Published Edit

This is a graded discussion: 10 points possible

Show Due Dates

D2(BH) Weekly Discussion

Erin O'Connor

Jan 23 at 8:12pm

37

Due this week

First, be sure to do the reading and watch the lectures:
Assigned reading and lectures

Then answer the following questions in this discussion forum (and yes, you may look to see what others write, but try to find what they might have missed and you should go back to the original reading and lectures to get answers for yourself). Then post your own question at the end, and then answer someone else's question. If no question is available, go ahead and check back later until the due date. If nothing comes available you can then pick any question you wish.

We hope to emulate a seminar classroom environment where students can share ideas. Always be respectful with all communications you have with your esteemed fellow colleagues (your fellow students) in this course.

- 1. DISCUSS in some detail something you found unusually interesting or intriguing in the reading or lecture material. Are there new insights that you have gained (something you had not thought of or considered before)? Focus on one of the concepts and explain as best you can in your own words. (4 pts)
- 2. Post a question that you have about something you read. Be sincere. What do you want to know? Write the word QUESTION all in caps, so that your fellow classmates know what your proposed question to the class is. (3 pts)
- 3. ANSWER the question of another student according to what we discussed in the lectures or what you read in the assigned readings (don't just make something up). Try to answer a question that no one else has responded to yet (but not a hard and fast rule). A good way to respond to another student's question would be to say something like, "Good question! The answer can be found on page..." and give the quote from the reading. You are free to reference other sources outside of class material, but always consider the credibility of the source, state what the source is, and give the link. (3 pts)

Search entries or author Unread Subscribed

Reply

Brian Wolden (https://canvas.sbcc.edu/courses/46681/users/274832)

Jan 29, 2022

DISCUSSION

One thing that I found fascinating about this lecture was about the expansion of space being able to allow for movement faster than the speed of light. The idea of the space that light and everything else is moving through is hard to conceptualize and it is a lot of fun to think about. It also reinforces the idea that time didn't exist before the big bang. It's almost easier to envision that, before the big bang, there wasn't a bunch of empty space and a dot in the center with EVERYTHING in it, but instead, that there wasn't even any space. I really like how out of place this concept is from how I normally perceive the world around me and I am really interested in learning more about it.

QUESTION

The idea of the expansion of space itself brings to mind a question I have had for some time and may even answer it. If the universe is 13.7 billion years old, intuitively it seems that size of the universe (from one end to another) should be no more than 27.4 billion light years across (13.7 billion light years in each direction from the big bang), since the speed of light is the limiting factor for speed of travel. However, the size of the observable universe is supposed to be something like 94 billion light years. Is the reason that the universe is larger than the speed of light should allow because the space itself was carrying matter faster than the speed of light as it expands outwards?

Reply

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

Jan 30, 2022

Hi Brian. Yes, you are on the right track. In the early universe there was a period of "hyperinflation" where the stretching of the fabric of spacetime was faster than light. This has resulted in a universe much much larger than just the "light sphere" of what we can see. More on this later.

Reply

(http

Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)

Jan 30, 2022

QUESTION:

I don't have an answer to your question, but I have another question to build off of it. Doesn't assuming that the universe is 13.7 billion years old mean that we're assuming that Earth is the center of the universe? We can see light coming from 13.7 billion light years in all directions like a sphere around us. The odds don't seem likely that we're in the center; This seems like another geocentric model. So where IS the center?

Where does the measurement of 94 billion light years come from? Is that 94 billion square light years in volume?

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:31am

Originally Posted 2/5/22

Well thought-out commentary and good questions. Yes, you are correct. Cosmologists believe that there was a time very early in the Big Bang inflationary process, where the universe experienced hyperinflation, where the fabric of space-time was stretching faster than the speed of light. In fact we will see in next week's readings that this hyperinflation helped the universe smooth out, and allows for the universe to show an expansion rate that is almost exactly balanced with the gravity needed to close it, approaching very close if not exactly to the flat universe model.

Reply

(https:/

Luke Rutherford (https://canvas.sbcc.edu/courses/46681/users/373514)

Jan 30, 2022

DISCUSSION:

Something that I found interesting that was pointed out in the lecture is the accuracy of previous models that were wrong. When Copernicus first introduced his heliocentric model the predictions were not as accurate as of the previous Ptolemaic model. Even though the heliocentric model is correct in placing the Sun in the middle of the galaxy compared to placing the Earth at the center the wrong model was more accurate. Even when Kepler added the

observation of ellipticals the new and improved heliocentric model is "as accurate" as the previous model. It intrigues me that a theory could be far off from actuality but still offer accuracy.

