

THE UNIVERSE SEVEN BILLION YEARS AGO TO NOW

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THE UNIVERSE SEVEN BILLION YEARS AGO TILL NOW (AS TOLD BY VC)



I wasn't sure why the team put me in charge of this mission, but I would try to do my best. Life at home during the pandemic was OK since we created the family bubble, and I got to see my cousins and grandparents. It let me get out of the house and away from my little brother, Griffin. Griffy was really smart, but he can definitely drive a girl nuts with his constant questions. I went to visit my cousins when the urge to kill him got too great, so that was good.

I read through the rules for our next mission to prepare for my leadership role. There was a whole list of things that we needed to find and photograph. They could all be found somewhere between 7 billion years ago and today. So, you know, easy peasy. Except not at all! Well, OK, some of the things on the list sounded like they might be pretty easy to find, like *two black holes merging*. I knew about things like that because Papa told me about them. It was the specific event that created the first gravitational waves observed by LIGO, the Laser Interferometer Gravitational-wave Observatory.

But some things didn't make much sense to me, like we had to find something called *the middle of the sword*. I was worried I was going to mess this whole thing up. So I was thrilled that we had a team meeting coming up to discuss the mission.

Everyone was there just after noon. Of course, the first thing we had to talk about was the *leaderboard*. We were still in first place overall, but our lead had been cut from about 3 hours to a



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THE LEADERBOARD FOR JULY 29

TEAM	% OF RACE COMPLETED	SCREEN TIME HRS USED	BONUS TIME AWARDS (HRS)
COSMIC EXPLORERS	40%	6.33	-1.0
EINSTEIN'S GIRLS	40%	8.5	-1.0
SPACE PIONEERS	40%	8.5	-1.0
JAPAN JOURNEYERS	40%	8.7	-1.0
THE SMASH	40%	8.9	-1.0
AUSSIE ASTRONAUTS	40%	9.0	-1.0
TIME TRAVELERS	40%	9.0	-0.5
ENGLISH EXPLORERS	40%	9.5	-0.5
THE WOW	40%	10.0	0
SPANISH SPRINTERS	40%	10.5	0

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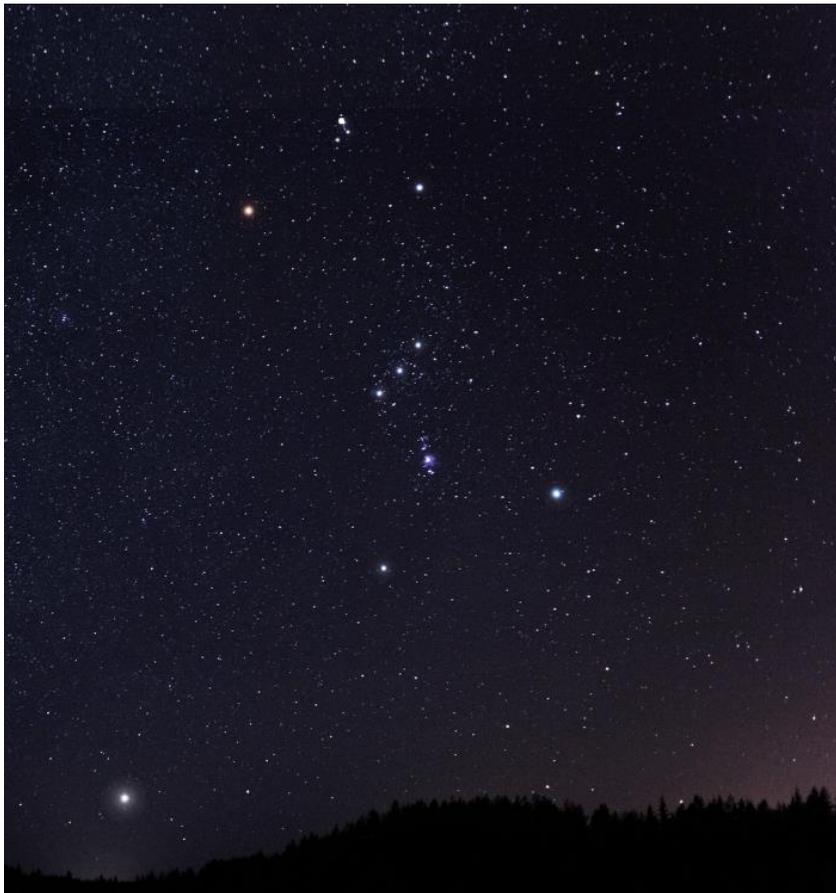
little over 2 hours. And the big news was that Milo's team had won the overall competition for *The Five Most Unusual Things in the Universe*.

