

Episode 19: The Pluto-Charon Dumbell

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Travis: Welcome to another episode of Slacker Astronomy. Each week we bring you a recent news event in the world of astronomy. And when there is no news we continue our research into geek steroids. You know the kind I'm talking about – the stuff that let's you write very long research papers in one sitting. And when we discover it, we will be crowned kings and queens. And we will name this elixir... (trumpet fanfare) Mountain Dew.

Pamela: Already taken.

Travis: Curses!

Pamela: Today we're going to talk about a recent discovery regarding the Pluto/Charon system. To most people Pluto is the furthest planet from our Sun. To some, though, it is not really a planet but actually a very large snow ball or Kuiper Belt Object. To still others, Pluto is part of a dual planetary system along with its moon Charon.

Travis: And to old timers, Pluto is the god of the underworld.

Pamela: And to young timers, Pluto is a dog.

Travis: No problem there, God can be a dog.

Pamela: Which would explain why galaxies are shaped liked frisbees.

Travis: Interestingly, Walt Disney did actually name the dog Pluto after the planet, which had been just recently discovered when he came up with the idea to give Mickey a pet.

Pamela: I was always a bit confused about how a mouse had a pet dog...

Travis: But astronomers are not cartoonists...

Pamela: We get half the pay and a third the respect.

Travis: ...so when we talk about Pluto we are talking about an icy body about 5 billion kilometers away from the Sun. Pluto is tiny, far away and weird so it gets no respect.

Pamela: And we are going to continue that tradition by pushing it aside for a moment. The focus of this week's show is not Pluto but actually Pluto's moon Charon.

- Travis: Charon is spelled with a C-H but pronounced as if it is spelled with an S-H. This is because its discoverer wanted it to sound like his wife's name, Charlene. Which is noble because HIS last name is Christy, with a C-H. So he could have stuck with convention and made it sound like his own name.
- Pamela: There is a form of currency in the astronomical community called the Spousal Permission Unit. It is earned by doing good deeds for one's spouse and it is spent on field trips and late night observing runs. Christy was probably getting his weekly quota of SPU's.
- Travis: Charon is a small moon compared to the rest of the solar system. Its diameter is only around 1,200 kilometers. But Pluto is also a very small planet, smaller than Earth's Moon. So Charon ends up being about half the size of its parent. The sizes are so similar that the two bodies orbit a fixed point that is between Pluto and Charon.
- Pamela: Also, the two bodies are tidally locked so they face each other the same way all of the time. Many moons in the solar system are tidally locked to their planets, but usually their planets are not tidally locked to the Moon. In this case it is believed Pluto and Charon's similar masses caused them to lock together.
- Travis: Or maybe they are just infatuated with one another and can't stop gazing into one another's fair surfaces.
- Pamela: This systems barbell style of rotation causes some people to think of Pluto and Charon as a double or dual planetary system instead of one planet and one moon.
- Travis: We have no good pictures of the Pluto-Charon system. The astronomical communities best images are very pixellated and look like a 1980's Atari video game images. In fact, for you trivia freaks in the podisphere, observers at the Keck Observatory in Hawaii routinely stop what they are doing and observe Pluto when seeing conditions get really, really good. Good images of Pluto are so hard to come by that it is scientifically worth turning away from more mundane objects like quasars and supernovae.
- Pamela: With good Pluto images being so rare, you can imagine how much more difficult it is to snap a clear shot of Charon, an object that is about half Pluto's size! And thus we have a new slacker law (Are you keeping track yet?): astronomers love a challenge.
- Travis: Astronomers with MIT, the Southwest Research Institute, Williams College and assorted other places teamed up to perform a novel experiment. Through fancy math and creative thinking they realized that on July 11, 2005 Charon was going to move in front of a background star.
- Pamela'' This is star blocking move is called an occultation and is the same thing as a solar eclipse, but with a star other than our Sun. Using very precise timing equipment, astronomers measure when a star gets blocked out by a body in our solar system, such

as a moon or asteroid. Then they watch for the star to reappear. Using some relatively simple math they can use these timing measurements to determine the diameter of the blocking object.

Travis: Occultations are actually one of the areas of astronomy where amateurs can help out by making observations for diameter measuring pros and other mathematically obsessed individuals.

Pamela: It also is quite fun to watch one through a telescope. You'll be watching a star and suddenly it will blink out of existence only to return a short time later.

Travis: Hopefully!

Pamela: Sometimes you get a grazing occultation where the star cruises along the edge of the body. Then the star can flicker in and out many times. These grazings have been used in the past to map mountain ranges on the Earth's Moon.