QUESTION:

I wonder how many theories that were made and disproven still offer accurate and applicable data to questions that have yet to be answered. Even though this is an open-ended question it still inspires me to think of the bits of theories that were correct. Also, what previous disproven theories contributed data to discover hypotheses that are thought to be accurate predictions?

Reply

(http

Abigail Jacobs (*She/Her*) (https://canvas.sbcc.edu/courses/46681/users/367167)

Jan 30, 2022

Hi Luke!

I think that's a very interesting question and often I think of the same thing, there are so many theories out there that haven't even been looked at. What information could those bring to us? How could they help us to better understand, well everything?

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:27am

Originally Posted 2/5/22

Isn't it interesting that the wrong model can give you better accuracy then the correct model in terms of physically visualizing the orbits of planets. I'm sure there are models today that we use that are not correct in their interpretation but give very accurate numerical results. My personal belief is that dark energy is one of these misconceptions that cosmologists have had to use to get the correct numbers, but they don't really understand at all what is happening. I hope to see in my lifetime if and how they might resolve this.

Reply

(https:/

Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)

Jan 30, 2022

DISCUSSION:

This lecture really helped me get my bearings on the concept of an expanding universe. The simplified idea of the Big Bang that we all learn at an early age is really misleading. I had thought that the fabric of space-time already existed and all matter was compressed into a point that exploded outward spreading the matter in all directions across that fabric, and that it was the matter that was somehow accelerating away from that central point. The concept that it was actually the fabric that was compressed into a point and it's the fabric that exploded outward is entirely different. I think I'm understanding that matter isn't accelerating. It's really that the fabric is expanding like a balloon and carrying the matter with it. And the acceleration the farther out you go is because the geometry of space while increasing in size causes the distance between objects to increase the farther you go out. I feel like the way the Big Bang Theory is taught at an elementary level should be adjusted so the next generation grows up having a better grasp on this.

Edited by **Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)** on Jan 30 at 3:58pm

Reply

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:29am

Originally Posted 2/5/22

Very thoughtful and insightful commentary and excellent questions. To respond to your efforts to understand how we are not at the center of the universe, if the universe is expanding outward, is to think in terms of everyone has their own center, meaning if we lived in a different galaxy far away from this one, and we were on the surface of an expanding balloon, we would see every other galaxies, including this one moving away from us, meaning like we're in the other galaxies, and so it doesn't matter which Galaxy you're in, every one of these will have its own lights sphere, where you can only see about 15 billion light years in all directions from that point, and to them it will always look like everything is moving away from them and so the century is with them, but because this view is shared by everyone in every different galaxies, you see that it does not violate any of the principles of cosmology and there is no actual center. The truth of the matter is that all of the fabric of space-time was once at the center so all of us can claim that everything in the universe is at the center.

Yes, the advent of the printing press was a cultural revolution, changing our society forever. The advent of the internet which allows everyone to publish, even if they have no idea what they're talking about, that is also a cultural revolution. But with every great

advance, come challenges and the opportunity for exploitation. And such is the origin and the power of "fake news".

Reply

Abigail Jacobs (*She/Her*) (https://canvas.sbcc.edu/courses/46681/users/367167)

Jan 30, 2022

In this week's reading I found out that Kepler found out information about elliptical orbits almost by mistake, that's a very exciting mistake made for a scientist. In chapter 1, “As far as Kepler was concerned, elliptical orbits were merely an ad hoc hypothesis and a rather repugnant one at that because ellipses were clearly less perfect than circles. Having discovered almost by accident that elliptical orbits fit the observations well, he could not reconcile them with his idea that the planets were made to orbit the sun by magnetic forces.”(Hawking, p. 5). There were many theories to the orbital rotation but Kepler was lucky enough to find the most fitting explanation, with facts and was able to make 3 laws from this.

QUESTION

When the first people on earth saw the stars in the sky what did they think of it? How much did they know about everything outside of our atmosphere?

Reply

Luke Rutherford (https://canvas.sbcc.edu/courses/46681/users/373514)

Jan 30, 2022

Hi Abigail,

In my anthropology class last semester we learned about how ancient civilizations looked at stars to make constellations to contribute to early mythology. Many ancient cave paintings/stories were inspired by stars and the shapes they made in the night sky.

Edited by Luke Rutherford (https://canvas.sbcc.edu/courses/46681/users/373514) on Jan 30 at 7:38pm

Reply

Franco Diaz Campo (https://canvas.sbcc.edu/courses/46681/users/403036)

Jan 30, 2022

Hi Abigail,

I think that the first thing it came through their minds was thinking, "What is it?". That was the first thing they thought since it is human to doubt everything. I think their first impression was of pure astonishment since it was something new they had never seen before. They might have reacted like us when we see something we have never seen and, as always, try to give it a reason, and they thought the stars they saw in the sky were of some strange God.