"Look," I said, "Svetlana's team just pasted Milo's dumb picture into last year's team photo."

I thought we were robbed because our choices were so good. They had four of the same ones, including the twin paradox because, obviously, their team had two sets of twins. But instead of gravitational waves, they had [Quasars](#). I guess the judges liked that better. So that moved them up to a tie for second place. The one thing we all agreed was that we couldn't let Milo beat us.

"Hey, guys," observed Johari, "look at all the small time additions for the *Stardust Mission*. Everyone must have figured out that traveling with their ships at a small size means it takes less time. We no longer have our advantage. The secret is out."

We all sort of sighed sadly at that, but it had probably been too good to be true. We moved on to a discussion of the things on the list that we had to find.



"Does anyone have any idea what *the middle of the sword* could be?" I asked.

Helen, whom I was starting to really love and wanted to be like when I grew up, came up with the answer. "I'll bet that refers to the sword in the constellation Orion." She shared a picture of Orion she had on her computer. "There is a really beautiful star cluster in the middle, and there are supernovas coming from there too. It's called the Great Orion Nebula."

"How about *950 times bigger than the sun*?" asked Lizzy. "What's that?"

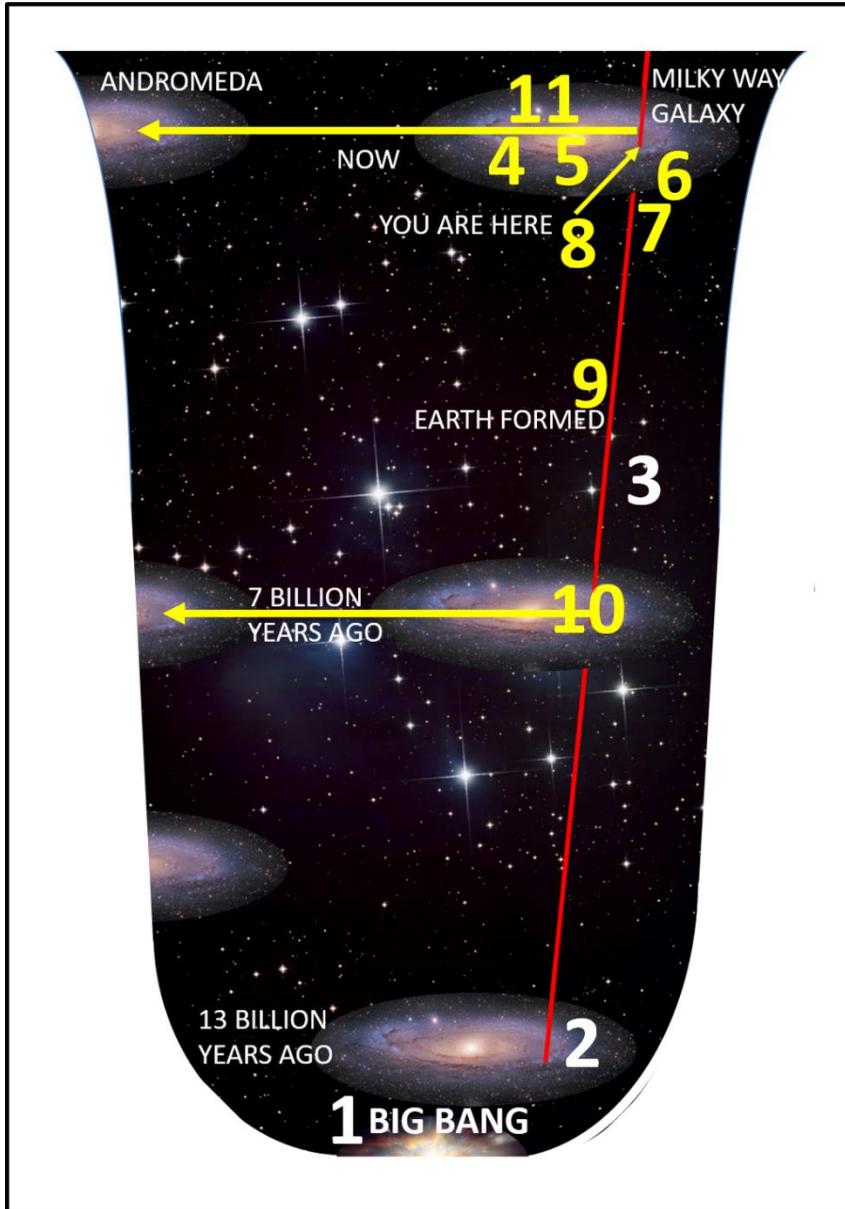
After searching on her computer, Helen once again had a great answer. "I think they want us to find *Betelgeuse*. Betelgeuse is one of the largest stars in the Milky Way. It's part of the Orion constellation too. It's the left shoulder."

