Astronomical Events During the Time of Epicurus (& Discussion on Letter to Pythocles Section 91)

Post by “Eikadistes” of May 27, 2021 at 6:34 PM

The morning of August 15th 309 BCE, while Epicurus was teaching his first pupils at Lampsacus, a total Solar Eclipse darkened his sky. No doubt, Epicurus would have spent time addressing this phenomena with his students.

Anyone who witnessed this event could have made the following observations:

1. Parts of the Sun are still visible even when the Moon slides in front of it, **so the Sun must be bigger than the moon no matter where it is.**

2. The body of the Sun goes behind the Moon, **so the Sun and the Moon must occupy different regions of space, the Sun being further away**.

3. The body of the Moon is not damaged, **so the Sun's distance behind the moon is at least greater than the size of its own diameter**.

Given these observations *which I am certain Epicurus would have made*, I'm curious why he suggested that both celestial objects are about the same size. Do we have any documentation of his estimation of the size of comets?

ASTRONOMICAL EVENTS DURING THE TIME OF EPICURUS

COMETS

Epicurus would have witnessed several comets throughout his lifetime. The only one I confirm is **Halley's Comet** which he would have seen in above the hills of Colophon with his Democritean teacher Nausiphanes in **October** of **316 BCE**.

SOLAR ECLIPSES

Year	Date	Type	Age	Location	View
337 BCE	03/01	Partial	4	Samos	poor

336 BCE	07/14	Total	5	Samos	poor
335 BCE	07/04	Total	6	Samos	good
334 BCE	12/17	Partial	7	Samos	poor
326 BCE	07/24	Partial	15	Samos	good
325 BCE	12/08	Hybrid	16	Samos	poor
323 BCE	**05/23**	**Annular**	**18**	**Athens**	**excellent**
322 BCE	10/07	Partial	19	Athens	average
321 BCE	09/26	Annular	20	Colophon	poor
309 BCE	**08/15**	**Total**	**32**	**Lampsacus**	**excellent**
308 BCE	12/29	Partial	33	Lampsacus	average
306 BCE	06/14	Annular	35	Athens	average
305 BCE	06/03	Annular	36	Athens	poor
302 BCE	04/02	Total	39	Athens	average
296 BCE	05/24	Annular	45	Athens	average
295 BCE	05/13	Hybrid	46	Athens	average
295 BCE	11/07	Annular	46	Athens	poor

294 BCE	10/27	Partial	47	Athens	poor
293 BCE	03/24	Partial	48	Athens	poor
285 BCE	10/18	Annular	56	Athens	poor
283 BCE	04/02	Total	58	Athens	poor
282 BCE	08/16	Partial	59	Athens	poor
281 BCE	08/06	Total	60	Athens	good
278 BCE	06/04	Annular	63	Athens	poor
274 BCE	03/24	Hybrid	67	Athens	average
270 BCE	01/09	Total	69	Athens	poor

Post by “Eikadistes” of May 27, 2021 at 8:27 PM

Thinking out loud...

While Epicurus sailed the Aegean, he would have seen how the Sun and the Moon maintain their size, no matter where they are located in the sky, nor in which direction they are moving; whereas, even the tallest mountains of Greece shrink in the distance as we sail away from them at a moderate pace, so the Sun and the Moon must be immeasurably larger by comparison than a mountain.

If some of the light of the Sun can still be seen when the Moon is in front of it, then the Sun must be larger than the Moon, and must be removed from the Moon by a distance greater than its own diameter (already defined as being "*immeasurable large by comparison*"), so the space between the Sun and the Moon must be at least as immeasurably large as the diameter of the Sun.

For a distant object to appear larger than a nearer object, it must at least *slightly* larger; for a **severely** distant object to appear larger than a *significantly* nearer object, it must be **much** larger than the closer object. The Sun is removed from the Moon by an immeasurably-large-by-comparison amount of space, so the Sun *could* be immeasurably larger by comparison than the Moon.

