A Continuation of Atomism: Shahrastānī on the Atom and Continuity

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A Continuation of Atomism: Shahrastānī on the Atom and Continuity

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ABSTRACT The present study investigates the atomism of Muḥammad ibn ʿAbd al-Karīm al-Shahrastānī (c. 1075–1153). After a survey of traditional Islamic atomism and Avicenna's devastating critique of it, I argue that Shahrastānī developed a new form of atomism in light of Avicenna's critique. Briefly, unlike earlier forms of atomism, which viewed atoms as actualized and discrete entities within the body, Shahrastānī's atoms have possible existence within the body, which is actualized only when separated from the whole. What makes this position particularly interesting is how Shahrastānī exploits and incorporates elements of Avicenna's own theories of the continua and natural minima into a new theory of the atom.

KEYWORDS Shahrastānī, Avicenna, atomism, continuity, *kalām*, natural minimums, *minima naturalia*

1. INTRODUCTION

WHILE IT SHOULD GO WITHOUT SAYING, it bears mentioning: the history of atomism in the medieval Islamic East is not the same as that of the medieval Christian West. One simply cannot assume that what is true of the conception of the atom in the West also need be true of the conception of the atom in the East, or even that the two traditions are drawing upon and responding to the same set of literature. In fact, the question is open as to whether these two histories even share a common origin. While there certainly is a presumption that the history of Islamic atomism is a continuation of Greek atomism, this remains very much a presumption. Indeed, Shlomo Pines, in his groundbreaking *Beiträge zur islamischen Atomenlehre*, suggests Indian atomism as a possible source for Islamic atomism, and more recently, Josef van Ess argues for an ancient Iranian source.[1] Moreover,

[1]Pines, *Beiträge zur islamischen Atomenlehre*, esp. ch. 3; and van Ess, "60 Years After," esp. § "The System in Its Historical Environment." I am extremely grateful to Hinrich Biesterfeldt for drawing my attention to van Ess's article.

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unlike in the medieval Christian West, very early atomism in the medieval Islamic East becomes the majority position. Muslim theologians (*mutakallimūn*) press it into service to answer and to address a host of new and technical scientific, philosophical, and theological questions and issues as they arise. Despite its prominence, Neoplatonized Aristotelians (*falāsifa*) working in medieval Islamic lands subject Islamic atomism to intense criticism and attack, which leads to another point of divergence between these two histories of atomism. While it is true that the works of Aristotle, pseudo-Aristotle, and the Hellenistic commentary tradition on Aristotle provide the historical basis for criticism of Islamic atomism, Islamic atomists rarely, if ever, directly respond to this Greek tradition, certainly not after 1000. Instead, they respond to the criticisms of Ibn Sīnā, the Avicenna of Latin fame (980–1037), who adapts and augments his Greek sources to meet the new and even unique elements of Islamic atomism.[2] As a result of the new contexts in which medieval Islamic atomism is employed and the constant criticism it receives, atomism in the Islamic East becomes highly sophisticated and adaptable. In fact, it might be best to speak of 'atomisms' rather than the singular 'atomism,' since different thinkers developed at times widely different atomic theories to address the various challenges.

One such thinker is the Persian theologian and historian of religion, Tāj al-Dīn Abū l-Fatḥ Muḥammad ibn 'Abd al-Karīm al-Shahrastānī (c. 1075–1153).[3] Shahrastānī comes after his fellow Persian Avicenna, the latter of whom was among the harshest critics of the atomism of his day, vigorously attacking it in a number of works.[4] Shahrastānī is also heir to the work on atomism by Imām al-Ḥaramayn al-Jūwaynī (1028–1085), one of the leading Muslim theologians of his time and teacher of the great critic of Graeco-Arabic philosophy, al-Ghazālī (1058–1111). In the shadow of these towering figures of Islamic intellectual history, Shahrastānī develops a new theory of atomism that not only draws upon the most sophisticated atomic theories of Muslim theologians of his time but also one that is adapted to developments arising from the Neoplatonized-Aristotelians of the Islamic world, both responding to their criticisms and assimilating their innovations (or so I argue).

Toward making good on the claim that Shahrastānī is important in the development of post-Avicennan atomism in the Islamicate world and indeed the history of atomism more generally, I dedicate two sections to the historical

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[2]John Murdoch mentions al-Ghazālī's *Metaphysica* (*Maqāṣid al-falāsifa*) as a source for fourteenth-century Latin thinkers' knowledge of Avicenna's criticisms against atomism ("Beyond Aristotle," 19). Another, arguably more important source, is Avicenna himself, namely, tractatus three of his *Liber Primus Naturalium*, which was available in Latin translation probably between 1275 and 1280; see *Avicenna Latinus*, 2*–3*. The *Avicenna Latinus* includes not only the geometrical arguments against atomism (Avicenna, *Physics* 3.4 [5]), which Murdoch mentioned, but also the rolling sphere argument and horn argument for atomism (Avicenna, *Physics* 3.3 [10–11]), the latter of which Murdoch considered a new element in fourteenth-century Latin discussions ("Beyond Aristotle," 35–38).

[3]The sources give Shahrastānī's birth year as 1074, 1076, and as late as 1086.

[4]See Avicenna, *Physics*, Book III, Chapters 3–5; *Psychology*, Book V, Chapter 2, Page 211; *The Metaphysics*, Book II, Chapter 2, Sections 14–17; *Salvation* Part IV (On physics) Treatise 1, Section 2, "On the Substantiation of bodies"; and *Pointers and Reminders*, *Namaṭ* I, Sections 1–5. The citation from these works are from the book (or in one case *namaṭ*), chapter, and sections of the editions cited in the bibliography.

and philosophical background against which Shahrastānī develops his theory of atomism. This historical context begins in section 2 with a brief overview of what we might call 'traditional *kalām* atomism.' In section 3, I turn to Avicenna's criticism of traditional *kalām* atomism as well as Avicennan innovations in the understanding of continuity (*ittiṣāl*) and a theory of natural minima, which I argue that Shahrastānī adopts for his own purposes.

In section 4, I provide a reconstruction of Shahrastānī's unique theory of atomism, which is best understood in contrast with traditional *kalām* atomism. In very general terms, and as a first pass, traditional *kalām* atomism maintains that there is some physically and conceptually minimal unit of magnitude: the atom. Additionally, *kalām* atomism maintains that when a finite number of these atoms are combined or aggregated so as to form a body, they continue to exist within the body fully in actuality (*bi-l-fi'l*) as discrete, articulated units (sg. *mafṣil*). In contrast, for Shahrastānī, while there is some physically and conceptually minimal unit of magnitude, namely, the atom, the atom exists in actuality only when taken in isolation; that is, literally separated physically from a given body. When combined or aggregated into a body, Shahrastānī's atoms form a continuous whole with the atoms having merely a possible existence within the body. This way of thinking of the atom is radically new and, as I hope to show, it involves merging elements from traditional *kalām* atomism with Avicenna's theory of the continuum and natural minima. I conclude very briefly by suggesting how Shahrastānī's atomism may have influenced Fakhr al-Dīn al-Rāzī (1149–1210), who is certainly one of the major framers of and contributors to post-classical Islamic theology and philosophy.

2. TRADITIONAL *KALĀM* ATOMISM

Traditional *kalām* atomism should be contrasted with Greek atomism.[5] Greek atomists view accidental properties, like color, taste, and the like, as emergent properties that arise from the combination and interaction of atoms. As such, accidents are not part of the Greek atomists' fundamental ontology, which instead consists solely of atoms (or minimal parts) and the void. In contrast, for traditional *kalām* atomists, accidents are an indispensable part of their most basic ontology, which precisely involves atoms and accidents.[6] While there is nothing like a monolithic theory of either the atom or accidents, which all practitioners of *kalām* accept in every detail, there are general trends that provide one with the flavor of *kalām* atomism prior to Shahrastānī.[7] Since this study concerns primarily the atom, let me just quickly sketch some of these trends with respect to accidents and then turn to the atom in more detail.

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[5]There are a number of excellent studies of Islamic atomism. These include the now classic Shlomo Pines, *Beiträge*; Harry A. Wolfson, *The Philosophy of the Kalām*, ch. VI; Carmela Baffioni, *Atomismo*; Richard Frank, "Bodies and Atoms"; Alnoor Dhanani, *The Physical Theory of Kalām* as well as his articles, "Kalām Atoms" and "Problems"; van Ess, "60 Years after"; and A. I. Sabra, "*Kalām* Atomism."

[6]Muslim theologians from Basra additionally include void in their ontology, whereas their critics in Baghdad argue that since void is supposedly nothing, it is just that, nothing, and so does not exist and so cannot be included among the most fundamental *existents* that make up the physical world. See Dhanani, *Physical Theory of Kalām*, 74–89; cf. Avicenna, *Physics*, II.8 [1], who raises the same objection.

[7]Unfortunately, Shahrastānī does not include a discussion of *kalām* atomists in his doxography (*K. al-Milal wa-l-niḥal*), where he preserves the key views of various *mutakallimūn*, and his comments about *kalām* atomism are only in passing and never more than a single sentence, if that, for the various thinkers.

