One only, without a second.’” *Chandogya Upanishad* (VI. 2.1-2). “The One is not born nor dies. This One has not come from anywhere, has not become anyone. Unborn, constant, eternal, primeval” *Katha Upanishad* (II.18). “As a unity only is It to be looked upon - This indemonstrable, enduring Being, Spotless, beyond space, the unborn Soul, great enduring.” *Brihadharanyaka Upanishad* (IV.4.20), see also (III.8.9) and *Maitri Upanishad* (VI.17).

of change. For atoms to move according to Democritus, there must be a space for them to move into, i.e., a space that they do not currently occupy. Relatedly, *abhava* is essential for Kanada “to render intelligible the non-existence of an originated thing both before it comes into being and after it ceases to exist, as well as the determinateness of its characteristics which excludes from it those qualities which would make it some other thing which it is not” (Hackett 1970, 137). *Abhava* is used to explain production (prior non-existence), destruction (posterior non-existence), distinction (mutual non-existence: A does not exist as B and B does not exist as A), and contradiction (absolute non-existence which is a pseudo-idea).¹⁸ The combination of antecedent and consequent non-existence explains contingency.

Through a qualified notion of non-being or *abhava*, and the acceptance of the existence of the void or cosmic vacuum, Kanada and Democritus argue that plurality and change are not a contradiction or a mere illusion. They point out that the conception of non-being is dependent on being or existence, because non-being cannot be described or explained except in relation to something that exists. Non-being does not imply an absolute negation but a relative one (*abhava* is a negative *padartha*) for absolute negation is unthinkable, as Parmenides says. The statement of Democritus which states that “not-being exists as much as being” finds its counterpart in one of the aphorisms of Kanada: “Likewise too from the perception of existence is non-existence” (V. S. 9.1.7).¹⁹ They both share the same idea of non-being as a gap or separator. Thus, the atom/*paramanus* does not have void in it, and as such it is partless or unsplitable. Non-being /void is the explanation for plurality (“something” must separate one atom from another), and atomic motion. Kanada uses *abhava* to explain the non-identity (distinction) between the cause and its effect since he follows the *asatkaryavada* theory. “In the absence of the interaction of *kriya* and *gunas*, before coming into being (an effect is said to be non-existent” (V.S. IX.1.1). In a sense, *abhava* separates the cause from its effect. Additionally, the void is used by the Greek atomist to give an account of the difference between heavy or hard objects versus light or soft ones (the former having less empty spaces in between their atomic parts compared to the latter).

But while Democritus identifies void with non-being, there are explicit distinctions among Kanada’s *abhava* or non-being, spatial coordinates or *dik*, and void or *akasa*. *Dik* is the substance necessary to understand spatial notion in terms of distance or direction. “This (is remote, etc.) from this. Such is the mark of *dik*” (V.S. II.2.10). The *akasa* of Kanada is not non-being, but a non-perceptible form of subtle matter. But much like the void of Democritus, *akasa* is “nothing other than the cosmic vacuum which contains all objects, and gives room for their activities” (Sinha 1923, 4). It has no other qualities except spatial extension.²⁰ In contrast to the primary realities, the non-atomic void or *akasa* is singular, empty, penetrable, immobile and all-pervading, an “undifferentiated reservoir, a kind of absolute space comparable to Newtonian space” (Lysenko 2007a, 437). Connection between the *paramanus* of Kanada is temporary or accidental rather than substantial, and this runs parallel with the view of Democritus. Similarly, atoms do not combine substantially to form a continuum and that which contains and separates

¹⁸ See V.S. (VIII.2.4-6).

