Published | Edit

This is a graded discussion: 10 points possible

Show Due Dates

D8(BH) Weekly Discussion

Erin O'Connor

Mar 4 at 8:59pm

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

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

Mar 8, 2022

Discussion:

Richard Feynman talking about a flower is one of the most interesting/beautiful videos I've seen in a while even though it's only 2 minutes long. He sees what everyone else sees which is the base of a flower end of a simple object but then he sees beyond that. He goes into detail about the processes that go on in a flower what flowers are composed of how they work what their function is. It's amazing to in a way see inside someone's head and be able to understand the way that they think when they're so intelligent like Feynman is. People like him make you sad and wonder about other simple objects in nature, thinking about the complexities that they hold and how we only see the base surface of everything but nature is complex and extremely interesting.

Question:

What will happen to the other planets in our solar system after the sun dies and the earth is a molten ball?

Reply

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

Mar 9, 2022

I would guess like the earth some of the planets would get scorched

Reply

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

Mar 13, 2022

Hi Abigail,

It is a really curious question because it is very difficult to know exactly what could happen. There are many theories, but until it happens, or until we have more knowledge about its components. I think that what is most likely to happen is that the planets die, but that could happen in a billion years.

Reply

(http

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

Mar 14, 2022

Abigail, I had the same feelings about that video. I know exactly what you mean.

Reply

(http

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

Mar 16, 2022

Hey Abigail, your question is very interesting to think about. I know that after the sun turns into a red giant, planets like Mars and Venus may be swallowed up. Earth however may be able to escape because it will be pushed into a further orbit as the sun expands although like you've stated already it will be scorched and turn into a molten ball. But as far as our gas giants, it's definitely hard to say. Planets beyond the asteroid belt should be far enough away to be excluded from any affects that the sun's death may offer. But it's interesting to think about how those planets' orbits will be affected. However I don't think that they'll receive as much of an effect like how the Earth will receive.

Reply

(http

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

Apr 5, 2022

Feynman's famous quote about the flower and his artists friend is also one of my favorites. In fact I always start my general astronomy course when we meet in person by reading it out loud to them and showing the video and talking about how I hope the class will help them appreciate the beauty of nature and for them to get more out of life by understanding it. It's great to see that you responded so positively to that quote. It's one of my favorites as well.

Reply

(http

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

Apr 5, 2022

About other planets in our solar system after our sun dies, this is a great question. For the Earth, it doesn't look so good, because the surface of the sun will expand to beyond Earth's orbit, but when you look at Jupiter and Saturn and the rest of the Jovian Planets,

they may be in the habitable zone after the sun has expanded. That means maybe we can move out to one of those planets or one of their moons, or maybe we will have to leave this solar system altogether. We have plenty of time, so don't lose any sleep over this.

Reply

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

Mar 9, 2022

What interested me about the lecture I was how the components of an atom were discovered at different times, I thought the entire atom would be discovered as whole but its crazy that the proton and electron were discovered less than a 100 years apart, atoms are very interesting to me that fact that you can break them down from molecules to an atom to a component of the atom.

My question would be could you break down the components of atom to even smaller and if so what would that be called?

Reply

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

Mar 13, 2022

Hi Luca, I don’t know too much about it, but I believe that the smallest components of an atom are actually electrons and quarks. There are several different kinds of quarks. Hopefully this class will Introduced us to that info.

Reply

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

Mar 13, 2022

There’s more info in Ch. 5 and the Ch. Lecture. The Elementary Particles include fermions, leptons, quarks, bosons, gluons, muons and even more!

Reply

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

Mar 13, 2022

Hey Lucca! To add to what Sarah said, the first page of Chapter 5 in the Stephen Hawking book provides some insight into the components that make up an atom. It includes some information about quarks that I found very interesting. Hope that helps!

Reply

(http

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

Apr 5, 2022

The incredible thing is that all of this knowledge about the atom is within the last hundred years, yet we've taken that knowledge and built particle accelerators like CERN, and developed semiconductor technology and computers and understand things all the way back to the beginning of the universe, and that's just in 100 years. Imagine how much we will have learned in the next thousand years, or many thousands of years to come.