I suppose I'm postulating then Epicurus may have had more nuanced opinions about the celestial spheres than we have documented. Simple knowledge of the eclipses should seem to have demonstrated that the Sun is, at least, *demonstrably* larger than the Moon, if not **incredibly** larger. Surely, Epicurus saw that the moon seems larger than distant mountains, which are *obviously* **immense**.

Post by “Cassius” of May 27, 2021 at 9:14 PM

> Quote from Nate
>
> why he suggested that both celestial objects are about the same size.

You're probably right but did he say that precisely, or was it that both were "about the size they appear to be?"

> Quote from Nate
>
> so the Sun and the Moon must be immeasurably larger by comparison than a mountain.

YES I think that is a very important point, and for me that seals in my mind that people who assert that he thought the sun to be the size of a basketball, or whatever analogy they use to indicate that Epicurus thought the sun was relatively small, are full of nonsense.

Like I said in the podcast I don't think it's necessary to try to maintain that Epicurus' view of the size of the sun has turned out to be "exactly correct," although i am open to the possibility that the "size that it appears" might even be stretched that far, especially if we could find more of Epicurus' writings on the subject.

But even if we don't maintain that Epicurus was completely right, there's no need at all to ridicule his position as absolutely wrong, at least without noting the point that you are making here that Epicurus surely understood that the Sun is very large.

Post by “Don” of May 27, 2021 at 10:31 PM

> Quote
>
> "An eclipse of the sun or moon may be due to the extinction of their light, just as within our own experience this is observed to happen ; and again by interposition of something else--whether it be the earth or some other invisible body like it. And thus we must take in conjunction the explanations which agree with one another, and remember that the concurrence of more than one at the same time may not impossibly happen. [He says the same in Book XII. of his "De Natura," and further that the sun is eclipsed when the moon throws her shadow over him, and the moon is eclipsed by the shadow of the earth ; or again, eclipse may be due to the moon's withdrawal, [97] and this is cited by Diogenes the Epicurean in the first book of his "Epilecta."]

So, according to Epicurus (in Herodotus), the moon and sun and Earth don't necessarily interact the way Nate had laid out. So, Epicurus, viewing the eclipse wouldn't necessarily have had to conclude that the sizes of the bodies implied those sizes Nate was referring to. Epicurus had multiple explanations at his disposal.
This still doesn't address "How big did Epicurus think the moon and sun were?" however. Still looking into that.

Post by “Don” of May 27, 2021 at 10:36 PM

> Quote
>
> "The size of the sun and the remaining stars relatively to us is just as great as it appears.119 [This he states in the eleventh book "On Nature." For, says he, if it had diminished in size on account of the distance, it would much more have diminished its brightness ; for indeed there is no distance more proportionate to this diminution of size than is the distance at which the brightness begins to diminish.] But in itself and actually it may be a little larger or a little smaller, or precisely as great as it is seen to be. For so too fires of which we have experience are seen by sense when we see them at a distance. And every objection brought against this part of the theory will easily be met by anyone who attends to plain facts, as I show in my work On Nature.

Aarrrgh! Those is so frustrating! He's right there! Just tell us how big you think it is! One stadia? The size of a kylix? The height of the Acropolis?? Anything!
We also don't have the volumes of On Nature. I'm sure it's in there buried in a charred scroll

still underground in Herculaneum. 

Post by “Cassius” of May 28, 2021 at 6:36 AM

It seems clear that he thought it was important to limit the distance on the grounds that (1) light sources don't shrink as much as other objects at a distance and (2) things that we see sharply don't tend to be as far away as objects that seem to us to be blurry.

But on the other hand we see the sun and moon on the horizon as further away or at least comparable in size to the mountain ranges, and we know the mountains to be huge.

I am thinking that part of the answer here lies, as in other areas, in comparing Epicurus to what he was arguing against. I don't have a reference but I seem to have picked up over the years that the people Epicurus was arguing against (Pythagoreans?) had calculated the sun to be huge as part of their program of seeing the sun (and maybe moon and stars) as gods, and so they were using their calculations of the size being hugely bigger than the earth itself as part of their program of deeming the sun to be a god. (Not sure what they thought about the size of the moon. Did they have that right?)