¹⁹ For Kanada, the word *bhava* stands for existence, whereas *satta* represents reality. (Halbfass 1992, 141)

²⁰ “These (*gunas* namely colour, taste, odour, and touch) are not present in *akasa*” (V.S. II.1.5).

them at the same time is the void. The *akasa* of Kanada separates *paramanus* too without creating absolute distance between them that could make any form of contact impossible. “Unlike the void in Democritus’ physics, which serves as an interval between the atoms, the role of *akasa* with regard to the atoms is quite obscure. There is no indication in the available sources that *akasa*, like the void assists the motion of the atoms and their combinations as a common milieu or free space.” (Lysenko 2007a, 433). But by making a distinction between void (*akasa*) and spatial coordinates or direction (*dik*), Kanada points out one important characteristic of the void which is lacking in the fragments of Democritus – that it is isotropic. Thus, the movements of particles in it are invariant to directions.

THE SOURCE OF MOTION – *ADRSTA*

Prior to Democritus, the Milesians argue that the originative stuff is intrinsically dynamic because it is divine. By admitting the existence of the void, the Greek atomist finds a natural explanatory cause of motion. The criticism of Aristotle against atomism is that it disregards the question of the efficient cause of motion. The idea of a prime mover however, is totally out of consideration in early Greek atomism because there is no point in time when the atoms are static. Since atoms and the void are not created, the former have always existed and have always interacted with each other in an infinite space. But despite the fact that Kanada arrives at the same conclusion as Democritus regarding the nature of the void/non-being/*abhava* and the atoms, he still sees the necessity of ascribing external motion to the atoms from the unseen force/power or *adrsta*.²¹ His aphorisms also cite extraordinary samples of motion that are caused by *adrsta* such as the movement of the needle to the magnet, gravitational pull, assimilation of food, upward movement of flames or air, conjunction between body and soul and the initial motion of the *manas* in the process of forming new organism (V. S. V.1.15; V.2.2-13). *Adrsta* initiates the first motion of the atoms, after which the latter combines in geometrical progression, forming dyads which in turn combine into triads and so on, until the compound object is produced. But with the exception of the first motion and a few isolated incidents, all other processes in the universe depend on the interaction among the atoms themselves. It is not clear how the unseen force continues to influence the the succeeding behaviors of the primary units. Like the nous of Anaxagoras, *adrsta* functions like a *deus ex machina* – an arbitrary construct in order to handle minor difficulties in the system such as finding an explanation for what appears to be unexplainable movements, e.g. gravitational and magnetic motion or the first motion of the atoms.

²¹ *Adrsta* is related to the pre-Vedic notion of *rta*: a universal rule that no one can alter, not even the gods. It works spontaneously within each thing to guide the orderly movement of nature. Further work has to be done to historicize and fully excavate across text traditions in Indian Philosophy the concept of *adrsta*. It plays an important role, not just in Indian atomism, but in several other traditions as well. See Halbfass (1991).

THE NATURE OF KNOWLEDGE

The epistemic gap between how reality appears and reality as it actually is constitutes the central thread of philosophical speculation in the ancient world. Such gap or disparity is expressed by the Hindu concept *maya* that entails that the entire empirical reality circumscribed by space and time is not reality itself but only an appearance. *Maya*, which is often translated as illusion, has nothing to do with the metaphysical status of the world.²² It is concerned with the way reality is perceived, i.e. it is a way of looking at, a perspective, or an epistemic limit. Vaisesika is one of the several Hindu *darsanas* or “points of view” which express truths to “a particular set of people possessing different degrees of mental and spiritual advancement. They reveal and explain the truths embodied in the Vedas to them from their point of view and according to their competence” (Basu 1974, iv). From Thales to Parmenides, the Presocratics are looking for an explanation for the oneness of things, a reality that lies beyond the ordinary appearances. Democritus says, “In reality we know nothing, for truth is in the depths” (Democritus, DK 68B117 in Mckirahan 2010, 335). What is perceived by the senses is just the temporary and superficial conjunctions of the elementary particles. “In a sense the actual facts of human experience do not really exist, any more than they did for Parmenides, since the atoms themselves do not inherently possess sense qualities” (McEvelley 2002, 315). Although Kanada attributes sense qualities to his *paramanus*, the latter in se are imperceptible just like the atoms of Democritus. Both thinkers affirm plurality against the unifying tendencies of the Upanishadic and the Eleatic philosophies respectively, but they somewhat maintain the phenomenal status of the world of sense experience, for what is truly real, as opposed to the purely phenomenal cannot pass away or degenerate.