Reply

(http

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

Apr 5, 2022

They've been working for 50 years on a theory to describe subatomic particles as being made up of tiny strings that are vibrating in different standing wave vibrational modes. This is called string theory and it has not been proven in any way, but it's very intriguing and there are many possibilities, so yes, there may be something even smaller then subatomic particles, but it hasn't been figured out yet or confirmed yet.

Reply

(https:/

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

Mar 13, 2022

Hi everyone,

This was an exciting week in terms of content and topics we have seen. We have learned about the sun, red dwarfs, and many other natural things, such as a simple flower. I liked all videos of Feynmann a lot, he is a knowledgeable guy, and I could spend hours and hours watching videos of him talking about nature and its beautiful components. Lastly, I liked all the topics where it was mentioned the atoms, it calls a lot of my attention to read about it, and I have always tried to learn a bit more of it every day since it has a specific type of complexity.

It was a nice week, and we learn something new every day :)

Reply

(http

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

Apr 4, 2022

Yes, every week we focus on a different topic in modern physics that is strange and wonderful at the same time. But all of these topics will come together and be needed to understand how black holes work. We will need to understand quantum mechanics, regular Newtonian physics, Einstein's theories of relativity, and even thermodynamics. Glad you're enjoying all the different topics we are discussing.

Reply

(https:/

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

Mar 13, 2022

DISCUSS:
I thoroughly enjoyed all of these videos this week on Feynman, both the ones with him speaking and the ones with him being spoken about. I really loved his quick video on the beauty of nature, discussing specifically the beauty of a flower. He said that knowing the details of the intricate workings, structure, and processes within the flower only adds to the flower's beauty. He has such an easy way about him and is able to explain things in such a straightforward and common way, that it feels like these videos would be accessible to virtually anyone. And his admittance of the fact that no one understands quantum mechanics and that it goes against our natural thought process is all the more refreshing. His analogy in the QED reading equating the scale of light to a musical scale or sound scale made the light spectrum make more sense. Clearly there are sounds that we humans can't hear, like dog whistles, so it this analogy made sense to me with there being lights so far to either end of the spectrum that humans would not be able to detect it.

QUESTION:
I'd really love to learn more about how scientists are able to figure out the lifecycle of a star. This week's crash course video on low mass stars was so detailed in the various stages of the star's evolution. But how on earth do we know? For example the fact that it expands and contracts again and again, has this all been figured out using computer simulations? Mathematics? Physically viewing stars through a telescope? Or all of the above?

Reply

(http

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

Mar 13, 2022

Hi Sarah,

According to esahubble.org, the Hubble telescope allowed us to see distant stars outside the Milky Way as they would appear in the early universe giving scientists a clue of how stars change over time. Distant stars are studied with spectroscopy, giving scientists properties within the star that emits light.

Reply

(http

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

Mar 14, 2022

Thanks Luke! Amazing that scientists were able to piece a star lifecycle together!

Reply

(http

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

Apr 5, 2022

I think analogies are a really helpful and Powerful way to explain these difficult concepts. Feynman was a genius at doing this, and there are many books about him and also books that he has written that you might enjoy. He was very approachable and loved science and loved to share his love of science with others.

Reply

(http

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

Apr 5, 2022

Yes, it's amazing what they've been able to figure out (and so much more still for us to figure out). You ask about, "has this all been figured out using computer simulations? Mathematics? Physically viewing stars through a telescope? Or all of the above?" The answer is "all of the above". Yes, they use all these things together to paint a fuller picture. Science is becoming increasingly interdisciplinary.

Reply

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

Mar 13, 2022

DISCUSS:

I am intrigued by the history of discoveries about the atom, especially smaller particles like quarks. I never knew that quarks were observable and we know of the six varieties and how many are in each proton/neutron. I am also intrigued that quarks are made of smaller particles which possibly could be the ultimate building blocks of nature.

QUESTION:

How would someone, like Dirac, observe and explain a phenomenon mathematically? What other theories are consistent with both quantum mechanics and the special theory of relativity?