So maybe it would be clearly to us what Epicurus was saying if we knew that he thought it was possible and acceptable that the sun be bigger than the mountains, just so long as he didn't have to admit that the sun was many times larger than the earth itself.

That probably takes us back to the issue of what the model really was. Our world is clearly not the center of the universe, but was the earth the center of our world? If so, then we might have the perspective there that would allow us to see that Epicurus could admit that the sun was pretty large just so long as the calculating didn't have it swallowing up the whole "world." And we could probably come up with a picture or diagram that would make the position a lot more clear, and a lot less ridiculous-looking, than presuming he meant the sun was the size of a basketball.

In fact, a diagram of our "world" in Epicurean terms would be highly helpful for many uses.

Post by “Cassius” of May 28, 2021 at 6:44 AM

I wonder if the Antikythera mechanism, or other Greek diagrams of the solar system (if they exist) would not give us insight into their way of looking at this. Perhaps the diagrams showing the sun to be large, and yet no so large as to swallow up the earth many thousands of times over, would help us get a more balanced picture of the situation.

https://scitechdaily.com/2000-year-old-...first-computer/

Post by “Don” of May 28, 2021 at 9:35 AM

As I interpret Lucretius, Epicurus believed that the sun and the moon inhabited the sphere of the air along with the Earth. Encircling that was the ether which held the stars. Lucretius says the sun MAY inflame the air around it which is why it's "small" but so hot. So, it appears to me, that the sun and moon were not seen as similar to the stars and that each (sun/moon then stars) inhabited different parts of our Cosmos. The Earth, sun, and moon were round celestial bodies surrounded by "air." The stars and planets ("wandering" stars) were fires, of some sort, embedded in the ether.

Post by “Don” of May 28, 2021 at 9:55 AM

https://www.loc.gov/collections/fi...-and-cosmology/

"By the 5th century B.C., it was widely accepted that the Earth is a sphere. This is a critical point, as there is a widespread misconception that ancient peoples thought the Earth was flat. This was simply not the case."

Plato's cosmology outline

https://faculty.washington.edu/smcohen/320/timaeus.htm

Plus, added bonus: This finally shows me why Epicurus wrote his "The Angles of the Atom." Plato thought atoms only came in 2 triangular shapes! Epicurus and Democritus had many shapes.

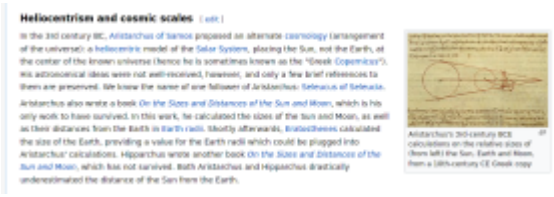
Also see section on Hellenistic astronomy here

https://en.wikipedia.org/wiki/Ancient_Greek_astronomy

Post by “Cassius” of May 28, 2021 at 11:06 AM

Great research.

So if this is Aristarchus' model as to the sizes:



What do we think about whether Epicurus was disputing this, or whether is "it is the size it appears to be" can be reconciled with this, which would indicate that the sun is larger than the earth?

It could not have been lost on Epicurus that as formula in words like "it is the size it appears to be" will strike some people as too ambiguous to be useful. So is that phrasing in itself an indication that Epicurus knew very well that the sun was not the size of an orange or any everyday object like people accuse him of believing? Almost certainly he knew that a very large size was a reasonable possibility, and it doesn't appear that he wanted to eliminate that possibility, along the lines of our continuing observation that only one among several alternate possibilities can't be arbitrarily selected as the sole answer.

Maybe that's an easier way to ask the question.