While the sensible material world is maintained as phenomenal,²³ the boundary between reality/appearance or truth /phenomenon is argued by the two atomists on the basis of rational reflection, rather than in a mystical or theistic way. In the first place, both texts are silent on the existence of god. The source of atomic motion or *adrsta* of Kanada is not divine power but an impersonal and unintelligent force. Thus, the boundary involved here is not between human/divine truths or knowable/unknowable, but between sense data and intellectual cognition. “From out of these sense-data we build our view of experience as consisting of things and their qualities and relations, but the atoms assumed are not integral factors of the world of experience” (Radhakrishnan 1969, 239). Democritus, on the other hand, distinguishes genuine or right knowledge from the obscure or imperfect. Genuine knowledge is knowledge of atoms and the void that are apprehended only through the inference of reason. Imperfect knowledge refers to our sense experience. It is called obscure because sensation cannot perceive the ultimate realities. The two kinds of knowledge are distinct but inseparable. Genuine knowledge is based on the microscopic level of reality while the obscure is based on the

²² Villaba (1996, 17; 1988, 514), following Radhakrishnan, challenges the interpretation of *maya* as mere illusion, arguing that *maya* has two functions: concealment and projection. There is no doubt that the concept has many meanings in various schools of Indian Philosophy, but the view that it implies illusion cannot be simply dismissed.

²³ “Whereas the Vaisesika considers the noneternal substances to be effects of, and derived from, the eternal substances, it does not regard them as less real. they, too, are real substrates of real qualities and other attributes. They have their irreducible identity and reality as long as they last.” (Halbfass 1993, 94)

macroscopic. The role of sense experience in knowledge is never out rightly rejected. One of the fragments attributed to Democritus contains an imaginary dialogue between the intellect and the external senses, where the latter addressed the intellect who claimed that physical sensations are mere conventions, saying that “ Wretched mind, from us are you taking the evidence by which you would overthrow us? Our overthrow is your downfall” (in Cartledge 1999, 10). Thought is dependent on the body and sensation for the latter is the starting point and the medium of knowledge, and this is also accepted by Kanada. “Perception of the macroscopic phenomena constitutes the first step in acquiring knowledge of the microscopic reality” (Mckirahan 2010, 335). Divisibility, which is an observable property of matter is used by both thinkers to establish the existence of indivisible and imperceptible atoms.

Since Kanada’s system relies heavily on the validity of sense experience (whatever is experienced exists objectively as such), several of his aphorisms deal with the merits and limits of sensation – what can and cannot be perceived by the senses. (V.S. 4.1.6-12; 4.2.8-13). Colorless substances, for example are not visible.²⁴ External perception happens with respect to objects possessing magnitude. Starting from sense experience, Kanada develops the categories of substances. The whole enterprise is an attempt to make reality more comprehensible by systematizing the different objects of cognition. This demonstrates that cognition starts from sense perception but because the latter is imperfect and selective in nature, cognition at first hand is unsystematic. Kanada’s inclusion of spatial coordinates and time in his categories implies that sense experience is limited. Hence, whatever is perceivable by the external senses is non-eternal or contingent, for sense perception occurs in a space-time dimension.