The Arabic term for 'accident,' *'araḍ*, comes from the verb meaning, 'to happen,' 'to occur,' or 'to presents itself,' and thus an accident is literally what is happening, occurring, or presenting itself. In this respect, the mutakalimūn's *'araḍ* is not identical with the Aristotelian *sumbebēkos*; rather, an *'araḍ* is the aspect under which something presents itself or appears at all.[8] While it is true that *kalām* accidents contingently befall the atom, it would be false to think that an atom could be devoid of all accidents. *Kalām* accidents are what give the atom whatever positive reality that it has at any given moment, and so in the absence of any accident, an atom simply ceases to exist and is nothing (or virtually nothing).[9] In other words, for the mutakallimūn, an atom is essentially dependent for its very existence on the accidents that occur in or at it.[10] There was no consensus about what the basic list of accidents is, although some of the common suspects include color, taste, odors, sound, and tangible properties like hot-cold, wet-dry, and even more complex vital and psychological properties like life, pain, desire, will, and reason.[11] For the purposes of this study, the most important accident is aggregation or cohesion (*ta'līf*).[12]

According to *kalām* atomists, the atom is *not* a body (*jism* or *jirm*); rather, it is both a limit of body and a part (*juz'*) that makes up a body.[13] Body, then, is an aggregation of atoms (although the exact minimum number of atoms required to form a body was a matter of dispute). The accident of aggregation, then, is what makes some given set of atoms *this body*, for example, the set of Socrates-wise atoms. It allows one to identify this set of atoms as a coordinated whole, unlike just any random set of a contiguous but otherwise unrelated atoms such as the gerrymandered mereological sum of atoms making up the air immediately above Socrates's head, Socrates's right side, the section of the couch on which he is sitting, and the floor immediately under his feet. What is important to note is that,

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[8]See van Ess, "60 Years after," 27–28.

[9]I say, "or virtually nothing," since an atom without any accident might be thought of as void space, which seems to be the view of certain Basrian theologians, but void space was thought to be nothing (see n. 6).

[10]For some *kalām* atomists, like Dirār ibn 'Amr or Abū l-Hudhayl, there literally is nothing until God creates accidents, in which case the atomic space in which the accident occurs comes to exist as a concomitant of the accidents, and correspondingly ceases to exist when the accident ceases.

Additionally, for some theologians an accident cannot last from one instant (*waqt*) to the next. Thus, God re-creates the accidents at every single instant anew, a view that entails a thoroughgoing occasionalism. Other theologians, however, allow that God might create in an atom or set of atoms the accident of persistence (*baqā'*) by which the atom or set of atoms and their other accompanying accidents persist for longer than an instant. Among this group some maintain that at each instant God still continually re-recreates the accident of persistence by which the atom and other accidents persist, while others maintain that the accident of persistence itself persists until God creates in the atom or set of atoms the accident of cessation (*fanā'*). See Wolfson, *Philosophy of the Kalām*, 522–44, and Dhanani, *Physical Theory of Kalām*, 43–47, for discussions of persistence (or duration) and cessation (or destruction).

[11]See Dhanani, *Physical Theory of Kalām*, 16, which includes the list from Ibn Mattawayh, 38–43.

[12]For a discussion of aggregation, see Dhanani, *Physical Theory of Kalām*, 152–59, who discusses it in terms of 'adhesion.'

[13]While 'part' is the standard translation of *juz'* in all the literature, and so is adopted here, one should not mistakenly think that since an atom is a *part* of a body, it must be a body. The notion of *juz'* should be thought of as more like a constituent. It is in this sense that Avicenna on occasion refers to form and matter as *parts* of the body.

for traditional *kalām* atomism, even when contiguous atoms are aggregated, they remain distinct from one another and do not form a continuous whole. In this respect, the atoms that make up a body are like the individual cards that make up a deck of playing cards, or even like the squares on a chess board. They exist in actuality (*bi-l-fi'l*) and as discrete entities within the body.

As for the nature of the *kalām* atom (*al-juz' alladhī lā yatajazza'u*, literally, "the part that cannot be parted," and *al-jawhar al-fard*, literally, "the individual substance"), its defining trait is that it is *mutaḥayyiz*, a term that the theologian Abū Hāshim al-Jubbā'ī (861–933) supposedly coined specifically to describe the atom.[14] *Mutaḥayyiz* in the technical vocabulary of the *kalām* is understood to mean "space occupying" or even "occupiable space." More precisely, the atom is the minimal amount of space in which there is the appearance or occurrence of any of the accidents. Despite being some (indivisible) minimal or non-zero amount of spatial magnitude, the mutakallimūn again insist that the atom is *not* itself a body; rather, the atom is a part from which body is composed or aggregated.[15]

It is worth noting that an atom, understood as *mutaḥayyiz*, might refer to an (non-corporeal) entity that exists in and moves through space, and thus is distinct from the space that it occupies. Alternatively, atom as *mutaḥayyiz* might refer to what constitutes space itself, in which case space itself is the collection, set, or mereological sum of atoms. On such a view, the cosmos would be the physical instantiation of Cartesian space with the set of all atoms representing the set of all coordinates. Both accounts—movable atoms and space-constituting atoms—seem to have been prevalent among *kalām* atomists.

Additionally, the *kalām* atom is purportedly both physically and conceptually indivisible. The idea that the atom is physically indivisible is easy enough to grasp: there simply are no physical means, whatever they might be, by which an atom can be separated or fragmented or partitioned such that the result is two new distinct parts. The idea that the atom is conceptually indivisible is more difficult to grasp, but, in general, it is the suggestion that it is impossible to distinguish any smaller parts within the atom, which would then be something smaller than the smallest conceivable thing. Again, despite being conceptually indivisible, the mutakallimūn considered the atom to involve some minimal, non-zero unit of magnitude and three dimensions.[16]

One argument presented for the conceptual indivisibility of the atom, which in a simplified form Aristotle ascribes to Democritus, and in its *kalām* form, Abū

[14]See Dhanani, "Kalām Atoms."

[15]One might think that if the atom is space-occupying or even occupy-able space, and so three-dimensional, it also must be a body, whether physical or mathematical. While such a view may be true on an Aristotelian or Avicennan conception of body, it nonetheless begs the question against the *kalām* definition of body in terms of aggregation. For discussions of three-dimensionality, space, and body in medieval Islam, see Jon McGinnis "A Penetrating Question"; John Walbridge, "Illuminationist, Place, and the Void"; and Peter Adamson, "Fakhr al-Dīn al-Rāzī on Place."

[16]The atom's dimensions may merely mean that it has an up-down orientation, a front-back orientation, and a left-right orientation. For Avicenna's criticism of the mutakallimūn's conception of dimensions, see *Physics*, 3.13.

al-Hudhayl (ca. 752–ca. 842) probably is the author, is the following:[17] if body is continuous, then it is possible, at least conceptually, to divide the body infinitely as in the process of taking 1/2 and then 1/2 again and so on without end. Next, according to the theologians, if there is a possibility (*istiṭā'a*) to do *x*, then there must exist some power (*qudra*) that can in fact do *x*, for instance, the infinite power of God. Thus, let God divide a body at all of its possible divisions. What results from such a division would be either an infinity of parts that have no—that is, zero—spatial magnitude or an infinity of parts that have some positive spatial magnitude, that is, are *mutaḥayyiz*. If the parts have no spatial magnitude, then the aggregation of those parts itself has no magnitude; the sum of adding even an infinity of 0s remains 0. Of course, body does have magnitude. Thus, it must be an aggregation of parts that have some positive spatial magnitude. If the resulting parts have some spatial magnitude and are infinite, then any body would be infinite in magnitude, which again is clearly false. Thus, conclude the theologians, body must be an aggregate of a finite number of indivisible, space-occupying parts, and those parts just are the atoms.

To conclude this section, the important features of the *kalām* atom are that it either is possessed of or occupies some minimal amount of space and that the atom and the minimal amount of occupiable space are not divisible, whether by physical or conceptual means. Moreover, despite the atom's three-dimensionality, it is not a body; rather, it is the minimal part from which body is composed.[18] Finally, when a body is aggregated from some set of atoms, those atoms exist in actuality within the body as discrete parts. It is this understanding of the atom that Avicenna attacks and to which I now turn.

3. AVICENNA ON ATOMS, CONTINUITY, AND NATURAL MINIMA

Avicenna is a watershed in the Islamic East. Indeed, after him medieval Muslim scholars in the East rarely read Aristotle and Hellenistic sources (save perhaps as historical artifacts), but instead find their inspiration or sparring partner in Avicenna and his system. Thus, it would be difficult to overestimate the impact of Avicenna's influence on *kalām* atomism, both negatively by way of his criticisms and positively by way of the doctrines that he develops and clarifies, and which later atomists could exploit. In this section, I begin by looking at Avicenna's explicit negative and critical project and the two classes of arguments that he uses to critique atomism: one class appeals to physical premises and the other to mathematical ones. I then turn to what I hope to show is Avicenna's positive contribution to the history of atomism. Specifically, I consider his understanding of continuity and natural minima.

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[17]Aristotle, *On Generation and Corruption* I.2, 316a13–b16; for the kalām version see Dhanani, *Physical Theory of Kalām*, 152–59. Shahrastānī presents the argument as well at *Nihāyat al-Aqdām*, 505–6. Citation are to Alfred Guillaume's edition by Oxford.

[18]In this respect, the *kalām* view of the atom is not unlike that of Epicurus's account of a minimal part (although whether Epicurus's thought is the immediate source of *kalām* atomism is again an open question). See David Furley, *Two Studies*, Study I, for Epicurus view; and Dhanani, "Kalām Atoms," for a comparison of the two accounts.

