

Episode 14: Asteroid Attack

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Written by: *Pamela Gay*

Disembodied Voices: *Travis Searle & Pamela Gay*

Engineering & Production: *Travis Searle*

- Pamela: Welcome to show number fourteen of slacker astronomy; a podcast about astronomy and just about anything else that floats over our heads.
- Travis: Every week or so we will bring you a summary of a recent news event from the world of astronomy. And during slow news weeks, we'll just tell stupid jokes to fill the time. Hey, Pamela
- Pamela: Yes, Travis...
- Travis: You hear the one about how the sky is falling?
- Pamela: The one about how the Ol' Man in the Moon was formed when the Solar System attacked during the Late Heavy Bombardment period?
- Travis: I was actually thinking more along the lines of Chicken Little...
- Pamela: Wanna hear the one about the Late Heavy Bombardment Period?
- Travis: Sounds like a news story instead of a silly joke, but let's go for it.
- Pamela: Well, it is a news story, but it is a pretty cool one. So if you look at the moon, what do you see? A big grey disk with darker grey fields of lava that trace out something that some people call the "Ol' Man in the Moon" and other people see a woman reading a book, the face of a clown, or other objects.
- Travis: Personally I see a Rabbit. Hey, we should have a contest – We'll stick a picture of the moon on our website, and you all should super-impose what you see on this picture and post it in our comments.
- Pamela: Well, so here's the thing – how did the moon get so beat up. If we look, as astronauts have looked, at the backside of the moon, it's even more cratered than the front side.
- Travis: The moon, unlike Earth, doesn't undergo constant erosion, so those craters may have formed a long time ago. Here on Earth, craters are quickly erased — on the geological time scales at least — by rain, weather, volcanism, and all sorts of other Earth moving events. I think I read that the Ol' Rabbit in the Moon was formed several billion years ago, like when the Earth and Moon were just 700 million years old.
- Pamela: Yeah, the Ol' **Man** on the Moon, and a bunch of other craters, including a bunch on the other planets, like Mars, were all formed during a period called the Late Heavy Bombardment period.
- Travis: The bombardment on Earth was so bad that geologists think it destroyed all the rocks that would now be more than 3.9 billion years old. And on Mars, the bombardment may have heated stuff up so much that liquid water flowed on the red planet's surface. At the same time, Mars had active Volcanism and plate tectonics like Earth.

Pamela: But until recently, Scientists had no idea what caused all this impact activity.

Travis: Well, its not that they had no idea. Back in 2002, David Kring of the Arizona Lunar and Planetary Laboratory and Barbara Cohen of the University of Hawaii figured out that the bombardment was caused by asteroids and not by comets. We just haven't known what caused the asteroids to go on the attack. Personally, I think they'd all been to see War of the Worlds and just wanted to prove that they could be more destructive than any alien every dreamed was possible.

Pamela: Cylons? Cylons destroyed not just one planet, but at least 12 planets. That is more than the asteroids ever achieved.

Travis: Yeah, but the Cylons aren't aliens, they're robots created by men, and man is really good at creating things that destroy our planet. Aliens can't dream up that sort of stuff.

Pamela: Okay, fine, so these asteroids went on the attack...

Travis: And now one knew why

Pamela: Until now.

Travis: So what was their real inspiration?

Pamela: Newtonian mechanics.

Travis: Um, freshmen physics sent a gazillion asteroids rocketing into the inner solar system?

Pamela: Freshmen physics explains an amazing amount death and destruction.

Travis: It's that whole "for every reaction there is an equal and opposite reaction" thing again, isn't it. That rule seems to be responsible for everything.

Pamela: You are exactly right. According to a gaggle of scientists who published three separate papers in the May 26 issue of Nature magazine, the outer gassy planets — Jupiter, Saturn, Neptune and Uranus — were originally grouped together in their own gravitationally bound system surrounded by a flock of asteroids and planetismals.

Travis: As anyone who has watches the dynamics of the people kissing the asses of Big Wigs in any society — Kings, politicians, movie stars, whomever — knows, personalities collide and people occasionally get chucked out and left for dead. Strangely, the same rules that control cool kid posse's also apply to asteroids around big planets.

Pamela: Overtime, gravitational interactions would occasionally cause asteroids and planetismals orbiting the 4 giant planets to get ejected. Some of these smaller bodies would get flung into the outer solar system, and others would get flung into the inner part of the solar system.