Although Democritus emphasizes the subjective component of sensation and is critical of the evidence presented by the senses since apart from the intellect, they cannot reveal the microscopic aspect of reality, he never says that sense experience is per se a mistake. “When the bastard can do no more – neither see more minutely, nor hear, nor smell, nor taste, nor perceive by touch – and a finer investigation is needed, then the genuine comes in” (*Democritus* no. 11 in Freeman 1977, 93). Intellection begins where physical sensation ends. The latter is relative to the observer, but it is not purely subjective because it has an objective basis: the aggregate matter produced by the structure of atoms. Sense perception for Kanada and Democritus is a source (*pramana*) of valid knowledge and not of belief (*doxa*), despite being limited and inferior to the intellect. Like Democritus, Kanada considers sense impressions as the result of physical contact between the sense organs and their proper objects, and that “perception is possible only of aggregates” (V.S. IV.1.6). Intelligence or consciousness is not an inherent quality of the soul for Kanada, because the soul needs the body in the process of cognition. The soul is not the mind (*manas*) which is merely an inner sense that serves as the organ of internal perception. Neither is the soul identifiable with the stream of consciousness for the latter is only a quality that inheres in the soul (the soul being its substratum). The reality of the soul is proven by inference. “Cognition of senses and their objects is the mark of the existence of something other than senses and their objects” (V.S. III.1.2). Cognition takes place

²⁴ “In general, color is supposed to be among the conditions of the visibility of a substance. This seems to imply that an object is visible insofar as it is colored, and that there is no room for the perception of a substance apart from its color. On the other hand, there is the unquestioned premise that the substance itself appears in and through the colored phenomenon.” (Halbfass 1993, 99)

by the use of the senses, but being mere instruments, it follows that they must be employed by a subject. That in which universal cognition resides and which employs sense organs is the soul or *atman*. *Manas* – the central processor of sensory data, is immaterial but atomic. Like other dualists, Kanada has difficulty explaining the relationship between the immaterial soul (*atman*) and the *manas*.²⁵ For Democritus who is a consistent materialist and who conceives the soul as both atomic and material, mediation between the soul and sense objects is unnecessary.²⁶ Both philosophers agree, nonetheless, that the human person is capable of knowing the truth.

Unfortunately, the limited Democritean fragments that we have contain little information to formulate a coherent theory of cognition.²⁷ Basing on the reports of Theophrastus, Democritus presents two types of explanation regarding the nature of sense perception. One is on the basis of geometrical properties that the atoms have that generate different flavors, and another which considers the effect of the contact between our sense organs and the physical aggregates. Both explanations cover the subjective and the objective components of sense knowledge. The two cannot be separated, but Democritus is not clear on how the two are exactly related. It appears that Democritus does not only highlight the subjective component of some of our sense perceptions, but also rejects the reductive account of the latter on the grounds that flavor, color, or heat are affectations of our sense organs. Fragment 589 states; “In reality we apprehend nothing exactly, but only as it changes according to the condition of our body and of the things that impinge on or offer resistance to it” (Kirk and Raven 1957, 422). For instance, honey may taste sweet to a healthy person or may be bitter to a sick one, but honey per se is neither sweet nor bitter for “in truth, only atoms and the void exist.” Sense qualities are not objective realities, not in the microscopic level because atoms do not have qualities, nor in the macroscopic level because they are the products of the interaction between sense organs and the compound. But does this imply that sense qualities are mere mental states?

Kanada cannot hold that sense experiences are mere subjective impressions or physiological conditions. His substance-quality framework establishes sense qualities as objective features of the external world. Each substance is endowed with *visesaguna* and connected to a specific sense organ. There exists as well a correlation between the basic material elements and the qualities perceived by the senses for each sense organ is made up of the type of atom which has the quality that serves as the proper object of the particular organ (V.S. IV.2.8-13). The *manas* mediates between the soul and the object of knowledge by systematizing sense data and focusing the attention of the knower to one or several qualities of the object, but intellectual knowledge is ultimately the act of the soul. Even if sensation is conceived by Kanada as a process that involves specific physiological mechanisms of some sort, he does not regard sense qualities as belonging exclusively to the purely phenomenal sphere without any

²⁵ There appears to be a threefold distinction in Kanada between *atman*, *manas*, and the material body, hence he is sometimes characterized as a ‘trialist’ as opposed to ‘dualist.’ He is a dualist however, in so far as distinguishes immaterial from material substances.