Reply

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

Apr 5, 2022

They've been working for 50 years on a theory to explain what quarks are made of, it's called string theory and we will talk about it later in the course. But the idea would be that there are microscopic standing waves, tiny strings, vibrating at different modes to explain all the subatomic particles. Stay tuned

Reply

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

Mar 13, 2022

I mentioned it in last week's discussion already but once again I'm amazed at how an area of science that is so essential and revolutionary and important as quantum mechanics can be so difficult to understand, even for the top scientists in the world! The fact that a Nobel Prize winner would admit that he doesn't understand quantum mechanics to a room full of people he's lecturing to *about* quantum mechanics makes this topic really fascinating to me. Nobody knows! Richard Feynman is such an interesting character and I really enjoyed learning about him and learning from him. And on an unrelated note, I found the switch from using Greek words to using words like "charmed" to name subatomic particles really funny. I don't know why but quarks really amuse me lol.

QUESTION: On pg 2 of Chapter 5, Hawking says, "...the higher the energy of the particle, the smaller the wavelength of the corresponding wave." Why is that?

Reply

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

Mar 13, 2022

Hi Lexie,

I really enjoyed listening and reading Feynman as well!

ANSWER

I'm not entirely sure that I can give an explanation that is much more detailed than that it is a product of the laws of physics, particularly as described by Planck's equation E=hv where E is energy, h is frequency, and v is Planck's constant.

https://www.franklychemistry.co.uk/20to9/snap_tuition/y13/Energy_of_photon.pdf (https://www.franklychemistry.co.uk/20to9/snap_tuition/y13/Energy_of_photon.pdf)

They do cover this a little at the beginning of Chapter 4 in the Hawking book where, until Planck, scientists were trying to resolve the issue of stars theoretically giving off an infinite amount of energy since they believed that they "ought to give off electromagnetic waves ... equally at all frequencies" (Hawking 68). The solution to this was Planck's idea of quanta and energy levels based on frequency. It also makes a certain amount of sense if you think of it from the perspective of other types of oscillations. To create higher frequency waves in a pool, for example, whatever energy source is the cause of the wave (a hand, paddle, etc.) would have to move faster per unit of time to make more waves in that same unit of time. Hope that helps!

Reply

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

Mar 14, 2022

ANSWER: When energy is high, the wavelength (measurement from wave crest to wave crest) of the wave has a high frequency. This means that the wavelength is shorter. So if you are standing still and the wave was moving past you, a high energy, high frequency wave would have more wave crests moving past you (more frequently). A low energy, low frequency wave would have less wave crests moving past you. But both waves would be moving at the same velocity - the speed of light.

Reply

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

Apr 4, 2022

I think what Feynman was trying to say was that quantum mechanics is so strange that humans can't relate to it. The microscopic world is so different and so alien that it's counter to anything that we would intuitively imagine. But yes, for the world's greatest scientists to say that even he doesn't understand that which he received the Nobel Prize in, that's quite impressive.

Reply

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

Mar 13, 2022

DISCUSSION

One thing that I found particularly useful in Chapter 5 of the Hawking book is the explanation of spin in reference to elementary particles. When I previously thought about spin in relation to particles, I had naturally assumed there was some spin around some sort of reference frame within the particle. Having an explanation of spin as a number of rotations before returning to its original orientation made a lot of sense. As mentioned in the book and our lecture, spin 0 is always in its initial orientation regardless of how you look at it, spin 1 requires a complete (360 degree rotation) to return to its initial orientation (like an arrow), and spin 2 only requires half a rotation (180 degrees) to return to its initial orientation (like a line segment). Spin 1/2 spin is the weird one that requires 2 full rotations (720 degrees) to return to its initial orientation. I don't know if this is the correct way to think about it but when I first read about 1/2 spin, I envisioned something that along its y-axis by 180 degrees as it rotates along its x-axis 360 degrees. In the playing card example, after 360 degrees of rotation, it would be in the same orientation but with the back of the card facing up. Only after another 360 degree rotation would the front of the card be shown. This kind of reminds me of a mobius strip except instead of traveling along the mobius strip, the strip is a rotating object. This made me wonder if the weirdness of 1/2 spin involves spatial dimensions outside of the 3 we normally deal with? I also found the Feynman Sum Over History stuff super interesting and I want to look into it further.