Avicenna criticizes atomism in all of his major philosophical encyclopedias.[19] Very early on in his critique, Avicenna concedes that there may be bodies for which there are no physical means to divide them.[20] In fact, his entire celestial physics relies on celestial bodies' being physically indivisible, and even in the terrestrial realm, he acknowledges natural minima, which cannot be physically divided further and still remain the same kind of body.[21] As a result of this concession, Avicenna focuses on the idea that atoms are, supposedly, conceptually indivisible, which in his technical vocabulary means that the estimative faculty (*wahm*) should not even be able to imagine divisions within the atom.[22]

In his excellent study of the impact of Avicenna's critique of atomism, Alnoor Dhanani identifies nine distinct arguments to which Avicenna appeals when attacking the conceptual indivisibility of the atom.[23] These arguments in turn may be classified again into physical- and mathematical-style arguments. The general strategy is the same for both sets of arguments: identify some phenomenon and indicate how that phenomenon and conceptually indivisible atoms require that one abandon some deep-seated physical intuition or some well-established mathematical theorem. Two examples should make Avicenna's strategy clear.

Let me begin with the mathematical-style arguments. In general, this form of argument appeals to problems of incommensurable magnitudes and shows how traditional *kalām* atomism is incompatible with various theorems of Euclidean geometry. [24] In one instance, Avicenna has one describe a right triangle on some portion of atomic space.[25] It is important to recall that, for the traditional *kalām* atomist, the atomic units that make up atomic space are discrete and exist as fully actualized. Consequently, atomic space is conceived on the model of a three-dimensional coordinate system, not unlike how a chessboard can be seen as dividing up two-dimensional space. Given this setup, imagine, for example, a 10x10 square of such space. One or another of two unsavory consequences confronts the atomist. On the one hand, the legs of the triangle and the hypotenuse all might be 10 units, in which case there is a clear violation of the Pythagorean Theorem.

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[19]See Avicenna, *Physics*, III.3–5; *Salvation* IV.1.2, "On the Substantiation of bodies"; and *Pointers and Reminders, namaṭ* I.1–5. Studies include Paul Lettinck, "Ibn Sīnā on Atomism"; and Dhanani, "Impact."

[20]Avicenna, *Physics*, III.3 [1].

[21]See Avicenna, *De caelo*, ch. 4, where he argues that celestial bodies are not subject to penetration (*kharq*) nor to generation and corruption; and Avicenna, *Physics*, III.12, for his discussion of natural minimal corporeal magnitudes.

[22]It should be noted that understanding conceptual indivisibility in terms of the estimative power's inability to imagine further divisions is an introduction of Avicenna's, which we shall see that Shahrastānī rejects. As for Avicenna's account of the estimative faculty, it is one of his five internal senses. It differs from both the retentive imagination (*khayāl*), which (passively) retains sensible images, like that of a particular man or horse, and the compositive imagination (*mutakhayyila*), which actively brings retained images together as in forming the image of centaur. For a general discussion of the estimative faculty, see Deborah Black, "Estimation (*Wahm*) in Avicenna." I discuss the role of the estimative faculty in Avicenna's philosophy of mathematics more fully in the next section.

[23]Dhanani, "Impact," 82–85.

[24]Avicenna, *Physics*, III.3 [5]; *Salvation*, IV.1.2, 200–201.

[25]The argument is the precursor to the contemporary "Distance Function Argument" against discrete space. Moses Maimonides repeats Avicenna's argument in his *Guide for the Perplexed*, I.73, which in turn Hermann Weyl repeats in *Philosophy of Mathematics*, 43, and for whom the contemporary version is now named, "Weyl's tiles."

That is because, according to the Pythagorean Theorem, the hypotenuse equals the sum of the square of the two legs, and so is greater than, not equal to, a leg, but we are supposing that both legs and hypotenuse are 10 units. On the other hand, the atoms of either the triangle's legs or its hypotenuse might be divisible into smaller (incommensurable) units, in which case there is a clear violation of *kalām* atomism. That follows, since there would be units either smaller than the least possible magnitude or units composed of the least possible magnitude *plus something smaller than the least possible magnitude* (for instance, approximating $\sqrt{2} \approx 1.41421356237$). In either case, the consequence is absurd. (I return to this argument in more detail when considering Shahrastānī's potential response to it.) In short, one is forced to choose between either the best mathematics of the time or one's preferred physical theory. For Avicenna, the choice is obvious.

Perhaps the most common instance of the physical-style argument, which in an incipient form can be traced back to Aristotle,[26] involves assuming the aggregation of atoms into a body and then considering the relation of the body's internal atoms to its external ones.[27] In its simplest form, Avicenna has one imagine three *kalām* atoms aggregated to form a line *XYZ*, in which all three atoms remain fully actual within *XYZ* as *kalām* atomism requires. The argument then continues: *Y*, the internal or middle atom, must separate atoms *X* and *Z*, otherwise there is the interpenetration (*tadākhul*) of atoms. In the case of interpenetration, the aggregation of atoms would not produce the extended bodies that one observes around us; instead, bodies would only ever be one atom in magnitude. Indeed, since the *kalām* atom purportedly is not a body, there would not even be bodies. Next, if *X* and *Z* do not interpenetrate *Y*, and so *X* and *Z* are not in contact with one another, and yet *X* and *Z* do contact *Y*, *Y* must be conceptually divisible into two parts: that part, Y_x, which is in contact with *X*, and a different part, Y_z, which is in contact with *Z*. Thus, the conceptually indivisible atom *Y* is conceptually divisible into Y_x and Y_z, a contradiction. Avicenna effectively has turned the tables on the traditional *kalām* atomists who had appealed to aggregation precisely as what made atomism most attractive.

While Avicenna's criticism of traditional *kalām* atomism certainly plays a role in the subsequent history of Islamic atomism, I believe that it is his positive discussions of continuity and natural minima that prove to be more influential for that history. In discussing both discrete and continuous theories of body, Avicenna regularly identifies three distinct mereological theories. The implicit principle guiding his identification is that body either (1) has actual parts or (2) has no actual parts. If (1) the body has actual parts, then the number of those parts is either (1a) finite or (1b) infinite. (1a) is simply traditional *kalām* atomism, and we have seen Avicenna's general reasons for rejecting *kalām* atomism. Ibrahim al-Naẓẓām (c. 775–c. 845) purportedly held (1b), a position that Avicenna virtually dismisses

[26]See Aristotle, *Physics* VI.1, 231a29–b6. Strictly speaking, Aristotle intends to show only that a continuous whole cannot be made up of what has no parts (*ameros*), like a line from points or a plane from lines.

[27]Avicenna, *Physics*, III.3 [3]; *Salvation*, IV.1.2, 198–200; and *Pointers and Reminders*, *namaṭ* 1.1.

out of hand and which need not concern us here.[28] As for position (2), the one that Avicenna himself endorses, he has this to say:

> in every body [either] there is a finite number of parts existing in actuality [*bi-l-fi'l*] or it simply has no parts in actuality at all, and when it does have parts, each one of its separate parts is also a body having no part in actuality. Thus . . . *the body is either a body having no part in actuality, or it is an aggregate of bodies having no part.* The meaning of 'having no part' is that [the body] presently has no part that one can posit as distinct; rather, [the body] is one by way of continuity [*ittiṣāl*], which does not mean it is not such as to be receptive to division. Instead, . . . it is always receptive to being divided, and whenever it is divided, what results from the division is itself a body that is divisible. Sometimes, however, you cannot divide it because of the absence of something by which to divide [it], or it is outside of the power of the one doing the dividing, or owing to [the body's] hardness, or the impossibility of its being broken up, though in itself something intermediate can be posited in it. Before the division, then, every body has absolutely no part, and instead it is the existence of division that makes the part, whether that division is by severing the continuity, or by some accident through whose occurrence we distinguish one part from another (whether it be a non-relational accident, such as white, or a relational accident, such as being opposite and parallel), or by the act of the estimative faculty and positing.[29]

There are a number of points worth highlighting about this passage. First, as mentioned, Avicenna effectively divides the logical space for a discussion of the composition or aggregation of body into two categorical propositions: either 'Some parts in a body are actual' or 'No parts in a body are actual.' These are logically contradictory propositions, and so along one dimension they exhaust all logically possible options. In the case of 'some parts,' the obvious question is, "How many?" where 'finite' and 'infinite' again exhaust the possible options. Of course, the question, "How many?" is irrelevant when applied to no or 0 parts. Thus, we see the three positions, (1a), (1b), and (2), just mentioned.

Second and related, this distinction is *not* made in terms of potential divisibility, as one might have expected (in which case the question, "How many potential parts?" would have been relevant). In fact, the term *qūwa* (potentiality) appears nowhere in our passage; rather, one reads of body's being "receptive to division" (*qabūl al-inqisām*). While receptivity and potentiality are certainly linked, *qūwa* (potentiality) is the philosophical Arabic translation of Aristotle's *dunamis*, which has both an active and a passive sense, whether in Greek or Arabic. In the active sense, *qūwa* might be understood as a power in a body or, in psychology, as a faculty in a body or the soul. In contrast, *qabūl* is a passive notion in Avicenna's usage, by which I mean it does not refer to something latent within a body waiting to be actualized (whereas I suspect that Naẓẓām's theory assumes that there is an infinity of latent, possible division points within the body). Potential divisions, then, do not exist in the body for Avicenna. Instead, receptivity means that there is nothing about the body—or specifically the body's matter (*hayūlā*)—that precludes some agent's dividing it, even if only in imagination.