²⁶ “The Greek word we used to translate ‘soul’ or ‘mind’ *psukhe*, was often conceived as having importantly material component, if not basis, and was indeed taken by Democritus to be entirely material” (Cartledge 1999, 11).

²⁷ Curd’s (2011) article “New Work on the Presocratics” does not contain any new information or discovery regarding the Democritean fragments.

objective basis. By comparison, Democritus' opposition to reductive approach is inadequate. It does not illuminate his position regarding the nature of sense perception. While physiological differences may be the explanatory cause of variations with regard to our sense observation or disagreements between two or more people concerning a particular sense experience such as the taste of honey, they cannot be the causal explanation for the existence of sense qualities themselves. Disagreements regarding sense observation could be resolved by appealing to some objective standards. Thus, these phenomena cannot disprove the claim of Kanada that sense qualities exist in reality.

THE INDIVISIBILITY OF ATOMS

The early atomic views of India and Greece are constructed on the same logical basis: matter which is extended and divisible cannot be divided infinitely, for anything that is finite and composite must be limited. According to Democritus, if we divide an object repeatedly, we will reach a point when the remaining particle cannot be divided. This is similar to the position of Kanada who claims that if compound objects can be infinitely divided, there would be no difference in size between a sewing needle and a kettle, both of which would be composed of infinite parts. Atoms are imperceptible since they have the minima of magnitude and yet, they have real existence independent of human experience. There are varying scholarly opinions on whether the atoms of Democritus and Kanada are indivisible theoretically or physically. This is because in both traditions, atoms are described as spatial entities having size and shape (V. S. VII.1.20 describes *paramanus* as round or spherical), which imply mathematical or theoretical divisibility.²⁸ Some authors claim that the *paramanus* of Kanada and the atoms of Democritus are not physical particles but mere abstractions, analogous to extensionless mathematical points.²⁹ Referring to Democritus, Godfrey (1990, 212) writes:

It seems unlikely that such a man would cheerfully hold that his atoms could have shape without having parts and without having magnitude. The different shapes of atoms were a major part of his physical theory, which makes it difficult to see how he could have held that they were partless and thus mathematically indivisible.

But if atoms/*paramanus* lack extension, we will have to “admit the paradoxical position that magnitudes are built up of what has no magnitude, bodies out of the bodyless” (Radhakrishnan 1969, 195). In the specific case of Vaisesika, if atoms are theoretical abstractions without qualities, the sensible qualities of compound objects cannot be reduced to their constitution at the atomic level, which is essential for Kanada in order to maintain the proposition that the observable qualities are the causes of our sense experience and are real features of the external world.

²⁸ That *paramanus* are infinitesimal substances, see Chakrabarty (2003, 23) and Villaba (1996, 42-43).

²⁹ “According to Chatterji, the *paramanus* are not atoms in the Vaisesika system; they should not be translated into English as ‘atoms’. The reason he adduces for this rare viewpoint is that the *paramanus* have no magnitude, whereas ‘Western atoms’ do”. D.H.H. Ingalls, on the other hand, has pointed out that the *paramanus* do have qualities of the visible substances.” (Puligandla 2007, 161).