Great work!
Franco.

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:25am

Originally Posted 2/5/22

Good questions and thoughtful responses. Just to clarify, Kepler's elliptical orbits we're not exactly a mistake, or determined by accident, he worked on the problem for 10 years and appreciated and valued the way that it could precisely calculate for the positions of the planets, but what he didn't like was that it didn't seem perfect in the traditional sense of geometry and circular motion. So it's not that he accidentally came across it, it was a very thoughtful and methodical process, but he just didn't like that it showed the universe to behave differently than how he wanted. And he thought maybe it was a mathematical representation that was not accurate in reality, sort of like the Ptolemaic model gave correct mathematical results but did not accurately represent what truly was. Oddly enough though, his ideas represented true reality, but he just wasn't able to accept it at the time.

I believe early civilizations thought the stars were pinholes letting the light of Heaven shine through, or something of the sort. But certainly they didn't realize they were Suns like our own sun shining brilliantly and with perhaps planets round their solar systems and always with the possibility of life. They just had no basis to understand anything like that.

Reply

(https:/

Franco Diaz Campo (https://canvas.sbcc.edu/courses/46681/users/403036)

Jan 30, 2022

DISCUSSION

I found interesting the idea that every day we see something different/new things that we may think we're different. It called a lot my attention that many years ago, people thought Earth was flat, and today we laugh at it, knowing it isn't even close to being like that. I liked that the book emphasizes that the same things can happen to us, and we may laugh in the future at the beliefs we have today; this occurs mainly because, as I said at the beginning of the paragraph, every day we know new things.

QUESTION

What belief of today's scientists do you think it is craziness, and that you believe we may laugh at it in the future?

Reply

(http

Naomi Xu (https://canvas.sbcc.edu/courses/46681/users/27955)

Jan 30, 2022

ANSWER

that we're the smartest we've ever been.

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:22am

Originally Posted 2/5/22

That's a great example about the Earth being flat and how now it's so obvious that it is not flat, but then we have people who are now reviving the mistaken belief that the Earth is flat, though I think they're doing it more for attention then actual science or because they believe it, but I think having people represent they believe it is causing others to fall into that false belief so it gets complicated.

Reply

(https:/

Lex Richardson Oliphant (https://canvas.sbcc.edu/courses/46681/users/376967)

Jan 30, 2022

Discussion:

For me a really interesting thing to learn in this weeks material was about past models, and how their accuracy was so good that they are still used. I find it incredible that these people where able to put together all of the necessary information (even if it was proven wrong later) to create accurate representations on the universe around them.

Question:

How fast did the ratio turn from the majority believing the earth centered model to the sun centered model? Also, where there any other models that were brought up that people mostly agreed with, for them to then get disproved?

Reply

(http

Brian Wolden (https://canvas.sbcc.edu/courses/46681/users/274832)

Jan 30, 2022

Hi Lex,

In doing a little research into this, it is hard for me to tell when exactly most scientists began to accept a heliocentric view, let alone the general population. However, it does seem that it was some time after Copernicus proposed the theory that it was even acceptable to discuss the model openly. This can be seen by the Catholic Church's treatment of Galileo. It looks like Descartes abandoned a heliocentric model out of fear of suffering a fate similar to Galileo. This suggests to me that he may have believed in the model but was afraid to do so publicly or promote it himself. Even after Newton published his Principia in 1687, the Catholic church was not onboard with heliocentric models. However, by 1758 the church dropped its ban on books advocating a heliocentric model. I would guess that this is when the model gained more general acceptance (at least publicly) as it was hard to go against the church in any way at that time. Moreover, many (if not most) scholars and educated people were, historically, associated with the church, making it that much harder to argue for theories that the church would not accept.

The above mostly came from the following wikipedia article on heliocentrism, particularly the section regard Reception in Early Modern Europe:

https://en.wikipedia.org/wiki/Heliocentrism (https://en.wikipedia.org/wiki/Heliocentrism)

Reply

(http

Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)

Feb 4, 2022

I would think that the invention of the printing press and access to education, which increased human literacy, must have played large roles in turning the majority of humans into believers of the sun centered model. These things would have helped to spread news of scientific discoveries in a way that the church couldn't control and helped more people become educated.

Ironically, there's such a thing as too much of a good thing. The invention of the internet has allowed every human to publish their own content regardless of their lack of education, leading to such an influx of misinformation that many people can't figure out what's true anymore.