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[28]For Avicenna's critique of Naẓẓām's position, see *Pointers and Reminders*, *namaṭ* I.2. For a general discussion of Naẓẓām, see Wolfson, *Philosophy of Kalām*, 495–517. It is perhaps worth noting that al-Ash'arī describes Naẓẓām's theory as one in which the parts of a body have no assignable number (*'adad lā yūqafu 'alayhi*) rather than as infinite (*ghayr mutanāhiyya*) as Avicenna does. Whether there is a distinction to be made here, I leave an open question.

[29]Avicenna, *Physics*, III.3 [1], emphasis added; all translations are my own.

Third, and as noted earlier, Avicenna recognizes here that there may be limits to the division of a body; however, these limits are either due to the physical limitations of the dividing agent, the absence of a suitable tool, or because of something that is *specific* to the particular kind of body, which in some way the species form precludes the division. As for body insofar as it is body, that is, a three-dimensional substance, it remains always receptive to division.

This last point needs clarification, since a standard account of continuity (*ittiṣāl*), both today and in Avicenna's own time, is and was often given in terms of *potentially infinite divisibility*: the continuous is purportedly what is divisible into parts that are themselves always divisible.[30] Elsewhere in the *Physics*, Avicenna rejects defining the continuous in this way and says that while infinite divisibility is a description (*rasm*) of the continuous, it does not capture what continuity is essentially.[31] Indeed, infinite divisibility, he continues, must be demonstrated to belong to what is continuous and simply cannot be assumed as a matter of definition.[32]

In its place, Avicenna understands the essence of continuity in terms of having no parts. To put the point positively, continuity for Avicenna should be understood in terms of a type of unity and being-one rather than in terms of divisibility and multiplicity. In a letter to the vizier Abū Sa'd, Avicenna explicitly identifies Aristotle's definition of continuity (Gk. *sunecheia*) from *Categories* 6, 5a1–2, as the correct definition of the continuous in itself, saying there that the continuous is "that for whose parts a common limit can be found at which they meet."[33] In other words, two things are continuous just in case wherever they are together they share one and the same limit. For example, when one considers a single playing card, there is nothing actualized in the card that truly divides and separates the top portion from the bottom portion or the left from the right. The card is simply a unified whole; it is continuous.

In contrast, divisibility, for Avicenna, does not belong to a continuous body essentially, but always refers to some physical or mental process of an agent distinct from the body. In principle, the division of a body, considered merely as quantity, can go on indefinitely or at least as long as the agent continues the process of dividing.[34] In the case of physical divisibility, it would be like cutting the playing card into two distinct, and now two new, smaller pieces, each having its own actualized limits, and then dividing one of those new pieces in half again and so on. In the case of mental divisibility, it would be like imagining the top and the bottom halves of the playing card, and then the top quarter, and then eighth, and so on. In this case of mental or conceptual division, there are no actually distinct limits that sever the unity of the imagined parts; rather, the top and bottom parts of

[30]See Aristotle, *De caelo* I.1, 268a5–6. It is this definition that underlies the *kalām* argument against body's being continuous seen above.

[31]Avicenna, *Physics*, III.2 [10].

[32]Avicenna, *Physics*, III.2 [10].

[33]Avicenna, *Lettre au Vizir Abū Sa'd*, 43; also cf. Aristotle, *Physics* V.3, 227a10–13.

[34]It is this point that allows Avicenna to respond to the theologians' argument for atoms based on infinite divisibility. To say that a body is potentially infinitely divisible does *not* refer to a potentially infinite number of divisions within the atom as the theologians supposed, but to a never-ending process. In this case, there is a contradiction in speaking of the completion or end of a process that has no end. Thus, not even an infinite power can bring a process to an end that has no end.

this mental halving share common limits. In other words, in mental or conceptual division, the continuity of the body is never destroyed, and indeed, the imagined parts completely cease to exist when the process of mentally dividing ceases.[35]

Avicenna is thus insistent that the so-called parts of a body exist in actuality only if the body is actually severed and the resultants of the division are physically separated from one another such that each part now has its own distinct limits. In this case of physically dividing a body, Avicenna not merely concedes that there might be physical limits to the number of divisions that one can make, but in fact positively argues that there are such physical limits, limits that terminate at a certain finite number of natural minima.

While a full discussion of Avicenna's theory of natural minima would go beyond the scope of this paper, a digression is warranted to appreciate fully another positive Avicennan source to which Shahrastānī arguably will avail himself.[36] In showing that there are natural minima, Avicenna assumes that the physically smaller a body is, the more quickly and effectively the opposing qualities surrounding the body can act on the affected body. Avicenna then notes that there is a physical limit to the smallness that a specific kind of body, k_1, can have beyond which it can no longer overcome the opposing qualities of the surrounding body or bodies, k_2. Beyond this limit, k_1 is instantaneously assimilated into k_2 so as to become the specific kind of body that k_2 is. This abstract point can be made clear with an example. In a hot-dry region the arid air evaporates a deciliter, a centiliter, a milliliter of water, etc., progressively more quickly than a liter of water. At some point in the division of the quantity of water, the heat of the ambient air simply evaporates the water instantaneously, as it were. That magnitude of size above which the drop of water can still remain water in isolation from other bodies of water and not be "assimilated" immediately into the surrounding air is the water's natural minimum.[37]

In effect, Avicenna recognizes that in a body of specific kind, *k*, there is a certain finite number of potential *k*-parts, where a *k*-part is *k*'s natural minimum relative to the surrounding environment, and that a *k*-part simply cannot be physically divided further and remain a body of kind *k* within a specified environment. Despite a *k*-body's being a composite of a finite number of potential *k*-parts, those parts, for Avicenna, are not distinct parts existing in actuality in that body. Those potential parts instead form a continuous body, which can be imagined as small as one likes, indeed indefinitely small. For example (and this is *not* an example Avicenna himself gives), one could in principle imagine a cuboidal quantity of body *k* consisting of 10x10x10 *k*-parts. Moreover, one could imagine a right triangle described on one of the faces of this *k*-cube, whose hypotenuse would be of a magnitude consistent with the Pythagorean Theorem. While the previous example is not Avicenna's own, it is consistent with his theory of mathematics, which I discuss in more detail when I consider Shahrastānī's possible response to Avicenna's mathematical-style arguments in the next section.

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[35]Avicenna, *Physics*, III.2 [8].

[36]See McGinnis, "Small Discovery," for a study of Avicenna's theory of the natural minima.

[37]While Avicenna recognizes different basic categories of degrees, such as "low," "medium," and "high," among the qualities hot-cold and wet-dry, to the best of my knowledge he never discusses how these various degrees affect natural minima.

We now have the background to locate Shahrastānī's atomism and to see how it differs from traditional *kalām* atomism and what Shahrastānī draws from Avicenna as well as how he is able to develop a new theory of atomism in response to Avicenna's critique.

4. SHAHRASTĀNĪ AND POST-AVICENNAN ATOMISM

We encounter mention of Shahrastānī's unique theory of atomism in Fakhr al-Dīn al-Rāzī (1149–1210) and Naṣīr al-Dīn al-Ṭūsī's (1201–1274) commentaries on Avicenna's short philosophical summa, *Pointers and Reminders*.[38] Apparently, Shahrastānī fully develops his theory of atoms in his work *Methods and Proofs* (*Manāhij wa-l-Bayyānāt*), which is unfortunately lost.[39] Fortunately, another treatise ascribed to Shahrastānī on atomism, "On Establishing the Individual Atom" (*Fī Ithbāt al-jawhar al-fard*), is extant and included as an appendix to Shahrastānī's work, *The End of Steps in Theology* (*Nihāyat al-Aqdām fī 'ilm al-kalām*).[40] Before considering that treatise, a word about its authenticity is warranted.

Carmela Baffioni, who offers the only other close study of "On Establishing the Individual Atom," admits that the text is perhaps spurious (*forse spurio*), but only on the basis that "the best and oldest manuscript, the MS Arabe 1246 of the National Library of Paris, shows no traces of the excursus [i.e. "On Establishing the Individual Atom"], and places the conclusion of the work in chapter XX."[41] Baffioni's reason for hesitation merely suggests that "On Establishing the Individual Atom" originally may not have been part of *The End of Steps*, while Shahrastānī still may have penned it as an independent treatise.[42] The editor of *The End of Steps*, Alfred Guillaume, who believes that our text is authentic, recognizes that "On Establishing the Individual Atom" probably was not part of *The End of Steps* originally but was added later as an appendix. Thus, the absence of our text from the earliest versions of *The End of Steps* is not conclusive evidence against authenticity.

More strongly, Alnoor Dhanani questions the authenticity of the text, since he finds in it "no evidence supportive of the view on the constitution of bodies which Fakhr al-Dīn Rāzī attributes to al-Shahrastānī" as a response to Avicenna's critique of atomism.[43] I agree with Dhanani that "On Establishing the Individual

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[38]Rāzī, *Sharḥ, namaṭ* I, 2, 1:7. Citations from this work are according to the *namaṭ* and section of Avicenna's *Pointers and Reminders* followed by the volume and page number of Āmolī's edition.