"*Does Epicurus' answer allow for the possibility of the Sun being larger than the earth?*"

Post by “Eikadistes” of May 28, 2021 at 11:42 AM

Interesting point, that "***the size it appears to be***" may not have meant: *that the Apparent Size or Apparent Magnitude of the star to an observer on Earth is equivalent to an objective measurement of that star's actual Size or total Luminosity;* and may have meant something more like: *that the non-Platonic, non-Aristotelian-influenced observations of pre-Socratics were* ***correct****; that the Sun is a massive object, in the same category of objects as stars, which are distant Suns, and that the Moon is something more closely related to the Earth, like the spheres we imagine accompany those distant Suns ...* or something like that.

I agree that the rhetorical function of his mentioning the sizes of the appearances of the Sun and the Moon was to refute the Platonic hypothesis that they were deities.

The prevalent interpretation t*hat Epicurus was arguing that the Apparent Size of the Sun is equivalent to an objective measurement of its actual Size* is really an Aristotelian idea: 'the Sun is (*duh*) obviously smaller than the Earth, and (*duh*) revolves *around* the Earth, because (*duh*) look up, *stupid*'. It would be uncharacteristic and inconsistent of Epicurus to support this, *especially* when he posits **the *explicit* existence of exoplanets**. That, and also, he *generally* supported the idea that these physical relationships are obvious to *all* seeing humans, and not simply learned mathematicians, so he wasn't submitting a mathematical figure (big *or* small) in the first place. The point is somewhat moot.

There's something else I thought that makes this criticism more meaningless:

Suppose another solar narrative like our own, except, allow for the possibility that instead of G-type main-sequence star (our white-yellow Sun), "our Sun" is a neutron star only 20 km in diameter. It would appear to be ***incredibly*** *small in the sky; it would actually be incredibly small, at that.* ***Unexpectedly*** *small (even to 21st-century cosmologists).*

In a parallel timeline, **that** society would not have **accurately** measured the diameter of their parent star until *their* 21st-century. However, both that society, and our own would have **functionally** measured the comparative size of the star since antiquity

Epicurus' observation is still true when taken to mean *that all of these objects are what they appear to be, compared to tall trees, massive monuments, and huge mountains: immeasurably massive and immeasurably distant on cosmic scales. Thus*, they are "about the size they appear to be", or, in other words "immeasurably large".

Whether one's planet's parent star is a G-type main-sequence 400x as massive as the Earth's Moon (and almost exactly 400x as distant), or whether it's a neutron star barely one-third of the size of Rhode Island, the human ethical condition is unchanged. Furthermore, excessive speculation about these measurements *without the necessary scientific tools* will inevitably

lead to superstition and mysticism, so are to be avoided.

Post by “Don” of May 28, 2021 at 12:02 PM

> Quote from Nate
>
> It would be uncharacteristic and inconsistent of Epicurus to support this, especially when he posits the explicit existence of exoplanets.

All great points, @Nate , but I do want to fine tune your statement quoted here.

What Epicurus posited was an "infinite number of cosmoi (cosmoses?):"

τὴν ἀπειρίαν τῶν κόσμων.

...tēn apeiran tōn cosmon.

We live in a cosmos composed of the Earth at the center with the sun and moon and stars encircling us.

Other cosmoses with their own sun, moon and stars exist according to his theory, but they're their own world-system. They don't inhabit our world-system or cosmos. And the gods live in between these cosmoi in the metacosmia/intermundia. And all those cosmoi are part of the All, Το Παν, To Pan, the Universe.

Sorry to be pedantic, but I don't want to equate our knowledge of exoplanets in our cosmos, as it were, with what Epicurus would have understood that to mean.

Post by “Eikadistes” of May 28, 2021 at 12:16 PM

That's a good point and it makes me consider a few other things:

The Heliocentric model, itself, was in need of being tweaked for systems with binary stars (*which are actually the most common types of systems in the universe)*, so **Epicurus'** model is consistent with contemporary relativity. That also applies to any systems (**WARNING**: **EXTREME SPECULATION**) with life-holding worlds that have stable orbits around Black Holes.

Heliocentrism carries a danger of being seen as a geometrically-ideal solar configuration to which other Solar System must necessarily conform. Relatively defaltes that.