The early Greek atomist does not explicitly distinguish different kinds of divisibility.³⁰ Atoms are indivisible, not only because of their minuteness, but because they contain no empty space or void, i.e. they are compact and have no parts. “Except that Leucippus and Democritus told that the cause of the primary bodies’ indivisibility is not only their inability to be affected but also their minuteness and lack of parts”(DK 67A13 in Mckirahan 2010, 309). Chapter VII of *Vaisesika Sutra* speaks of immaterial and non-atomic substances like *akasa*, time, soul, and spatial coordinates (*dik*) as having magnitude, and distinguishes eternal and non-eternal extensions.³¹ Extreme largeness and minuteness are super-sensible and eternal. Even if the atoms are mathematically divisible on account of their magnitude, it does not follow that they are so in a physical sense, for they may be physically indivisible for some other reason, such as having no empty space in them, and as such they are partless and solid wholes. Conversely, compounds are divisible in fact and in theory not only because they are extended, but also because they contain empty spaces between their constituent parts. Hence, it is not extension per se that makes something physically divisible. In both doctrines, physical divisibility is possible only in the macroscopic realm where gross matter is observed, not in the microscopic realm of atoms. The ultimate constituents of things, as they are, independent of our perception, are partless and indivisible. The question of whether atoms are physically divisible is misplaced, for divisibility is not a property of what is real per se, it is observed only in compound matter by a perceiving subject. The impossibility of infinite divisibility is used only to infer the very existence of the atom but the indivisibility of the latter is based on its own nature. Since we do not have a direct perception of atoms, we can only speak of their indivisibility in a theoretical sense. Moreover, the reason why the two atomists claim that a physical object is not infinitely divisible is that since they separate entities by the void or *akasa*, to argue otherwise is to admit the existence of void in the atoms. “Now, if the atoms could themselves, by the the presence or introduction of void, be or become pluralities, then there would be no firm unit to be found which could not be or become plurality by division” (Stokes 1971, 229). The void would then be the ultimate constitution of matter and this would turn the sensuous macroscopic world into a mere “shadow” or manifestation of the void, rather than an effect.³²

³⁰ “Democritus held, and was prepared to argue, that his atoms, being not only too small to be divided physically but also logically indivisible. To suppose otherwise would admit the principle of infinite divisibility, which to Democritus was inconceivable” (Guthrie 1965, 396).

³¹ Sankara Misra’s commentary on the chapter explains the different kinds of extension: “This Measure or Extension is of four kinds, namely, Largeness, Smallness, Length, and Shortness. Of these, extreme largeness and extreme length exist in the four universals (i. e., Space, Time, Ether, and Soul); extreme smallness and extreme shortness exist in the ultimate atoms ; the next (higher) degree of smallness and shortness exists in binary atomic aggregates; largeness and length exist in substances from tertiary atomic aggregates upwards to composite wholes (or compound bodies as they exist in nature). In this manner, all substances whatever possess two Measures or Extensions” (Sinha 1923, 203).

³² “Another characteristic doctrine of the Vaisesika is its Arambhavada: the doctrine, namely, that the world as an effect, is not a mere appearance (*vivarta*) of the cause, nor an evolution (*parinama*) of the cause, but is produced by aggregation of the cause which is the ultimate atoms. And this leads to the doctrine of *Asat-karya-vada*, that is; that an effect has only a temporary existence, and that, before its production, and, after its destruction, it is non-existent” (Sinha 1923, 6).

ETERNAL CYCLE

Because atoms are eternal, there will never be a time when all things are completely annihilated. From the integration, disintegration, and reintegration of these ultimate particles, the universe evolves and innumerable worlds are produced. Atoms are in a state of constant motion according to Democritus and in their motion, some atoms formed conglomeration that gave rise to a spatially and temporally limited world-system or *kosmos*.³³ Democritus posits the possibility of innumerable worlds that come to be and perish at different times. Fragment 562 in Kirk and Raven (1957, 410) states:

Hence arises innumerable worlds, and are resolved again into these elements. The worlds come into being as follows: many bodies of all sorts move “by abscission from the infinite” into a great void, they come together there and produce a single whirl, in which colliding with one another and revolving in all manner of ways, they begin to separate apart, like to like.