[39]Tūsī, *Ḥall, namaṭ* I, introduction, 2:25–26. Citations from this work are according to the *namaṭ* and section of Avicenna's *Pointers and Reminders* followed by the volume and page number of Najafzāda's edition.

[40]Shahrastānī, *Nihāyat al-Aqdām*, 505–14. While Alfred Guillaume, the editor of our text, vowels the title *Nihāyat *al-iqdām* fī 'ilm al-kalām* (*The Final Venture in Theology*), Guy Monnot has argued forcefully that the correct title should be *Nihāyat al-aqdām fī 'ilm al-kalām* (*The End of Steps in Theology*), which is followed here; see Monnot, "Shahrastānī," 215. Carmela Baffioni translated Shahrastānī's text into Italian with running commentary, which provides an excellent account of Greek parallels in Shahrastānī's text; see *Atomismo*, 179–210.

[41]"Il migliore e più antico manoscritto infine, il MS Arabe 1246 della Biblioteca Nazionale di Parigi, non mostra tracce dell'excursus, e pone la conclusione dell'opera al cap. XX" (Baffioni, *Atomismo*, 179n2).

[42]For additional problems with this particular manuscript, also see Shahrastānī, *Nihāyat al-Aqdām*, "Editor's Introduction," xiv.

[43]Dhanani, "Impact," 91.

Atom" is not an *explicit* response to Avicenna's criticism of atomism as Avicenna's criticism appears in the *Shifā'*, the text on which Dhanani focuses. Still, I hope to show that "On Establishing the Individual Atom" has elements, admittedly in a germinal state, that are sensitive to Avicenna's critique of atomism, particularly as it appears in Avicenna's *Pointers and Reminders*, as well as being sensitive to other later developments among Islamic theologians. Thus, Dhanani's reason for rejecting the authenticity of our text stands or falls on how well I make my case in what follows.

As for reasons to accept the authenticity of our text, both Alfred Guillaume, the editor of Shahrastānī's *Nihāyat al-Aqdām*, and Guy Monnot, the editor of the French edition of Shahrastānī's *Kitāb al-Milal wa-l-Niḥal* (*Book of Religious and Philosophical Sects*), believe it is by Shahrastānī.[44] I mention these editors not as an appeal to authority, but because they draw on issues of stylometrics to make their assessment of the text's authorship. Shahrastānī was from Khorasan, and Arabic is clearly not his native language. Our text is replete with the sorts of awkward phrases and peculiar grammatical structures suggesting that the author is a non-Arab writer who is probably Persian. Additionally, "On Establishing the Individual Atom" explicitly mentions al-Jūwaynī (1028–1085) and his innovations to atomic theory while showing an ignorance of Fakhr al-Dīn al-Rāzī (1149–1210) and his contributions. What our text includes and excludes suggest an author probably writing between 1050–1200, which correspond with Shahrastānī's dates. In short, there is strong evidence that the author of "On Establishing the Individual Atom" was Persian and writing at the time that Shahrastānī was flourishing. Thus, while it might not be beyond all reasonable doubt that Shahrastānī is our author, certainly there is clear and convincing evidence that he, or someone in his circle, is.

I now turn to the content of "On Establishing the Individual Atom." I hope to show that, when contextualized against the testimonies of the commentators about Shahrastānī's developed theory of atomism, one recognizes the contours of his unique theory emerging in "On Establishing the Individual Atom."

By the time that Rāzī wrote his commentary on Avicenna's *Pointers and Reminders*, the logical space for a discussion of body has changed from that presented by Avicenna, a change that well may be traced back to Shahrastānī. Recall that Avicenna begins his critique of atomism by effectively dividing the possible positions concerning body into those that maintain that some parts in a body are actual and those that maintain that no parts in a body are actual.[45] The position that some parts in a body are actual is in turn subdivided into the positions that the actual parts are finite (the atomists' position) or that they are infinite (Naẓẓām's position). Rāzī (and again perhaps Shahrastānī before him) now begins by effectively distinguishing among those positions that maintain that the body consists of either a finite or infinite number of *actual* parts and those that maintain that the body consists of either a finite or infinite number of *possible* parts. Thus, one reads:

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[44]Guillaume simply includes our text as an appendix to *Nihāyat al-Aqdām* without comment, while Monnot is more explicit; see Monnot, "Shahrastānī," 221.

[45]Avicenna, *Physics*, III.1.

> One record of the schools of thought writing about [individual or simple body (*jism mufrad*), like elemental water] says: undoubtedly the individual [or simple] body is receptive to divisions [*qābil li-l-inqisāmāt*]. In that case, those possible divisions must occur in it either [1] in actuality or [2] not. On top of [these] two suppositions, those divisions are either [a] finite or [b] or infinite. Thus, from this division four [logical] possibilities occur beyond which no more can be added.
>
> The first is to claim [1a] bodies are composites of parts each one of which is not receptive in any way to being divided into parts [*lā yaqabalu l-tajzi'a*] and those parts are finite in number.
>
> The second is to claim [1b] bodies are composites of parts existing in actuality, infinite in number.
>
> The third is to claim [2a] the divisions do not occur in actuality but they are something [whose] occurrence is possible [*mumkinat al-ḥuṣūl*], and additionally those possible divisions are finite.
>
> The fourth is to claim that [2b] those divisions do not occur in actuality but they are something [whose] occurrence is possible, and additionally those possible divisions are infinite.[46]

In his commentary, Ṭūsī further identifies the adherents of the four positions, specifically mentioning Shahrastānī as the author of the third position, (2a).[47]

What is most interesting is the reconceptualization of the problem space and the shift from Avicenna's three possible options to four. For Avicenna, the chief divide is between those who believe that there are *no* parts in the simple body and those who believe that there are *some* parts. Of course, if there are no parts, then the question of "How many?" is meaningless. In contrast, by the time of Rāzī the divide is now between actual parts and possible divisions. Thus, the question of how many possible divisions does arise: an infinite or a finite number of possible divisions?

Here it is worth noting that 'possible divisions' need not refer to something latent within a body waiting to be actualized, and so like Avicenna before him, Shahrastānī's position is not necessarily committed to a body's having some unique, single, determinate set of potential divisions existing in it waiting to be extracted. Instead, there may simply be a finite number of possible yet different ways to divide a given body into atomic units, not unlike the finite number of natural minima to which Avicenna is committed. To put the same point differently, Shahrastānī's atoms, unlike traditional atoms, should not be thought to remain as discrete entities within a body formed from them; rather, the body formed from them is a continuous whole in just the way that a body consisting of a finite number of natural minima is a continuous whole for Avicenna. The difference is that for Shahrastānī the number of possible divisions that body qua body can "receive" (rather than a specific kind of body) is finite, not infinite.

This last point needs to be developed further, but before doing that, I note that, since Avicenna envisions only three possible positions, he does not explicitly consider Shahrastānī's form of atomism. Instead, Avicenna only explicitly rejects (1a) traditional atomism and (1b) Naẓẓām's theory. Thus, it is an open question as to what he might have to say about Shahrastānī's form of atomism. Rāzī, on

[46] Rāzī, *Sharḥ, namaṭ* I, 2, 1:7.

[47] Ṭūsī, *Ḥall, namaṭ* I, introduction, 2:26.

the one hand, does not take up the issue of how Avicenna might respond to Shahrastānī. Ṭūsī, on the other hand, claims that Avicenna's original arguments against traditional atoms still apply to Shahrastānī's theory of the atom, since, Ṭūsī notes, Avicenna's original arguments apply especially to "conceptual division" (*al-qisma l-wahmīya*, literally, "division imagined by the estimative faculty").[48]

Despite Ṭūsī's dismissal of Shahrastānī's position, it seems that the suggestion of atoms as potential parts might have more resources to respond to Avicenna's objection than Ṭūsī acknowledges. In "On Establishing the Individual Atom," Shahrastānī explicitly mentions Avicenna's physical proof in terms of aggregating three atoms. The rubbing point again, claims Avicenna, is that the middle or internal atom inasmuch as it separates the two outside or external atoms would be divided into two conceptually distinct parts, one part touching one outside atom and a different part touching the other outside atom. Shahrastānī explicitly addresses this objection in our text, and his response is telling, even if at first it appears to be a red herring.[49]

Shahrastānī's response begins by likening the individual atom (*jawhar fard*) to the two substances (*jawharayni*), form and matter, of the philosophers. In her rich study of atomism and its detractors in Islamic thought, Carmela Baffioni criticizes the move on the basis that it rests on "an erroneous identification (with respect to the authentic Aristotelian positions) of the form as a discriminating principle (and, therefore, as a source of 'division')."[50] While I do not deny this comment with respect to Aristotle, Shahrastānī is unquestionably not responding to Aristotle here, but to Avicenna. In *Pointers and Reminders*, Avicenna immediately follows up his rejection of atomism—which appeals exclusively to the present three-atom problem—with his proof for the hylomorphic makeup of body, that is, that body is a form-matter composite.[51]

Two brief background comments—one historiographical, the other philosophical—should be made about Avicenna's argument for the hylomorphic nature of body as it appears in *Pointers and Reminders*. First, the form of the argument in *Pointers and Reminders*, namely, to move from a rejection of atomism immediately to a proof for form and matter, is unique to that text, appearing neither before Avicenna nor in any of his other philosophical encyclopedias, although becoming common after him.[52] This point is important, since Shahrastānī's own discussion moves from the three-atom problem immediately to a discussion of matter and form, which provides indirect but fairly strong evidence that he is responding to Avicenna's argument against atomism as that argument appears in *Pointers and Reminders*, and so not earlier Greek sources, as Baffioni suggests, nor the *Shifā'*, as Dhanani suggests.[53]

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[48]Ṭūsī, *Ḥall, namaṭ* I.4 2:58–59.