Then we had this talk about how it was spelled because Richie thought it was Beetlejuice, like a movie he loved, which I think Papa loves too. And then Lizzy was like, "No, it's like the juice of a beetle, so two words."

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Then Neddy shut us up by stating that it was "Betelgeuse," which, in Arabic, meant "the hand of Orion" or "the armpit of Orion." She spelled it for us.

After we finished discussing what each list item was, Jackson put them in the order that we would look for them. He added the stop location in time and space to his map. We were ready to go. The meeting took 3 hours, so we decided to get a fresh start at 11:00 a.m. the next day.



MISSION STOPS

Stop Four: Center of the sword (1,350 years ago)

Stop Five: 950 times larger than the sun (1,350 years ago)

Stop Six: Event that saved the dinosaurs (201 million years ago)

Stop Seven: Pangea (300 million years ago)

Stop Eight: Merging black holes (1.3 billion years ago)

Stop Nine: Asteroid that made the moon (4.4 billion years ago)

Stop Ten: Find two other space stations (7 billion years ago)

Stop Eleven: Most artistic photo



That night, I took Griffy out in the backyard to show him

the constellation Orion. That was going to be the first part of our mission for the next day. Orion was beautifully visible in the sky.

"There's Orion, Griffy," I explained as I pointed to Orion's stars. "See if you can see a person in those stars. The bright star on the top is his head. Then there are two stars for his shoulders. The three stars on a slanted line in the center is his belt, and his sword hangs down from his belt. The two bottom stars are his feet."

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"I see it," said Griffin. "He's cool."

"Orion is part of a lot of different legends," I continued. "In one, he is a hunter. He is tall and handsome, and he's the son of the sea god, Poseidon. In another, he fights a bull, also outlined in stars. Tomorrow we are going to visit two places in the Orion constellation. It's eight thousand trillion miles away. Its starlight takes 1,350 years to get here. First, we'll visit the center star on his sword. It is actually a star factory where new stars are being born with gas collected by gravity. It is called the Great Orion Nebula. Then we'll visit his left shoulder, a star called

Betelgeuse. It is one of the largest stars in the Milky Way. It is 950 times heavier than our star, the sun."

"Beetle Juice," he said, laughing about the name too. "That is a funny name. It's gotta be made from squished beetles, right?"

"Yeah," I agreed as I led him back to the house for bedtime, "it's gotta be made from squished beetles."



