

IBN SĪNĀ—AL-BĪRŪNĪ CORRESPONDENCE—VIII

Translated by Rafik Berjak and Muzaḥḥar Iqbal

This provisional translation of the correspondence between Ibn Sīnā and al-Bīrūnī (*al-Asʿilah waʾl-ajwibah*) contains the complete text of the response of Abū Saʿīd al-Maʿšūmī to the objections of al-Bīrūnī regarding the set of eight questions posed by him to Ibn Sīnā. Al-Bīrūnī had not been satisfied with Ibn Sīnā's initial response and had replied in short, categorical statements showing his dissatisfaction. In this eighth and final installment, Ibn Sīnā's student and friend, al-Maʿšūmī, responds to these objections in turn in terse language, indicating his exasperation with al-Bīrūnī.

Keywords: Ibn Sīnā–al-Bīrūnī correspondence; Peripatetic natural philosophy; history of physics; criticism of Aristotelian physics; Islamic scientific tradition; natural elements; schools of thought in Islamic scientific tradition.

ON THE OTHER EIGHT QUESTIONS

On the First Question:

Your objection to the question of reflection of light is based on your lack of its observance in the flask. [Ibn Sīnā], however, had trusted that you would observe it in the flask, which is why he mentioned that a stronger reflection is to be found in [the case of] water and the flask together, as reflection occurs by them both and not within them. Furthermore, you see how the focused ray burns by the smooth surface of the water and the solidity of the glass. Had the flask been [filled]

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Islam & Science, Vol. 5 (Summer 2007) No. 1
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ISSN 1703-7603 (Print); ISSN 1703-7602X (Online)

with air, however, [and not water] no reflection could occur in that air—since it is transparent in reality—and even though there will be [some] reflection from the flask [alone], it would be weak and unable to cause burning on its own. In short, I can see no problem in his reply.

On the Second Question:

As for your response to the wise one regarding his saying, “if it never arrives at the center, that means it is not moving toward it”, I do not think it was correct, and it would have been better had you worded your comment more appropriately. Further, had you perceived what the wise one meant by his noble words on this issue, you would not have allowed yourself to make this objection, because he clarified to you that all four elements cannot be in other than their natural places. From one perspective, the prevailing opinion of physicists and metaphysicists is that there is no force or particular thing in nature that is totally suspended. Its [true] explanation is better left to the knowledge of the Divine, and is inappropriate for our discussion. However, if elements are fixed in their position by force, the [two possible cases] are either that they (i) move from their natural positions or (ii) they do not. If the center of the earth is in its natural position, this movement will never occur so long as the universe is established in order and elements are pressured equally toward [the center] from all directions, with no direction having superiority over another. And if movement did not [in fact] occur, [the notion] of natural position will be contradicted and, therefore, the ability [of elements] to move toward [the center] will also be contradicted since they did not arrive there. As the [notion of] existence of anything superfluous in nature is superfluous in itself, therefore elements do not have any natural position except the position in which they are fixed.

Regarding what you have said about dried mud and the rocks, that, in my opinion, is also at its center, as the center of the mud is under air and water; wherever it is, that will be its center. Because our discussion pertains to stable elements and not corrupted parts (*al-juzʿiyyāt al-fāsidah*), we [can] derive strong proofs for anyone who deals with physics and metaphysics. [Ibn Sīnā] also clarified this [matter] for you from another aspect, saying: “If the movement of fire was potential, it belongs to another body in actuality, as the Philosopher clarified in the first Book of his *Kitāb al-samāʾ waʾl ʿālam* in his detailed account of movements and the moving bodies.” This is a well-known opinion among the physicists, but this is not the place to [fully] enter into

its discussion. As there is no other body which is naturally moving upward, if we say that there is, in fact, such a body while [also claiming] there is no such body, [you recognize] we are creating an impossible contradiction. If we were to say, as you have mentioned, that air puts pressure on fire, and water puts pressure on air, and earth pressures water, that would necessitate that small particles of fire or of air should move faster than larger particles, because of the stronger ability of the smaller to respond and their swiftness in being affected. A large fire is slower in its upward movement because of its passivity and its [reduced] ability to respond, as you see in the [case of] a big rock thrown upward; it does not act as does the smaller stone due to its restricted movement. If the case of fire and air were reversed, we should learn that their movement is not from the direction of pressure, but their movement is natural. Alternatively, if the pressure were the cause, it would either be equal from all directions—in which case it will not move at all, because there is no path for it—or it would come from some [and not all] directions. Because there is no direction in air which has priority over another to block it, if a [pressure] is stronger from one direction, it is likely to be from top downward. In this case fire should spread along the ground and should be affected by what is stronger than it and has more force, but not from its surroundings. The existence of this, as opposed to what we mentioned, is a proof against [the notion] that movement is from the direction of pressure. Furthermore, it is well known that steam and particles of water and earth are denser than air. We do not see these in rising smoke or in steam, so who then is moving them and pressuring them [to cause movement] while they are [yet] denser than air? The particles of water and earth in smoke and steam are definitely denser than air. All of these refute your arguments.