[49]Shahrastānī, *Nihāyat al-Aqdām*, 510–11.

[50]"un'errata identificazione (rispetto alle autentiche posizioni aristoteliche) della forma come principio discriminante (e, quindi, come fonte di 'divisione')" (Baffioni, *Atomismo*, 202).

[51]Avicenna, *Pointers and Reminders, namaṭ* I.5.

[52]See McGinnis, "Pointers."

[53]That Shahrastānī was intimately familiar with Avicenna's thought is well documented; see Shahrastānī, *Struggling with the Philosophers*.

The second brief comment concerns the philosophical content of Avicenna's proof for the hylomorphic nature of body, since there are key elements in that proof for understanding Shahrastānī's own response to the three-atom problem and his new theory of the atom. From Avicenna's earlier arguments against a body's being an aggregate of either an infinite or a finite number of discrete parts existing in actuality within body, he takes as proven that body must be continuous. He next observes that despite body's being continuous, it can be divided so as to lose its existing continuity and be made discontinuous. Since the continuity itself cannot become discontinuous, there must be something about the body that is receptive to both continuity and discontinuity, which Avicenna identifies with matter (*hayūlā*). Thus, concludes Avicenna, body is a composite of an underlying matter, which explains a body's divisibility, and a form of corporeality, which explains the body's continuity and so explains its being a unified whole.[54]

The key point of Avicenna's position is that something must underlie a body's continuity and potential divisibility. This point is the one that Shahrastānī latches onto when he writes:

> All that we mentioned concerning matter and its receptivity to form is that it has three dimensions, length <511>, width, and depth. The same thing is confirmed about the individual atom and its receptivity. That is, it is a single continuity [*ittiṣāl*], namely, a continuity consisting of six directions or continuities. The only difference [between the theologian and philosopher's conception of the composition of body] is that the theologian says that that is by joining like to like, while the philosopher says that is by joining its form with [its matter].[55]

In other words, according to Shahrastānī, the finite number of atoms from which a body is composed form a continuous, unified whole, just in the way that the philosophers' hylomorphic body is a continuous, unified whole. This is just to say that atoms do not exist in the body as actual in the way traditional atomists envisioned them, but merely as possible, the very position Rāzī and Ṭūsī ascribe to Shahrastānī.

Of course, 'continuity' here cannot essentially mean infinite divisibility now, but Avicenna had already argued that infinite divisibility is *not* the defining trait of continuity. Recall that Avicenna claimed that infinite divisibility is merely a description of continuity not what it is essentially.[56] Avicenna himself preferred Aristotle's definition of continuity in terms of parts' sharing a common limit. Shahrastānī simply helps himself to this account of continuity. When atoms are aggregated into a body, they lose their actual individuality, such that there are no longer limits differentiating the space of one atom from another. Instead, the atoms form a continuous whole.

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[54]Avicenna, *Pointers and Reminders*, *namaṭ* I.6.

[55]Shahrastānī, *Nihāyat al-Aqdām*, 510–11.

وكل ما ذكرناه في الهيولى وقبولها للصورة فهي الابعاد الثلثة الطول والعرض العمق تحقق مثله في الجوهر الفرد وقبوله ذلك اتصال واحد واتصال من ست اتصالات الا ان المتكلم يقول ذلك باانضمام امثالها اليها والفيلسوف يقول ذلك بانضمام صورتها اليها.

Shahrastānī's Arabic presents the translator with a particular difficulty. There is the perennial dilemma of whether to translate *ad litteram* or *ad sensum*, but additionally Shahrastānī was not a native Arabic writer. Thus, even the sense of his text in the original Arabic is frequently far from clear. Here and below I have provided more of a paraphrastic translation, which hopefully makes for readable English.

[56]Avicenna, *Physics*, III.2 [10].

Of course, if the atoms that are internal to body form a continuous whole, then the three-atom problem does not obviously arise. Again, the problem had one imagine three atoms, *XYZ*, and then had one consider *Y*'s relation to *X* and to *Z*. For Shahrastānī, *Y* no longer exists as a discrete actualized atom within the body, and thus it is more correct simply to speak of the body *XZ*, where *X* and *Z* refer to boundaries delimiting a continuous body. Both Aristotle and Avicenna also recognize that body must have distinct boundaries that delimit it (for an infinite body, both thinkers maintain, is impossible).[57] They also recognize that between a body's boundaries there is a middle consisting of potential parts.[58] Yet, despite their recognizing these limiting boundaries and a middle, nothing forces an analogue of the three-atom problem on them. Similarly, it is not clear why the problem should arise in the case of Shahrastānī's atoms, since there is no actually existing atom *Y* separating *X* from *Z*, but rather, a continuous whole. The situation is analogous to a body composed of three of Avicenna's natural minima. In both cases, there are no conceptually distinct parts of *Y*, Y_x and Y_z, dividing *Y* when *Y* is an internal atom. The onus of proof has now shifted to the Aristotelian or Avicennan to show how finite potential divisibility leads to conceptual absurdity.

Perhaps one might complain that even if *Y* is continuous with *X* and *Z*, there is what is right-of-center and what is left-of-center, and thus there is a potential division of that which is purportedly conceptually indivisible. Shahrastānī considers just such an objection and even ups the ante, observing that presumably a cuboidal atom, as the atom is apparently envisioned, should be conceptually divided into up, down, left, right, front, and back parts, too.[59] Shahrastānī simply responds that up, down, left, right, front, and back do not refer to parts of an atom, but to relations (*nisba wa iḍafa*) and that relations do not belong to a thing essentially and so need not indicate any real feature in the thing itself.[60] He gives the example of the center of a circle. The circle's center is that point from which all points on the circumference of the circle are equidistant. Let this point be a true Euclidean point, and so it has no parts.[61] Despite having no distinct parts, the center point, Shahrastānī observes, stands in numerous different relations to the numerous different points on the circumference, like being to the left or to the right or above or below, etc. Shahrastānī's atom also has no parts, even though occupying a minimal unit of space. In fact, Shahrastānī explicitly identifies his atom with a Euclidean point, precisely because Euclid defines the point in terms of having no part (*sēmeion estin hou meros outhen*) and his atom also has no part (albeit, being a non-zero magnitude); rather, it is the part from which a line, surface, or solid is composed.[62] Thus, for Shahrastānī, either the philosophers are wrong to attribute

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[57]Cf. Aristotle, *Physics* III.5 204b5–206a8 and *De caelo* I.2–7; Avicenna, *Physics* III.8; and Shahrastānī, *Nihāyat al-Aqdām*, 511.

[58]See Aristotle, *Physics* V.3, 226b19–227b2 and VI.1, 231b15–18; and Avicenna, *Physics*, III.2 [8–10].

[59]Shahrastānī, *Nihāyat al-Aqdām*, 512.

[60]While both *nisba* and *iḍafa* can be translated as "relation," *iḍafa* is the common Arabic term for the Aristotelian category of relation (*pros ti*), whereas *nisba* either indicates the most generic sense of relation or when used in a technical sense indicates a mathematical ratio, which the present context seems to preclude.

[61]Euclid, *Elements*, Book 1, defn. 1.

[62]Shahrastānī, *Nihāyat al-Aqdām*, 512. Juwaynī makes a similar claim in *al-Shāmil*, 143 and even Avicenna intimates it at *Physics*, III.3 [7].

distinct parts to different relations in which the atom can stand or they should attribute distinct parts to Euclidean points too, which they do not.

It would seem that Shahrastānī believes that this two-pronged response to the three-atom problem could be generalized for all of Avicenna's physical objections against atomism. On the one hand, if Avicenna's objections appeal to discrete, actualized features of aggregated atoms, then Shahrastānī simply observes that the internal atoms form a unified whole and so in aggregation they have no discrete actualized features, and so the purported objection does not get off the ground. On the other hand, if the physical objections appeal to relational attributes, then Shahrastānī can deny that relations refer essentially to discrete actualized features of an atom, and again it is not clear that a problem arises.

As for how Shahrastānī's atomism might fare against Avicenna's mathematical-style arguments, in *Pointers and Reminders*, Avicenna does not present any of these proofs against atomism. Consequently, given the hypothesis that Shahrastānī is responding to *Pointers and Reminders* in "On Establishing the Individual Atom," he does not explicitly consider any of Avicenna's mathematical-style proofs. Still, Shahrastānī's final remarks in that work do seem like a general recipe for responding to physical or mathematical forms of arguments against atomism that appeal to conceptual divisions when understood in Avicenna's technical vocabulary of divisions that the estimative faculty (*wahm*) imposes.

Shahrastānī's general move is simply to challenge the imagining of the estimative faculty when those imagined results are contrary to the conclusion of a demonstration. To appreciate this response two things are required: first, a statement about Avicenna's own understanding of the estimative faculty and its relation to the objects of mathematics and, second, a presentation of Shahrastānī's purported demonstration for atomism.