Travis: So astronomers at three observatories around the world watched this occultation as a rare opportunity to learn about Charon. All of the observatories recorded an occultation time of 55.3 +/- 0.2 seconds. This tells us Charon is around 1,179 +/- 4 km in diameter. Pretty darn good precision for an object over 5 billion kilometers away!

Pamela: But there is more. In 1988 and again in 2003 Pluto itself occulted a star. When those stars were occulted they did not suddenly drop from view. Instead, they gradually faded away. Only one thing can cause this to happen: An atmosphere.

Travis: This was the first confirmation that Pluto even had an atmosphere. It is thin and mostly made of nitrogen but it is there. It is thought that it is thicker when Pluto is at its closest to the Sun in its eccentric orbit, as it is now, and then freezes to Pluto's surface as it gets farther away.

Pamela: There has even been speculation that Pluto shares its atmosphere with Charon. One reason is that Charon appears warmer than it should be this far from the Sun. Charon is made up primarily of water ice and the manner in which it is frozen suggests that either it is warmer than it should be now or else has been warmer sometime in the recent past.

Travis: If Pluto and Charon share an atmosphere, it could deposit fresh ice onto Charon's surface. So this occultation by Charon was important because it could test the theory. The result? After this brief commercial message.

Bill: How would you like to own your very own star? You can, through the Acme Star Registry. That's right. For only \$19.95 we will name a star after you or a loved one. We will send you a picture of the star, a certificate of nomenclature with our seal of

approval and then register it on a coffee stained napkin shoved between the seats the Jeep belonging to Slacker Astronomy's Pamela Gay.

Want Lindsay Lohan? She's yours! What about Brad Pitt or Mel Gibson? What's in a name anyway? What did Shakespeare say? "A rose by any other name would smell just as fishy." Or something like that.

Give the gift of the stars! Name a star today! It's gotta be real, we'll put it on a napkin! Send us your money now!

Pamela: Welcome back.

Travis: So does Charon have an atmosphere? (very long pause) Iiiittt (shorter pause - drawn out) doesn't seem like it. Early analysis of the occultation does not find any evidence of an atmosphere. Although it is slightly possible that conclusion could change upon further review of the data.

Pamela: We've learned a lot about Charon. We've narrowed down its diameter to plus or minus 4 kilometers and found out it doesn't have an atmosphere after all. So why is the ice not as cold as it should be? We'll let you know if anyone figures it out.

Travis: One of the groups that observed this occultation is at the Southwest Research Institute. They are working with NASA on a mission to send a probe to Pluto. If all goes as planned, the probe will be launched in 2,006 and arrive in 2,015. It will only get to spend a few days there because it will be moving too quickly to fall into orbit. But it will be long enough to pick up tremendous data and images.

Pamela: And then it will head outward into the Kuiper belt and explore some of the coldest, oldest objects in our solar system.

Travis: Like Keith Richards??

Pamela: The MIT Planetary Astronomy Laboratory has put online a cool animated GIF of the occultation. We have put a link to it in our show notes. You can see Pluto and the star clearly. But you can't see Charon until the star moves behind it and even then it is only a faint blue smudge sticking out of the side of Pluto.

Travis: It is a good illustration of the limitations in observing caused by equipment and the atmosphere. The star looks bigger than Charon at first, so how does Charon completely block it out?

Pamela: It's because the star is a point source. That means that the better our imaging techniques get, the smaller the star will be. We can never fully resolve its surface because it is just so far away.

Travis: All that light you see in the image is light that is scattered out of focus due to limitations in the optics, the detector, movement of the atmosphere, and other stuff.

Pamela: Interestingly, some of the same techniques used to process and focus astronomical images such as those of Charon are also used to focus medical imaging scans of your body. It's one of many areas where astronomical research pays dividends in other areas.

Travis: That's the nature of research and why it is so important. You never know what you're going to find at the other end of that experiment.

Pamela: Unless you are sponsored by a corporation, then you'll find whatever they tell you to find.

Travis: (interupts) Okaaaaaay! I think that is a good time to wrap this show up!

Pamela: In the last week we've put online two new Slacker Astronomy Extra shows. One is an interview with an astronomer at the US Naval Observatory. He used to be a naval fighter pilot and among other things talks about building a telescope he used from the cockpit. We also put online our latest Chit Chat show, which includes another fun visit by Phil Plait, the Bad Astronomer. Subscribe to the SA Extra XML feed via iTunes or check out the shows on our web site.

Travis: Remember that you can find show notes and archives at slackerastronomy.org. Also, sign up for our new e-mail newsletter at the home page. Send feedback to us at info@slackerastronomy.org.

Pamela: On behalf of Travis and our author Aaron, I'm Pamela Gay. Thanks for listening.

Travis: Clear skies and Clear bandwidth. This has been Slacker Astronomy, a podcast for you, for fun, for the voices in our heads.