The next day, at ten after eleven in the morning, we were logged on to the [Virtual World](#). We teleported to the *Cosmic Egg* and were on our way to Orion for stops [Four](#) and [Five](#). We were going back 1,350 years to see Orion at the time it released the light that we see on Earth today. Stop [Four](#) was the Great Orion Nebula. It was beautiful. We took a photo that we could submit for the most beautiful part of our mission.

"All those swirling colors make it look like an abstract painting," Johari observed.

"The swirling colors come from all the space gases," said Jackson. "Those gases are getting concentrated by gravity to form new stars. That's our universe growing and evolving."

"Cool," I said. "OK, guys, time to move on to stop [Five](#)."

Neddy piloted the *Cosmic Egg* to Orion's left shoulder to see *Betelgeuse*, the star with a mass of 950 suns.

"That is definitely the biggest star I have ever seen," declared Lizzy. "It's awesome."

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"Awesome?" asked Neddy. "That's what Milo would say. You would say *cool*."

"I hate to say it," confessed Lizzy, "but I do kinda miss him. He must be creeping into my brain."

I kind of agreed, even though I didn't admit it. Milo was a traitor, plain and simple.

We took some photos of *Betelgeuse* and moved to stop Six, Planet Earth 201 million years ago. We were looking for an event that saved the dinosaurs.

"I did the research on that," said Neddy. "It's the *Triassic Jurassic Extinction Event* we are looking for—that started the Jurassic period, when the dinosaurs ruled. Most scientists believe that huge volcanic eruptions released high amounts of carbon dioxide to cause global warming. The higher temperatures weren't good for a lot of the other large land animals that competed with the dinosaurs. They needed cooler climates, so the dinosaurs took over. We need to find the volcanos."

We started circling the planet while we went slowly back in time from 200 million years ago.

"Look at that," observed Lizzy, "the continents have all moved. North and South America are almost touching Africa."

Close to 201 million years ago, we saw volcanos erupting. They were off of the west coast of Africa, and there were lots of them. The eruptions continued as we went back in time for about 600 thousand years. We took more photos and then started moving further back in time to stop Seven.



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By 300 million years ago, the seven continents were all squashed together into one big continent called [Pangaea](#). We took some stop [Seven](#) photos.



"I know all about stop [Eight](#)," I announced. "Papa told me all about it. It is the merger of two black holes that was the first detected gravitational wave by LIGO. It was detected on September 9, 2015. The gravitational wave came from over 1.3 billion years ago, and we know the location it came from."

So off we went. We changed size to save on time-travel screen time. We used our *Hyper-Speed Booster* for space travel.

To find the exact location, we spent some of our gold to order the [Multi-Messenger Astronomy system](#). It included a portable LIGO detector. Jackson installed the system and turned it on. Within a few minutes of searching, he got a gravitational

wave signal. We moved in a direction that made the signal stronger.

"Wow," said Neddy, "there they are. They are dancing around each other. I'll move us forward in time to see the merger."

The two black holes merged, and the gravitational wave hit us, shaking the ship.



"Hey," yelled Johari, "we have a problem. We are moving closer to the new, big black hole. Neddy, you'd better move us away."

"It's not working," called Neddy. "I'm using full power, but we are still being pulled toward the black hole. We're getting closer and closer."

"This isn't good," yelled Lizzy. "If we get sucked into the black hole, we destroy the *Cosmic Egg*, and we are out of the competition. We need to do something."

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"Lizzy, try changing our size," yelled Jackson.

"That's not working," called Neddy, who spent 15 minutes piloting the ship with different settings. "When we are smaller, there is less pull, but we go slower. When we're bigger, we can go faster, but there is more pull from the black hole. We are still getting closer to doom."

"OK, I have an idea," proposed Jackson. "Instead of trying to go directly away from the black hole, try to circle it. Maybe we can spiral out away from it."

Ten minutes later, Neddy reported, "No, not working, Jack. Think, guys, think. We are getting closer and closer. This could be very bad."

"How about using the *Hyper-Speed Booster*?" suggested Johari.