For Avicenna, the subject matter of mathematics is body, but not body insofar as it is a specific kind or undergoes various motions, processes, and changes specific to a certain kind of body; rather, mathematics, for Avicenna, investigates body under the description of having quantity.[63] For Avicenna, no body in the physical, extra-mental world is just a quantity, but is always some species of body, whether, celestial, animal, plant, mineral, or the like. Consequently, a degree of abstraction or idealization is needed when conceptualizing the object of mathematics inasmuch as it is body as quantity. This consideration of the mathematically idealized body solely under the description of quantity is, for Avicenna, the result of the estimative faculty.[64] For Avicenna, then, the objects of mathematics really are the physical objects that surround us but now considered solely under the description of quantity, which involves a process of the estimative faculty.

While the processes of the estimative faculty involve a degree of imagining, the imagining is not of the fanciful kind that produces unicorns and pink elephants. It

[63]See Avicenna, *Introduction*, I.2, 12–14; *Physics*, I.8 [1]; and *Metaphysics*, I.1 [5]. Only recently have sophisticated studies of Avicenna's philosophy of mathematics become available, namely, those of Mohammad Ardeshir, "Ibn Sīnā's Philosophy of Mathematics"; and Mohammad Zarepour, "Avicenna on the Nature of Mathematical Object."

[64]For discussions of the estimative faculty's role in mathematics, see Tanelli Kukkonen, "Thought Experiments," esp. §3; and McGinnis, "Experimental Thoughts," esp. §2.

is of a kind that allows one to perceive the non-sensible connotative attributes (sg. *ma'nā*) in material bodies. The classic example is of the sheep's estimative faculty that recognizes the ferocity in the wolf.[65] In short, the estimative faculty provides a fair estimation of physical things and what is possible for them, but it does not provide absolute knowledge or certainty.[66] In this respect, it is much more like inductive reasoning (*istiqrā'*) in that it alerts (*tanbīh* or *tanabbuh*) one to what is likely to be the case, all things being equal, but not what is necessarily the case.[67] Consequently, Avicenna insists, the imagining of the estimative faculty always must give way to a demonstration, and in general the conclusions of the demonstrations of physics take precedence over mathematical idealizations.[68]

Shahrastānī latches on to this epistemic limit to the estimative faculty's power. He notes that nothing about the underlying matter of the philosophers precludes the estimative faculty's imagining that matter's potentially being multiplied infinitely (as it were, the inverse of its being infinitely divided as the philosophers propose).[69] In that case, allow that the physical universe is limited in spatial extent forming a sphere with a finite radius, as the philosophers heartily endorse. Of course, one can imagine the circumference of the universe extended outward by one meter, two meters, and so on ad infinitum. Despite the possibility of imagining that matter is extended potentially infinitely, the philosophers believe that they have a demonstration of the finiteness of matter and that this demonstration trumps the imagined *potentially* infinite multiplication or extension of matter by the estimative faculty. Shahrastānī exploits this same move to rebut the imagined implications of the estimative faculty with respect to *potentially* infinite divisibility.

Shahrastānī's arguments assumes that infinite divisibility is the complement of infinite multiplication and extension. Thus, if there is a rational proof that there is a limit to division, then the estimative faculty's imagining potential divisions beyond this limit need not tell against the demonstrated limit to the division of body. When coupled with Shahrastānī's new theory of atomism, this last point becomes important for a possible response to the mathematical-style proofs against atomism. Again, Shahrastānī's does not explicitly comment on Avicenna's mathematical style arguments in "On Establishing the Individual Atom." Thus, the following represents my best guess at what Shahrastānī's more developed theory might have been, based upon certain hints and suggestions in "On Establishing the Individual Atom."

Again, in very general terms, Avicenna's mathematical critique of atomism appeals to issues of incommensurability.[70] For example, recall the problem of

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[65]Avicenna, *Psychology*, 1.5, 43. For Avicenna, the sheep does *not* possess the universal concept of "ferocity" when it recognizes the potential danger of the animal before it; rather, it has a "mixed up" (*makhlūṭ*) awareness, which provides it with a "fair estimation" of possible danger. For Avicenna's full account of animal self-awareness and the estimative faculty, see Ahmed Alwishah, "Avicenna on Animal Self-Awareness."

[66]Avicenna, *Physics*, II.1 [14].

[67]McGinnis, "Experimental Thoughts," 81.

[68]See Avicenna, *Physics*, IV.8 [8].

[69]Shahrastānī, *Nihāyat al-Aqdām*, 512–13. The general move of challenging the limits of the estimative faculty already appears in al-Ghazālī, *Incoherence of the Philosophers*, discussion 1, [§§83–87]; the specific application of it to atomism seems new to Shahrastānī.

[70]See Avicenna, *Physics*, III.4 [5].

reconciling atomism with the Pythagorean Theorem. The issue is this: impose a right isosceles triangle on some atomic space. On the one hand, assuming that the units measuring the hypotenuse are each one atom in magnitude, then the units measuring the legs of the triangle would be less than a conceptually indivisible atom in extent (an absurdity). On the other hand, if the units measuring the legs are each assumed to be atoms, then the units measuring the hypotenuse would equal one atomic unit *plus some magnitude less than an atomic unit* (again a purported absurdity).

Shahrastānī could grab the dilemma by this second horn. Again, the units (that is, Shahrastānī's parts or atoms, to which the proof appeals) exist for him only as possible parts within the triangle, at least until there is a physical process of dividing and separating off the atoms from one another. Now regardless of how one does the physical division, Shahrastānī could claim, one *never* has a separate part less than an atom, that is, the conceptually smallest spatial magnitude (call it 1). Admittedly, there are parts resulting from the division that are greater than 1, namely, parts that are equal approximately in magnitude to $\sqrt{2}$; call such a part, 1+.

The existence of 1+, a part greater than the least possible spatial unit, however, is far from absurd. At most, Shahrastānī merely would have to concede that there can be spatial magnitudes that are greater than the least possible spatial magnitude but not composed of a whole number of atoms, and as such cannot be divided further. Such a concession, however, would *not* entail that, within 1+, 1 is something actualized and some spatial magnitude less than 1 (call it <1) is also actualized, let alone that an atom has been divided. This absurd implication would follow only on traditional atomism. In contrast, 1+ is a continuous whole for Shahrastānī much in the way that Avicenna imagined his natural minima in a specific kind of body. The primary difference is that for Shahrastānī minima also apply to body more generally and absolutely rather than merely to specific kinds of bodies and relative to their surroundings.

Thus, the question is whether the existence of 1+ is still conceptually absurd, as Ṭūsī claims.[71] It seems that Shahrastānī may have the resources to push back against this charge. First, Ṭūsī understands conceptual division in terms of divisions imagined by the estimative faculty (*al-qisma l-wahmīya*); however, given Shahrastānī's reservations about the limits of the estimative faculty, it not clear that Shahrastānī needs to identify conceptual divisibility in terms of what the estimative faculty can imagine.

Second, even given Avicenna's own philosophy of mathematics and the limits of the estimative faculty, it is not clear that the existence of 1+ (that is, a spatial magnitude greater than 1, where 1 is the smallest conceptually possible magnitude, but less than 2) is conceptually absurd. That is because one is *not* conceptualizing a magnitude less than a conceptually indivisible atom, when one conceives 1+ (that is, one atomic unit plus some). By 1+'s very description, it is something greater than 1. The problem would occur only when the estimative faculty imagines 1+ divided into 1 and <1, that is, when the estimative faculty purportedly imagines a magnitude less than an atom in extent. Shahrastānī explicitly responds to this concern:

[71] Ṭūsī, *Ḥall, namaṭ* I.4 2: 58–59.

> [What I am suggesting] on this issue is different from the conclusion of the Mu'tazila mutakallim.[72] That is because the adversary may well concede that it is inconceivable that there are *actually* an infinite number of parts in the body, and yet may not concede that [it is inconceivable] with respect to potential [parts] and the imagining of the estimative faculty.
>
> [In response], it has already been established concerning potentiality that the body's matter is not potentially receptive to infinite division any more than it is to infinite multiplicity or extension.[73] We also explained concerning the estimative faculty that it does not stop at some limiting boundary [*ḥadd*] to which something more cannot be imagined to be added to that body, like [imagining] the addition of another world or empty space and void beyond the world. Similarly, [the estimative faculty] does not stop at some limiting boundary at which it cannot imagine some decrease in the body even to the point of supposing the [imagined] decreases go on infinitely.[74]

In other words, just as Avicenna and the philosophers say that body must be physically finite with respect to how large it can be, despite the estimative faculty's ability to imagine a space beyond those physical limits, so likewise, Shahrastānī maintains, body must be finite with respect to how small it can be, despite the estimative faculty's ability to imagine a space below those physical limits. Such a position is not necessarily to give up on the conceptual indivisibility of atoms as much as to deny that the estimative faculty tracks conceptual possibility.[75]

If this response is not to be a mere *tu quoque* fallacy, then just as Avicenna provides a purportedly demonstrative proof against body's being infinitely large,[76] so likewise Shahrastānī must provide a proof against body's being infinitely small. He provides two sets of proofs. The first set of arguments appeals to various problems associated with infinity assuming the infinite divisibility of body.[77] In general, these arguments appear little more than a restatement of those of the traditional *kalām* atomists rehearsed in section 2.[78]

A more interesting set of proofs, which Shahrastānī ascribes to Imām al-Ḥallaramayn al-Juwaynī, appeals to issues of a body's limits.[79] He has one posit a

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[72]*Naẓar al-nāẓir*, literally the "speculation of the speculator," which is probably a reference to *ahl al-Naẓar*, that is, the Mu'tazila *mutakallūn*, as translated here, who are among the traditional atomists.