In a similar manner, the cosmic processes of production and dissolution/rest and movement follow an endless cycle for Kanada. Neither creation from absolute nothingness nor ultimate annihilation is possible. Whereas the Greek atomism affirms the reality of innumerable *kosmoi* that exist simultaneously and are randomly scattered in the void, Vaisesika claims that the world as the collective totality of atoms undergoes a cycle of construction and destruction. In other words, there are also innumerable worlds for Kanada, but they exist successively.³⁴ One can observe that the notion of eternal cycle is a logical consequence of the atomic cosmology itself. The production of a new entity is the result of the recombination of previously existing basic realities. As there is no theoretical limit to the number of combinations they can produce, the present world is just one of the many possible world systems that could exist. It is also an implication of the Parmenidean principle that has its counterpart in *Chandogya Upanishad* (VI.1-13) – being (*sat*) cannot come from non-being (*asat*). Every beginning involves an antecedent non-existence and every end, a consequent non-existence. But what does not exist in the beginning and in the end does not necessarily exist in the middle. This implies that presently existing things that come into being (i.e. contingent) will not have a sufficient reason to exist. Atomism solves this difficulty by arguing that the world undergoes a cycle of creation and annihilation, it has no beginning or end. One cannot speak of an ultimate beginning *ex-nihilo* since every beginning would have a precedent. There is no question as to why things started to exist because in the final analysis, the world has always been existing vis-a-vis the omnipresence of physical change.

³³ Democritus uses the principle of synonymy to explain the origin of *kosmos* or world-system. The account given by Diogenes Laertus regarding Democritean cosmology states that in the beginning the world system is formed as atoms moved and interacted in diverse ways, some of them were segregated from the the rest, like to like, forming a kind of vortex. “When they are no longer able to rotate in equilibrium, the fine ones depart into the void outside as if sifted, the rest remain together, become entangled, move together in unison, and form a first spherical complex” (Mckirahan 2010, 324).

³⁴ The early Ionian philosophers posit a plurality of *kosmoi* succeeding one another in time, which is consistent with the view of Kanada.

CONCLUSION

The fundamental questions raised by Kanada and Democritus regarding the nature of void and cosmic evolution, the behavior and characteristics of infinitesimal units, and the possibility of innumerable and parallel *kosmoi* continue to inhabit the minds of contemporary physicists. Centuries before Newton proposed the concept of absolute space, the Indian and the Greek atomists had already arrived at the notion of a cosmic vacuum that is singular (in its own nature), homogenous, immobile, and uncreated. Because of their pluralistic tendencies, emphasis on causality, their materialistic account of sense knowledge and the attempt to explain the physical system by means of reduction to the configuration of its constitutive elements, both philosophers present an epistemological base that could accommodate scientific inquiry. The emergence of early philosophical atomism in India and Greece is a significant manifestation of proto-scientific thinking, and probably the greatest attempt of the early pioneers of rational thought to solve the problem of the one and the many.

Like most philosophical theories, those of Kanada and Democritus are beset with a number of difficulties, but our comparative analysis shows that the explanatory gaps in each of them could be filled in by appealing to the tenets of the other. The Indian views on *akasa*, *abhava*, and causality supplement the meager discussion of these concepts in the existing Democritean fragments. They can be integrated into the atomism of Democritus without contradicting the latter's basic premises. The different *darsanas* in Indian Philosophy have distinct views on the nature of *akasa* and causality depending on their own ontologies. It must be the lively debates and exchange of ideas among these schools that led Kanada to articulate a more sophisticated notion of *akasa*, *abhava*, and causality, compared to Democritus who is nonetheless, the first Presocratic to admit the existence of the void and to suggest a non-identity (*asatkaryavada*) view of causation which is akin to the empiricist notion of causality adapted by modern science. Both philosophers work out a materialistic theory of knowledge, but with his substance-quality paradigm and a more detailed treatment of the topic, Kanada develops an epistemological realism that complements the incomplete views on knowledge by Democritus. The pluralism of the former goes further than that of Democritus through his exhaustive analysis and enumeration of *padarthas*. Since the Democritean atoms are active and eternal units that constitute all things but are not constituted, Kanada's notion of substance (sans sense qualities except shapes and sizes) can be attributed to them.