Lizzy started working at the controls to get the *Hyper-Speed Booster* engaged. "I can't get it to turn on," she screamed. "I think we need to be back at normal size."

"I got that," said Neddy, who quickly changed our size setting.

"OK, I got it engaged," reported Lizzy. "But it is not doing anything except shaking the ship. It doesn't seem to work against the huge pull of the black hole's gravity."

Then I got the idea that saved us. "Lizzy, just back up in time to before the merger. Then we should be able to move away."

Lizzy smiled hugely as she changed where we were in time. Two minutes later, we were in the clear. My idea had worked! We all cheered and did high fives and fist bumps.

With the emergency over, we time-traveled back to the merged black hole with a lot of distance between us for safety. This time I took photographs to record the whole merging sequence for our report. When we started getting drawn into the black hole, we knew what to do.

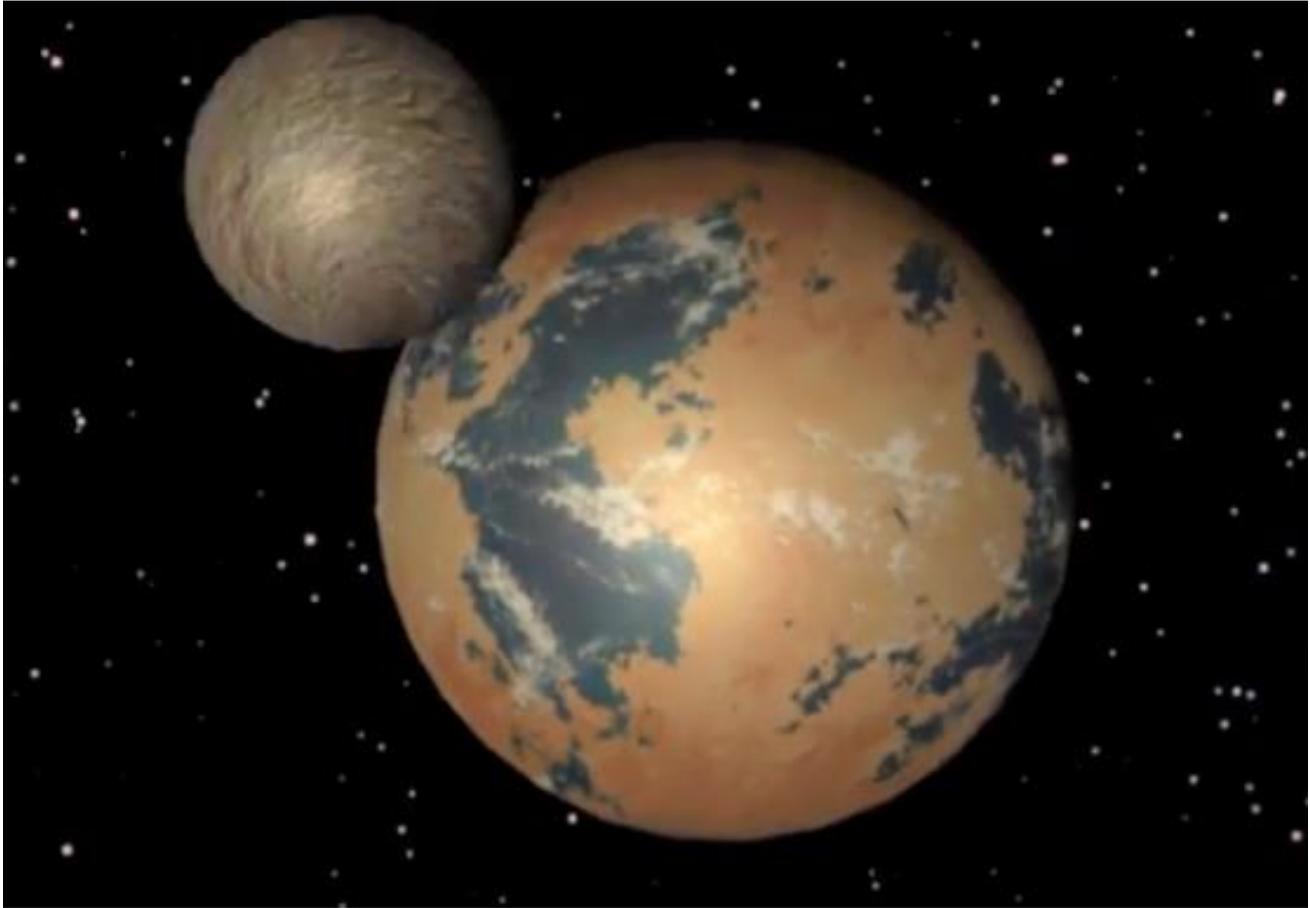
The only problem? Our near-disaster had taken us a whole extra 45 minutes of screen time.