Travis: And some of these cast off asteroids and planetismals hit us, the moon, Mars, Venus and Mercury.

Pamela: And thanks to the good old action-reaction rule, when a little planet got cast into the inner solar system, the body it was orbiting, would get sent outward. According to the press release, this was initially a very slow process, taking millions of years to move the planets very slowly. Then one day, Saturn and Jupiter had moved enough that suddenly Saturn's orbital period to become exactly twice Jupiter's orbital period.

Travis: So for every time Jupiter orbited twice, Saturn would orbit once, and they would always meet in the same place in the solar system.

Pamela: And this meeting would cause the two planets to gravitationally interact in very dynamic ways. Suddenly, instead of orbiting on politely circular orbits, Jupiter and Saturn's orbits became highly elliptical.

Travis: And these new orbits gravitationally must have upset Neptune and Uranus, flinging them outwards through the disk of asteroids of planetesimals.

Pamela: According to the papers in Nature, this whole process destabilized the orbits of the asteroids, sending these small planets inward where they crashed into the inner planets, disrupted the asteroid belt, and generally made a mess.

Travis: <hokey pokey rhythm> Put the gassy planets out, put the asteroids in, Put the other gassy planets out, and shake the asteroids all about.

Pamela: Over time, as the disk that had originally contained all four gassy planets and whole lot of asteroids and planetesimals fell apart completely, sending the gassy planets to their current locations.

Travis: So if these folks are claiming all the asteroids in the outer solar system got sent flying off to attack in all directions, how do they explain that there are currently asteroids orbiting near Jupiter?

Pamela: Well, that did appear to be a problem initially. During the period of heavy bombardment the asteroids orbiting near Jupiter did get flung all over the place. But, just as some of the asteroids near Jupiter got flung away, other asteroids from other places got flung toward Jupiter where they got trapped into orbits in the outer solar system.

Travis: For every asteroid that is lost, another is found?

Pamela: Well, not quite, the solar system is significantly emptier than it used to be. Yes, there are asteroids out near Jupiter and trapped in the asteroid belt, and icy bodies out near Neptune, but over all, their just isn't as much stuff out their waiting to hit us as their used to be.

Travis: But while it's unlikely that the surface of the Earth is going to get completely pulverized by the impact of a gazillion angry space rocks, there is still enough stuff out there that we do have to worry about getting hit by space rocks.

Pamela: NASA lists 7 different programs on it's website that are prowling the skies for deadly rocks that are embittered that they didn't get to destroy anything during the late heavy bombardment period.

Travis: Roughly every 65 million years an asteroid the size of a small town — about 15 km across or so — hits the Earth and destroys life as they knew it.

Pamela: The last time this happened, roughly 65 million years ago, the dinosaurs bit the dust.

Travis: So, it is time for something to hit us. Could be tomorrow, could be in 1000 years, but, it is coming.

Pamela: The problem is, once we find the asteroid that has us in our target sites, what do we

- do? We currently are able to land lawn mower sized rovers on Mars, but Mars is slow moving, and we give our rovers a year to get there, and we spend several years building them. We just don't have the "Armageddon" style technology to go land men with bombs on fast moving incoming asteroids with a couple weeks notice.
- Travis: Proving that clearly NASA needs more Bruce Willis.
- Pamela: Everything is better with the addition of Bruce Willis.
- Travis: But since NASA has no Bruce Willis, the best we may be able to do when NASA finds that killer asteroid headed our way is to move to high ground and buy out everything in the local Walmart.
- Pamela: But at least we'll know it's coming.
- Travis: Hmmm, the more I learn about astronomy, and all the ways the universe can kill you, the more I keep thinking that ignorance is bliss.
- Pamela: But mammals survived the impact, and hopefully we mammals will live through the next one as well.
- Travis: And as long as that impact doesn't occur in the next week or so, we will bring you another cheery show on a topic involving more death and destruction coming from the sky in another week or so.
- Pamela: But for now, I think its time to tie up this show. Thanks for listening, and thanks for sending us your comments and criticisms. We live for your comments and emails. You can reach us any time at info@slackerastronomy.org.
- Travis: And don't forget to post comments including your pictures of what you see when you look at the face of the moon.
- Pamela: On behalf of Travis and Aaron, this is Pamela Gay. Thanks for listening.
- Travis: Clear Skies and Clear Bandwidth. This has been Slacker Astronomy, a three-person collaboration for you, for fun, for the voices in our heads.