A weak point in Vaisesika's atomism is how to explain the conjunction of atoms. This is because compared to Democritus who conceives the void both as a separator and a common space for the movement of all atoms, Kanada is unclear concerning the relationship between the *akasa* and the atoms. Perhaps, the latter does not see the need to give an account on how contact between atoms happens, for such is always possible since they are all contained in singular space. With its consistent materialistic worldview, Greek atomism drew a demarcation line between spirit and matter, and its understanding of matter as that which is extended, spatial, and mechanical, continued to influence the thinking of physicists until the early 20th century (Capra 1991, 21). The Greek atomist departed from any supernatural or hylozoist interpretation of motion, abandoned a teleological worldview, and found no reason to posit the existence of a prime mover. If all events in the physical world are determined by the movements of atoms, then the whole universe is governed by the law of causality. Contrary to Democritus, Kanada posits

the existence of non-compound imperceptible substances in addition to atoms. His inclusion of non-material substances and his acceptance of immaterial entities such as *samsara*, *moksha*, *dharma/adharma*, and *adrsta* made his philosophy distinct from the materialistic pluralism of Democritus and prevented him from conceiving the universe in a purely mechanistic way. Reliance on an *unseen* (supernatural) force as the cause of unexplained phenomena discourages further effort to rationally discover a natural cause.

POSTSCRIPT

Interest in atomism by the ancient Greeks gradually diminished on account of Aristotle's unrelenting critique of the theory and the influence of his own hylemorphic doctrine. But the "legacy of Greek atomic theory was received and transformed by Islamic thinkers in the middle ages, who in turn bequeathed knowledge of the doctrine to the west, and influenced the revival of atomism in the renaissance" (Konstan 1982, 60).

According to Puligandla (2007, 157), "Vaisesika originated as an unorthodox (non-Vedic) system but eventually turned orthodox by accepting the authority of the Vedas on certain matters." While this contention has been challenged by recent scholarship on the subject, a salient feature of most Indian *darsanas* is that they became more theistic as they evolved. There is some evidence that Kanada was not a theist. But while there is no explicit mention of god in his sutra, it begins and ends with the affirmation of the authority of the Vedas. Efforts were made by the later adherents of Vaisesika to assimilate *Shaivism* and the worship of *Isvara* in the system. Upon its merger with the Nyaya school, the epistemology of Kanada was expanded to include verbal testimony as a means to obtain valid knowledge, and the emphasis of the system shifted to the logical defense of its main tenets, without abandoning its original cosmological and physicalistic orientation. Followers of the syncretic Nyaya-Vaisesika propounded logical proofs for theses that were not taught by Kanada, such as proofs for the eternity of the Vedas and the existence of God, the latter being based on the argument that as an unintelligent force, *adrsta* needs an intelligent being as a controller and supervisor in order to give a full account of the orderly and rhythmic movements of natural events.³⁵ Eventually, moral principles were integrated to its atomic account of material composition and decomposition. The theistic orientation of the succeeding Indian atomists resulted in an eschatological and teleological view of cosmic evolution. These internal and external limitations, relative to Greek atomism, are the

³⁵ After the completion of each cosmic cycle, *Isvara*, in his merciful desire to give rest to all struggling souls who cannot be released by the chain of karma, suspends the function of *adrsta*. After the release of all bounded *atmans*, *Isvara* will set the cosmos in motion once again through the unseen power, for the sake of the experience to be gained by all sentient beings. "The *Vaisesikasutra* does not state that the unseen power behind such phenomena as the upward flaming of fire and the retributive power of past deeds stored in the soul are identical nor does it state that they are different. We do not know when the identity, which is taken for granted by Prasastapada and later Vaisesika, was first established in an explicit and definite manner." (Halbfass 1991, 312-313)

principal reasons why Vaisesika failed to establish a coherent and consistent naturalist tradition in Indian thought.

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