For that matter, his speculation is also applicable to *(another common, cosmic possibility, to which our own system is, again, an unusual rarity*) systems where the only identifiable life exists on the satellites of gas giants. To a lunar organism making **this** cosmic inquiry on the moon of a Gas Giant, the discovery of Heliocentrism – which is *key* to a planetary organism – becomes a **less** significant scientific advancement than Geocentrism *to a lunar organism,* **especially** considering that a primary energy source for such a satellite would be volcanism, fueled by the shifting tidal forces of the parent gas giant's colossal gravitational force, not the Sun. Geocentrism *is* the Heliocentrism of Moonlings.

Given attempts to measure the relative sizes and energetic-importance of neutron stars, gas giants, brown dwars, and supermassive black holes to the possible life-supporting planetoids which orbit around them, Copernican Heliocentrism comes up *sort of* short.

Post by “Cassius” of May 28, 2021 at 12:33 PM

What are you guys thinking about this way of asking the question. I think I see your answer, but can this be answered clearly yes or no?

"***Does Epicurus' answer allow for the possibility of the Sun being larger than the earth?***"

Post by “Don” of May 28, 2021 at 12:36 PM

> Quote from Cassius
>
> What are you guys thinking about this way of asking the question. I think I see your answer, but can this be answered clearly yes or no?
>
> "***Does Epicurus' answer allow for the possibility of the Sun being larger than the earth?***"

I think there are multiple possible responses that answer that question. But, if that's the case, I guess the answer to that specific question is yes.

Post by “Eikadistes” of May 28, 2021 at 12:36 PM

Absolutely. I think the mistake is on the behalf of the inquirer. Questions about measuring the relative geometric proportions of celestial objects implies that Epicurus had such an answer, or, more importantly, *cared* about it, which I think he did not.

He recognized that we had a *functional* understanding of the immeasurably large, immeasurably distant spheres above the terrestrial regions of the World, so there was no need to posit any number, large, or small, as the predominant view seems to imply.

Post by “Cassius” of May 28, 2021 at 1:14 PM

> Quote from Nate
>
> cared about it, which I think he did not.

As usual I may or may not be plagiarizing this from DeWitt, but I do think that he would have cared about it to the extent that some people might equate immense size with an attribute of being a god (in the supernatural/non-Epicurean sense). I think I remember reading DeWitt say that, or maybe it was someone else, or maybe I am just dreaming it. There should be no necessary relationship between size and being a supernatural god, but I can see the possibility of enough connection that it might have been on Epicurus' mind as a reason to denounce the conclusions of those who were arguing that their geometric calculations were somehow divine.

(Note - I may be reading it into that passage from Lucian criticizing the mathematicians, which wasn't directly on point, but I think would be related. Let's see if i can find it reasonably quickly. Ok it's here:

from Lucian’s Dialog “***Icaromenippus, An Aerial Expedition:”***

“Menippus. Ah, but keep your laughter till you have heard something of their pretentious mystifications. To begin with, their feet are on the ground; they are no taller than the rest of us ‘men that walk the earth’; they are no sharper-sighted than their neighbors, some of them purblind, indeed, with age or indolence. And yet they say they can distinguish the limits of the sky, they measure the sun’s circumference, take their walks in the supra-lunar regions, and specify the sizes and shapes of the stars as though they had fallen from them. Often one of them could not tell you correctly the number of miles from Megara to Athens, but has no hesitation about

the distance in feet from the sun to the moon. How high the atmosphere is, how deep the sea, how far it is round the earth— they have the figures for all that. Moreover, they have only to draw some circles, arrange a few triangles and squares, add certain complicated spheres, and lo, they have the cubic contents of Heaven.

Then, how reasonable and modest of them, dealing with subjects so debatable, to issue their views without a hint of uncertainty; thus it must be and it shall be; *contra gentes* they will have it so. They will tell you on oath the sun is a molten mass, the moon inhabited, and the stars water-drinkers, moisture being drawn up by the sun's rope and bucket and equitably distributed among them."