On the Third Question:

You said that [Ibn Sīnā] only referred to the belief of the Philosopher regarding vision [in his own] response. This is true, but you only asked him about how vision occurs. He clarified to you that it is not because of a ray external to sight, but is due to the formation of colors in the vitreous humor (*al-raṭūbatu'l-jalīdiyyah*) in the eye through the medium of air (the transparent [medium] which carries colors). If there is no light, it would be transparent by force, but if there is light, it will become transparent in actuality and will take colors to the area beyond the vitreous humor that is transparent inside the eye. This is where [the colors] will meet and form. For this reason it does not have its

own color, it recognizes colors—just like water that does not have taste by itself but is the medium through which taste itself occurs [passing] through saliva.

The [question of] the distinction between distances and sizes (such as large and small) through vision: this is a matter of much discussion and to clarify it would require a lengthy discourse; likewise, the [question regarding] sounds. Since we find that large [bodies] at a distance and small objects [which are] closeby are often contrary to observation. Consider [the matter] as follows, that we might distinguish between them: If a person who has never seen a high mountain were to do so from afar, he would not be able to estimate the actual distance between him and the mountain, and might think it is closer to him and smaller in size [than it is], because of his [experiential] background, but the one who has [previously] observed mountains and is familiar with their distances will not be confused about their distance, [even] if he saw [only a] part of them. Likewise, one who has never heard a specific sound or any sound similar to it or who has not grown accustomed to it, will not be distinguish between many such sounds [coming] from afar or a few [such sounds] coming from nearby—for example, the sounds of storms, earthquakes, and the like; this proves that the cause of this is not what you have mentioned but rather it is one's experience.

Further, regarding the black [color]. Your claim that it should all seem black is wrong because transparent bodies, even if they carried colors to vision, would carry them in a straight line and along the shortest possible path between them and the vision—not on curves or slants. So, the amount of color in line with vision will be seen as black and whatever is extra will be seen as white.

As for your question about the ability of the vision to perceive fish under the surface of water and the stars above in the same manner: as opposed to what you said about them [as] the perception of the ray of sight, we say that they are actually being formed inside the eye.

On the Fourth Question:

Regarding the reflection of light at angles, [Ibn Sīnā] clarified it in [response to] the ninth question from the first [set of] questions. You mentioned a location where the sunset lasts forever—what an astonishing suggestion! You thought such a matter was hidden from the wise one! What he meant is, rather, that the continuous sunrise is the cause of [that location's] hot [climate] and the continuous sunset is the reason for its cold, not the length of the duration of dawn nor the

length of dusk, nor their perpetual existence.

On the Fifth Question:

Your objection about the wise one's denial that the surface has width is evidence [enough] that you have never been trained in the terms [used] by philosophers and physicists and are not used to their methodology: had you only restricted yourself to asking questions, without entering far into [such] difficult [matters], it would have been better for you, because the wise one thought highly of you and trusted that hints would suffice in place of long explanations. However, I will [now] clarify this to you in detail. I say: the one possessing something is not that thing [which he possesses], just as the one who has dominion is not the dominion [himself], and the one who has whiteness is not whiteness [himself]. Since a surface is width in reality, it does not possess width; it *is* the width without matter (*māddah*). Indeed, the body is just that which has surface without width—because [the body] is the one which has width and is not it [in itself]. The surface has width because it has a line, and it is not a line [in itself]. It is so permissible to say *the one that has length* in this manner, because the length is not the thing; it is its extremity and the extremity of anything is not that thing itself. On the contrary, it is not permissible to say [about] something that it has width, when it is the width itself. And likewise the line, it cannot [be said to] have length, because it is the length itself without matter, while [the line can be said to] have a point, because it has extremity. They are not the same thing. As for the point, it possesses nothing, because it has no extremity: it is the extremity of extremities. Had you looked into *kitāb al-samā' wa'l 'ālam*, and reflected on the sayings of the Philosopher where he said: “From [existent] things there are those which possess body and volume and those which *are* bodies and volumes”, you would know the difference between the thing itself and its property.