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:25am

Originally Posted 2/5/22

Yes, it's interesting to see how accurate these early models were, even if they weren't correct in reality with respect to how planets actually moved. I don't know about how many different models there were, other than several variations to the theme, but I do know that there were at least two others prior to Galileo that had professed that the sun was at the center of the universe, and they had been burned at the stake for challenging the established beliefs of the time. The Cosmos series with Neil deGrasse Tyson, in their first episode they discuss the two other people who historically had challenged the church and had been killed because of their views.

Reply

(https:/

Naomi Xu (https://canvas.sbcc.edu/courses/46681/users/27955)

Jan 30, 2022

DISCUSSION

I'm not sure what to write since there were two of these due for the same set of materials, so I'm just going to jot down what I liked from them.

I thought it was really funny when Feynman poked fun at astrologists.

I found that the limit for the initial speed of the projectile model is 7.

Turtles all the way down was also very funny.

QUESTION

What was your favourite part of the materials:)

Edited by Naomi Xu (https://canvas.sbcc.edu/courses/46681/users/27955) on Jan 30 at 11:19pm

Reply

(http

Lucca Gambone (https://canvas.sbcc.edu/courses/46681/users/405319)

Jan 31, 2022

my favorite part of the materials was the reading I really liked the chapter one of brief history in time.

Reply

(http

Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)

Feb 4, 2022

I loved the Feynman video too. He was quite funny!

Edited by Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381) on Feb 4 at 9:01pm

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:32am

Originally Posted 2/5/22

Very good! And very clever answer! We may be the smartest we've ever been with regard to scientific knowledge, but it seems to me that we are the dumbest we've ever been in other facets of culture and society.... such as stealing people's Instagram accounts to sell cryptocurrency? Who comes up with this stuff?? Haha?

Reply

(https:/

Lucca Gambone (https://canvas.sbcc.edu/courses/46681/users/405319)

Jan 31, 2022

What I found interesting from the reading was the talk about how most philosophers at the time did not believe that there was a "first cuase" that started the existence of our universe, Cosmologies and the Jewish/Christian/Muslim tradition believed there was an earlier event that caused the event of the creation of the universe, while Aristotle and many other philosophers believed that the idea of creation was wrong. This is the part I found interesting, when they talked about how the universe just always existed therefore, the human race always existed and would exist forever. So they believed that everything has been around forever and everything will continue to be around forever

Now my question is what caused the stars to turn on in the first place?

Reply

(http

Lexie Brent (https://canvas.sbcc.edu/courses/46681/users/122267)

Feb 2, 2022

Hi Lucca,

I hope I'm not misinterpreting your question, in which case I might be explaining something you already know haha. If we're speaking literally about the way that stars are born (or turn on), it starts with some natural event occurring in space that affects nearby areas and as a result, gravity pulls together matter in one of those areas. As the matter gets closer, it spins faster and faster due to the Conservation of Angular Momentum. This also causes matter around the newly formed protostar to flatten into a disk called the protoplanetary disk. At this point, the newborn star has become hot and bright, but one might argue a star doesn't necessarily "turn on" until nuclear fusion begins in the core (fusing hydrogen into helium) and it becomes a main sequence star.

Reply

(http

Sarah Savage (https://canvas.sbcc.edu/courses/46681/users/375381)

Feb 4, 2022

Lucca, there's an interesting video by Vsauce about the Illusion of Time that addresses the concept of people believing that everything has existed forever and will continue to be around forever. That was actually the common frame of mind of the general population prior to the 18th century.

It has to do with how our brains mark time using changes in the world around us. In 2022, we tend to believe that things are always changing in part because we divide the passing

of modern time up into decades, each with its own culture, music, fashion, politics, etc and we compartmentalize the decades into separate entities. We think of the 1980s as being significantly different from the 1990s, but people who lived back in the 1380s didn't find much of a difference between that decade and the 1390s. This isn't astronomy related but it's a fascinating video (as are all Vsauce videos). https://youtu.be/zHL9GP_B30E

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:24am

Originally Posted 2/5/22

I'm glad to hear you pondering the philosophical implications, because I think what makes this class different and more interesting and more fun is that we confront the philosophical, spiritual, ethical questions and challenges that accompany scientific progression. In the past, people were literally killed for not sticking with the preferred narrative, or the religious dogma, so science by Nature challenges, and there is growth and expansion of the mind, but not without danger and retaliation for those who challenge the establishment.