For stop Nine, we used the *Hyper-Speed Booster* to travel back to Earth and then time traveled to 4.4 billion years ago to witness the formation of our moon. We moved to a time when Earth had no moon and then went forward in time. We watched it happen.

We watched a giant asteroid smack into Planet Earth. Earth shook and deformed, and then a large piece flew off into orbit.

"That's our moon," declared Neddy. Doing a perfect imitation of her sister channeling Milo, she said, "Awesome."

"It's a good thing that we weren't around when this happened," observed Jackson. "No life on Earth would have survived the impact."



We went on to stop ten, finding two space stations from other teams 7 billion years ago as part of our scavenger hunt. That was easy. No one else used a planet for a space station, so all the stations were right in the location where Earth had later formed. That was on Jackson's map as the red line. We found the space station of Milo's team, which cloned part of their time/spaceship, right away. We also found a bunch of space stations that used parts of the *International Space Station*.

For stop Eleven, we agreed that the most beautiful thing we found was the *Great Orion Nebula* that we had photographed at stop Four. The volcanos from stop Six came in second.

It was time to end the mission. We traveled to our *Planet Colorado Space Station* and teleported to the surface, where we entered the headquarters building. That is where we were supposed to log off. But when we were inside, something strange was going on.

"What are all those noises coming from outside?" asked Neddy.

"Yeah, I heard it too," I agreed. "But the instructions say to log off. We can look into it when we start the next mission."

We had used a total of two hours of screen time for this mission by the time we logged off.

GRANDPA'S GLOSSARY

[Virtual World](#): Virtual worlds, also known as virtual environments, use computer technology to create a simulated world that a user can explore and interact with, while creating a feeling as if he or she were in that world. The representation of the user in that world is called an [avatar](#). The user can even wear goggles to make it appear that he or she is surrounded by the 3-D virtual world. That is called virtual reality.

[Quasars](#): Quasars, or quasi-stellar objects, are extreme radio sources emitting the energy of an entire galaxy or more. The power for quasars appear to come from their super-massive black holes.

[Continental Drift](#): Continental drift was a theory proposed in 1912 by Alfred Wegener, a geophysicist and meteorologist, that explained how continents shift positions on Earth's surface. The theory proposed that the present continents were once joined, forming a supercontinent called Pangaea. It explained why lookalike animal or plant fossils and similar rock formations are found on different continents. While details of how the continents moved were incorrect, the general ideas were important. Today, the theory of continental drift has been replaced by the science of plate tectonics which provides the explanation for how the continents move.

[Pangaea](#): Pangaea was a supercontinent that existed over 300 million years ago. It was made up of all the continents that exist today. Pangaea began to break up about 175 million years ago as plate tectonics started separating the land mass into the separate continents of today.

[Multi-Messenger Astronomy](#): The detection of the neutron star pair merger by LIGO and other detectors in 2017 is considered to be an excellent example of Multi-Messenger Astronomy. The messages arriving on Earth are the gravitational waves detected by LIGO and radiation (visible, infrared, ultraviolet, x-ray and gamma ray) detected by other instruments. The combination of multi-messages provides information not available from a single observation. Such a combination was employed to identify the event as a neutron-star pair merger.

THE STARDUST MYSTERY PROJECT

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