And the body which possesses length, width, and depth together, it is the possessor of depth but is not depth itself, because of its link to the *hyulé* and its existence in matter. But the surface and the line do not have [properties] to be added except themselves, because they are imaginary and opposite to matter.

Your claim that length, width, and depth are extended in directions shows that you are a man of poor logic who calls quantities qualities: extension is a quality to show quantity. Quality and quantity are two different categories. And your demonstration about width by a *thawb* which possesses length and width actually proves our position, since the

thawb is a body which possesses matter, it possesses width and length and also depth; since surface never has matter, it does not have width but is width itself. No wonder you were faced with this confusion, since you were using the *thawb* as a [faulty] analogy to surface!

And as for your argument about the common boundary between two tangential bodies [and] that this is the position of atomists—it seems you have never heard this except from them and so you thought it was their opinion and not that of others. Had you reflected on what has been said in *kitāb al-samāʾ al-ṭabīʿī*, you would have known that it is in fact the position of those who do not believe in the divisibility of the atom. I saw that the wise one has explained the tangential and connected [bodies] in detail; nothing can be added to his explanation. It seems to me that you did not truly reflect on what he said; had you pondered with your mind and been sure of what he said regarding the unity of extremities and their connection, you would not need to repeat the question. You went [too] far when you replied that his answer on the connection (*tamās*) of surfaces was not valid. It would have been better for you to ask him for more of an explanation and clarification. Again I will say that the wise one made clear to you with correct proofs that if the lines were to gather they would be one line only, and would not form a surface; likewise, if the surfaces came together, they would make one surface only, and would not form depth; likewise in the case of points: if they met and gathered, they would be just one point; a line would not form, but they would unite. He gave you the analogy of surfaces and I will [follow with the example of] points, to more closely clarify this matter. So: If two points were to meet and they made more than one point, the extra will certainly form a length. Length is a continuous quantity which has two points as its two ends—but between the two points there was no any other quantity, so whence came this [span]? And where would any quantity exist between them? They did not, in fact, meet in any connection, but remained separate in a sequence [creating a line]. Therefore, according to this argument, two points do not exceed one point, and the same holds true for more [than two] points. [If it applies to] two, that they meet and do not exceed one, then [why not] four? The two combined are taken as one, and do not exceed it; so is the matter of surfaces and lines, applied accordingly. The four surfaces, then: if they meet on four points by force, they will unite in actuality, because they met as we explained. This does not happen to corporeal bodies in actuality, because there is no square in them in reality. It can thus only

be pictured in imaginary lines and shapes.

On the Sixth Question:

Your objection about the rising of air when heated and your question how it can occur in the absence of vacuum—the answer was already presented in the example of the heated flask. That is, the air nearest to it thickens and increases in heat as we have clarified in the case of the air in public baths. Regarding your experiments with flasks, they did not work for you because you did not do the experiment properly: you have to blow in it until the air heats; then you put it upside down into water without covering its head and observe how the extra air will bubble out from it; this is caused by the heat. Then, if the coldness meets with what is left, it will gather and shrink and become less than what it was, and finally the water will enter it. The bubbling is the release of air increased by heat, because it was densely [compacted] in [the flask], and we are able to see its exit with the influx of water.

On the Seventh Question:

Your objection about the breaking of the flask, that it should have broken inward because of vacuum, is false. The cause of the breaking is coming from within, because when water gathers and solidifies inside the flask, it leaves a little space between it and the wall of the flask: that space longs for something to occupy it, because it is impossible for it to remain empty. That natural longing breaks the flask, but it is hard to differentiate [in observation] between the breaking from within or without. In any case, the breaking from without would be severe because the outside surface is greater than the inside surface, and also because extreme cold, when it effects bodies, shrinks and expands them; this will create a crack as cracks appear on hard ground during cold weather.

On the Eighth Question:

In regard to the floating of ice on the surface of water although it is colder than [the water], [the answer is] that ice floats because it contains airy particles. Some ice however may sink, because it would contain fewer airy particles and would be more solid. The proof that ice contains such air particles lies in that it can be crushed inward, whereas bodies which do not have such air pockets cannot be pressed inward.

And as for your question about when the air enters [the ice, the answer is]: it happens during the process of solidification, because it is cold air [itself] which causes [this] solidification. [This applies to] what you mentioned about the bladder, that if you blow air into a balloon and

put it on the surface of water it will not sink but float, because of the airy particles within. If however air was not blown in, then its case will be as that of water leaving [the flask]. You [asked] how air enters a sealed container, but should know that the air has a passage to [do] so. If [air] never enters it at all, water will never freeze in [the flask]. You will find a cure to [all] these doubts in the *Kitāb al-athār al-luwīyyah*.

And Allah knows best.