QUESTION

One thing I am having trouble conceptualizing is how gravitons as particles relate to the warping of space-time in relativity. Are the gravitons actually (or virtually) interacting with other

objects or are they causing the warping in space-time? Is this why gravitation isn't yet incorporated into a unification theory?

Reply

(http

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

Mar 14, 2022

Hi Brian, I don't have an answer to your question, but I really appreciate your example of how 1/2 spin might work with a single rotation also rotating on another axis. So the first 360-degree rotation includes flipping the card over. Then a second 360-degree rotation flips the card back to it's original position. You're right, that would mean a 3D particle with x, y, z axes. So the Spin 1 and Spin 2 properties would only be 2D since the card would only have x, y axes. The Spin 0 would have x axis. Perhaps there are more spins but we can't observe them because of our limited dimensionality…?

Reply

(http

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

Apr 5, 2022

The spin thing has confused many people. It's unfortunate that they utilize a term that implies a physical concept such as actual spinning. It's much more like Hawking explained, like with the arrow, that it's how things look after a complete rotation or two, but it's very abstract and I myself struggle with these ideas. I'm glad you seem to have a better sense of it all. Maybe it's your computer science background which of course has you deal numerically and mathematically and graphically with things.

Reply

(http

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

Apr 5, 2022

Great question about gravitons. Do they themselves warp spacetime? Oh my.... this does get interesting.

Reply

(https:/

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

Mar 14, 2022

DISCUSSION

I am so stunned at the amount of nobel prize winner, as well as discoveries made just within this 100 years. It's exciting and scary to think about how much progress we've made yet how little we know still.

my favourite mcconell's flavour was praline pecan whiskey, which they also discontinued a couple years ago:/

QUESTION

what would be the difference between "anti"-me and parallel-me?

Reply

(http

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

Apr 5, 2022

Yes, so many advances in physics and with our understanding of the structure of matter and the universe. Many Nobel laureates, but there are some spots set aside just for you and your classmates. I hope you will invite me to the grand ceremony someday.

Reply

(https:/

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

Mar 14, 2022

DISCUSS:

I found it really interesting that people did not discover electrons till under 100 years ago. Its mind-blowing that in ancient times people came to the conclusion of the existence of an atom but only thousands of years later did we actually understand the components of an atom. Its also fascinating hearing about quantum mechanics especially because we cant understand it by thinking in regular terms. Like trying to understand how something exists that can look different if fully rotated once, but look the same if it is fully rotated twice. That just shows how powerful the human mind is.

QUESTION:

Since we cannot yet unify relativity and quantum mechanics, do you think that we might find a better model for understanding the universe on small scales and big scales sometime in the future? Or do you think its more probable that we will find a way to unify the already existing models.

Reply

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

Apr 5, 2022

That's a really good point, that the atom was hypothesized in ancient Greece thousands of years ago, but only in the last hundred years did we really understand what it was and start to look inside. How many thousands of years in the future will we wait to learn about some of the things that we are wondering about day?

Reply

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

Apr 5, 2022

Great question about the unification of physics. I really am intrigued by String Theory, because I love how it explains everything in an elegant way, by using vibrating standing modes of tiny strings. The problem though is that string theory has been around for 50 years and they still haven't confirmed that it is a working theory. But we shall see.

Reply

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

Mar 16, 2022

DISCUSS: Reading about quarks is something that is very interesting to me because I still don't exactly get what they are. I mean I understand that they make up what we know as protons and neutrons and whatnot. But I don't exactly get what the quarks themselves are, like is their only function just to be the building blocks for the protons and neutrons? And it becomes even more interesting to me when it's explained that there are 6 different varieties of quarks. I'm sure there's a more in depth explanation of them somewhere and I just haven't gotten to it yet, but overall it's just interesting to me.

QUESTION: How do each of the six varieties of quarks relate to one another?

Reply

(http

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

Apr 4, 2022

As Feynman said, I don't think anyone can fully understand what quarks are and how they work and where they came from and why it's complicated the way it is. But this is how nature works and these are the rules of the game. Maybe you'll be the one to figure it all out and you can come back and explain it all to me and the rest of the class in the future someday.

Reply