[73]I present Shahrastānī's proof for this position immediately following the discussion of this text.

[74]Shahrastānī, *Nihāyat al-Aqdām*, 513 (emphasis added).

وهذا اخر ما ينتهي اليه نظر الناظر في هذا المسئلة فان الخصم ربما يساعد على ان الاجزا التي هي غير متناهية بالفعل في الجسم غير متصور وانما يخالف في القوة الوهم وقد ثبت في القوة ان هيولى الجسم بقوته لا تقوى على قبول انفصالات بلا نهاية كما لا تقوى على قبول اتصالات بلا نهاية وقد بينا في الوهم لا يقف الى حد لا يتوهم زيادة على الجسم المحدود كزيادة عالم اخر وزيادة فضا وخلا وراء العالم كذلك لا يقف الى حد لا يتوهم نقصان اخر حتى يقدر ملاقى الجسم لا يتناهي.

[75]Having said that, one generation after Shahrastānī, Fakhr al-Dīn al-Rāzī does claim that while atoms are physically indivisible, the estimative faculty can imagine their division; for a translation of the relevant discussion see Adamson, "Fakhr al-Dīn al-Rāzī on Void," §5.9. Since I conclude this study with the suggestion that Shahrastānī's atomism may be a source for Fakhr al-Dīn al-Rāzī's atomism, it is possible that al-Rāzī's position is Shahrastānī's from his lost work, *Methods and Proofs*.

[76]See Avicenna, *Pointers and Reminders*, *namaṭ* I.11 and the same argument as well as additional ones at Avicenna, *Physics*, III.8.

[77]See Shahrastānī, *Nihāyat al-Aqdām*, 505–7.

[78]See Avicenna, *Physics*, III.5.

[79]Shahrastānī, *Nihāyat al-Aqdām*, 507–8. It is not clear to which, if any, of Juwaynī's texts Shahrastānī is referring, since the arguments in Shahrastānī's texts do not appear in any of the former's major works on *kalām*, like *al-Shāmil*, *al-Irshād*, or *al-'Aqida al-Niẓāmiyya*. Thus, the argument is either from some

true sphere and a true plane (*kuraḥaqīqīya wa basīṭ ḥaqīqī*), by which he presumably means the perfect physical instantiation of a mathematical sphere and plane. Next, one is to strike the sphere down on the plane. The sphere either comes into contact with the plane or it does not. If there is contact, the point of contact must be either divisible or indivisible. The point of contact cannot be divisible, observes Shahrastānī, because in that case the point of contact would be along a plane. Thus, the contacting sphere is not a true sphere, but it was posited that it is a true sphere, and so there is a contradiction. At this point, Shahrastānī immediately concludes, "if [the sphere] contacts [the plane] at something indivisible, then there is that individual atom."[80]

One may want to object that the argument assumes that an indivisible point is an extended atom, which is a contentious claim. A mathematical point, the objection might continue, should be thought of not in terms of some minimal magnitude but in terms of no magnitude or zero magnitude. In some sense, Shahrastānī anticipates this objection, when he begins by asking whether the sphere comes into contact with the plane when it is brought down upon it. That is because if there is contact, then for Shahrastānī a *part* of the sphere must be in contact with a *part* of the plane. As Aristotle himself had observed, however, a part can be used to measure the whole, and so must have some magnitude.[81] Thus, if the point is zero magnitude, and so not a part, then no part of the sphere contacts any part of the plane when the sphere "contacts" the plane. At the very least, this conclusion is paradoxical. Even if one counters that the point is not a part but it is something, namely, something belonging *potentially* to the plane and sphere, there still is the seemingly paradoxical conclusion that when the sphere and plane are *actually* in contact with one another nothing *actually* belonging to them is in contact with one another.

This argument is the one that Shahrastānī ascribes to Juwaynī. The underlying intuition motivating the argument is twofold. First, a limit, like a point, must be a part of that which it delimits.[82] Second, if it is a part of that which it delimits (and so among the "external atoms"), then it must be some real subsisting feature of that thing, which means that the part is some minimal, non-zero magnitude of the delimited thing.[83] In short, for Shahrastānī a part must be an atom (even if it exists only potentially within the delimited body). Given these two principles, Shahrastānī generalizes the previous argument to apply to all limits, whether the points that delimit a line; the lines that delimit a plane or surface; and the planes or surfaces that delimit a body. The very reality of lines, surfaces, and bodies requires atoms, or so Shahrastānī suggests. Shahrastānī is apparently trying to turn the tables on the philosophers by claiming that the atomists have the mathematically preferable theory, at least when it comes to points, lines, and planes' applying to the physical world.

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independent treatise on the atom by Juwaynī or they are from the pen of Shahrastānī (or someone else after Juwaynī but before Shahrastānī).

[80]Shahrastānī, *Nihāyat al-Aqdām*, 507.

[81]Aristotle, *Physics* IV.10, 218a6–8.

[82]Shahrastānī, *Nihāyat al-Aqdām*, 507.

[83]Shahrastānī, *Nihāyat al-Aqdām*, 507–8, where he specifically addresses whether points are accidents of a body.

While Shahrastānī has more to say about the atom, both in its defense and in critiquing the hylomorphic analysis of body of the philosophers like Avicenna, hopefully the above provides one with some sense of the resources available to post-Avicennan thinkers who might want to defend atomism.

5. CONCLUSION

Let me quickly conclude with a thesis for future research about the subsequent influence of Shahrastānī's atomism on post-Avicennan natural philosophy. I suggest that Shahrastānī's new theory of atomism may have impacted Fakhr al-Dīn al-Rāzī's own understanding of atomism, and consequently much of the subsequent history of post-classical *kalām* atomism. We have already encountered some initial evidence for this thesis. Recall that Rāzī does not reject Avicenna's critiques either of traditional *kalām* atomism or of Naẓẓām's theory of bodily composition. Thus, arguably he finds Avicenna's critiques effective against both positions, since he is willing to push back and even to reject outright Avicenna's arguments when he believes that they are wrong.

This point is telling because, in his commentary on *Pointers and Reminders*, Rāzī initially defends Avicenna's own account of body in terms of form and matter from objections by Abū l-Barakāt al-Baghdādī (c. 1080–c. 1165) and Sharaf al-Dīn Muḥammad al-Mas'ūdī (c. 1120s–c. 1204).[84] His defense involves introducing a notion of 'individual corporeality' (*jismiyya mu'ayyana*), which bears a remarkable resemblance to Avicenna's natural minima and Shahrastānī's atoms, as part of his response to Baghdādī and al-Mas'ūdī. Despite defending Avicenna against these detractors, in a series of highly intricate and technical arguments, which will not be rehearsed here, Rāzī critiques and rejects his suggestion that the underlying subject of a body's continuity is matter.

Recall now that Rāzī identified four possible positions concerning the composition of body: 1) traditional *kalām* atomism, 2) the theory of Naẓẓām, 3) Avicenna's hylomorphism, and 4) Shahrastānī's atomism. Of the four initial positions concerning the composition of body, Shahrastānī's theory of the atom is the only one standing, and again Rāzī explicitly states that beyond the four noted logical possibilities "no more can be added."[85] Thus, I submit that as early as his *Pointer and Reminders*'s commentary, Rāzī ascribes to some form of Shahrastānī's atomism.

If Rāzī does adopt some form of Shahrastānī's atomism, then what is needed (but will not be undertaken here) is a reappraisal of Rāzī's own attitude toward and adoption of atomism, particularly as he presents it in his *Lofty Pursuits* (*al-Maṭālib al-'āliyya*), which is frequently viewed as his most mature work on atomism. This project seems pressing given Rāzī's stature in Islamic intellectual history and that there is some scholarly debate concerning Rāzī's own position about atomism, with some scholars claiming that he affirmed traditional atomism,

[84]For excellent and detailed studies of earlier criticisms of Avicenna's theory of the hylomorphic nature of body and Rāzī's defense and finally rejection of that theory, see Ayman Shihadeh "Corporeal Form"; *Doubts on Avicenna*, ch. 6; and "Rāzī's (d. 1210) Commentary on Avicenna's *Pointers and Reminders*," 14.6.

[85]Rāzī, *Sharḥ, namaṭ* I, 2, 1: 7.

while others suggesting that initially he was antipathetic or at least agnostic on the issue of atomism, even if later he claimed to endorse it.[86] No study of which I am aware considers Shahrastānī's possible influence on Rāzī. What I suspect is that, assuming Rāzī has adopted Shahrastānī's line of atomism, then Rāzī could be antipathetic toward traditional atomism and even endorse Avicenna's criticism of it while remaining sympathetic toward atomism more generally; but again, this is another story.[87]

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[86]See Muḥammad Zarkān, *Fakhr al-Dīn al-Rāzī*, 465; Baffioni, *Atomismo*, ch. 5; 'Adī Setia, "Atomism versus Hylomorphism"; and Dhanani, "Impact," 91–104, for studies of al-Rāzī's atomism.

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