Reply

(https:/

Lexie Brent (https://canvas.sbcc.edu/courses/46681/users/122267)

Feb 2, 2022

I find the idea of recessional velocity very interesting. When it was first mentioned in the lecture that the galaxies and objects on the far edges of the universe are moving at incredible speeds I didn't understand at all how that was possible. After the explanation, though, I understand better -- but it's still quite wild to me that these things could be moving at the speed of light. I guess that's what happens when you've been speeding up continuously since the Big Bang 13.7 billion years ago!

QUESTION:

If the universe is finite, and there are "edges," how can there be no center or even something close? Perhaps this idea goes hand in hand with that of the universe not expanding into anything because the universe itself is the only thing in existence within our realm of spacetime (another thing I don't quite understand hahaha).

Reply

(http

Alak Fryt (*He/Him*) (https://canvas.sbcc.edu/courses/46681/users/354278)

Feb 3, 2022

Hey Lexie, I think you brought up a really interesting question. Although I don't really have an answer for your question, I do have a couple ideas. For one, maybe it's just an assumption that the universe is finite, since the universe is expanding in all directions can it really be assumed that the universe has borders if it is growing right before our eyes. Also, even if the universe did have "edges" we may not really have an idea of what the actual shape of the universe, I don't think we could really assume that the universe is something of a circle, and so in that case we'd probably have to map out the entire universe to get an estimate of where the center might lie. But then when we consider that universe is still expanding, I feel like it's impossible to figure this question out. So even though there may lie a center, I'm not sure how it would be possible to locate it.

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:21am

Originally Posted 2/5/22

Great summary of stellar formation and also good question about why is there no center to the universe. The best way to visualize this is by imagining that we live on the surface of a balloon that is being inflated. If an ant walks on the balloon, it walks around and around but never comes to an edge.

Reply

https:/

Alak Fryt (*He/Him*) (https://canvas.sbcc.edu/courses/46681/users/354278)

Feb 3, 2022

DISCUSSION:

Reading about the beginning of the universe and what that has to do with the beginning of time was pretty interesting to me because I've never really thought about it before. It makes sense to think about the beginning of the universe and when everything began but I think it's a compelling question to think about when you throw time into the mix of it all. But when reading about this particular subject, I noticed that it was pretty much all dependent on God's actions and what God wanted to do.

QUESTION:

My question is based off of considering that God isn't an "all-creator" type entity that formed the universe. Taking God out of the equation, what is really a reasonable conclusion for the beginning of time? I think it's pretty logical to assume that time began as a property of when the universe began. But when St. Augustine proposed this idea, "he said that time was a property of the universe that God created...". So going back to my originally question, without the inclusion of God, what is a reasonable conclusion for the beginning of time?

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:23am

Originally Posted 2/5/22

That was a great philosophical question. I see that you are quite the philosopher. Of course, if the discussion is about time only existing because God created it along with universe, and now if you consider a universe where there is no God, then what would that sentence mean and how would you get around the paradox of having time, or not having time.

Reply

(https:/

Malachi Scott (https://canvas.sbcc.edu/courses/46681/users/409981)

Feb 7, 2022

Like many others, I found it extremely intriguing how accurate past astronomers and their models' that they created were. given their lack of technology and true understanding it is insane to think they were so close to being completely correct about some things. Another thing that truly had my brain working was when I found out and understood the universe is actually finite !

question:

What did you find the most entertaining personally out of this chapters' reading?

Reply

(http

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:30am

Originally Posted 2/5/22

Yes, it's amazing what they could figure out even so long ago.

Reply

Malcolm Tircuit (https://canvas.sbcc.edu/courses/46681/users/427388)

Feb 13, 2022

Discussion:

The Idea that time itself had a beginning was always very fascinating to me. Hearing how time itself did not exist before the beginning of the universe and even trying to comprehend it (even though there is no possible way to) completely blows my mind. The analogy of "what was it like before you existed" made me at least understand it a little bit better.

Question:

It was briefly mentioned that pictorial representations of the universe are always 3 dimensional when in actuality it is 4 dimensional. This got me thinking: If there were multiple 2 dimensional universes, they would have to exist in a 3 dimensional space like a stack of paper. So if we carry it up one more dimension, if there are multiple 3 dimensional universes out there, then they would have to exist in a 4 dimensional space. I was wondering if anyone knew if I was correct in my assumptions?

Reply

Erin O'Connor (https://canvas.sbcc.edu/courses/46681/users/24247)

10:31am

Originally Posted 2/13/22

That's a very thoughtful comment. You see, you can take a 2 dimensional piece of paper and curve it into a third dimension. Then you could take a fourth dimensional space-time and curve it into a 5th dimension. We can think of our universe as being fifth dimensional. I don't know why, but I don't hear it being referred to that way very often, usually it's just referred to as fourth dimensional.

Reply