

## Episode 26: **Deep Impact is not a p0rn flick**

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(at regular speed)

Travis: Welcome to another edition of Slacker Astronomy. Each week we bring you a recent news event in the world of astronomy. And when there is nothing new to report, we'll... (slower) we'll....we'll.... umm, hmph.. What will we do?

(crickets chirping)

Pamela: Scrabble?

Travis: That's no fun.

Pamela: Twister?

Travis: Only fun when drunk.

Pamela: Hmm..

Travis: Hmm..

Pamela: I guess that's never really happened before.

Travis: Oh, no I've played drunken twister many times.

Pamela: No, I mean nothing new to report in astronomy. Normally, that is one of the cool things about astronomy. It is a frontier science so every time we discover something new, it leads to a great deal more.

Travis: Frontier Astronomers. That would be a good name for a nerdcore band.

Pamela: Happily, this week we do have some news. Only it is old. On July 4, 2005 NASA's Deep Impact mission successfully nailed a comet at an impact speed of around 23,000 miles per hour or 37,000 kilometers per hour.

Travis: This was all over the news and the media covered the event well. So well in fact that we decided not to do a show on it at the time because, well, we didn't really have much extra to add. So we wanted to wait for some of the science to come out of the mission and then do a show. This is the time that the media normally ignores.

Pamela: And sure enough the science is here, and the media is gone. NASA issued an excellent press release on September 6 detailing much of what has been discovered from analysis of the impact. A few of the hard-core astronomy sites covered it, but the mainstream media ignored it.

Travis: Of course there were a few other things going on at the time too. We've gotta give them that. But do we honestly think this still would have been covered?

Both: Naaaaaaaaaaaaah..

Travis: So what was discovered?

Pamela: Remember that comets are often referred to as dirty snowballs in space. Made up of ices and dirt, they travel through the solar system in orbits around the Sun. As they get close to the Sun they heat up, melt and the gas is blown away from the Sun, forming the beautiful tails.

Travis: That is a pretty generalized picture of a comet. It's like saying humans are bags of water covered by meat. True! ... but hardly enlightening.

Pamela: So by ramming the comet we did two things. First, we stuck up for our dinosaur brethren and got a bit of payback. Secondly, we knocked off a bit of the comet and were able to peer inside.

Travis: What we found was that the comet Temple 1 was a heck of a lot porous than we thought. In fact, it is so porous that the surface of the comet heats up and cools down almost instantly in response to sunlight.

Pamela: All these holes mean the heat from the Sun cannot penetrate the surface because there is very little material to conduct the heat to the innards of the comet.

Travis: This is the same reason fiberglass insulation works so well; membranes act as the best type of insulator.

Pamela: This raises some questions about our theories about the interior of comets. We used to think that uneven heating of a comet caused gas inside to burst out in jets and geysers. But how can they inside heat up enough to vaporize gas if a near perfect insulator protects them?

Travis: Support of this new, pocket filled, discovery came from the spectra of the explosion plume. This spectrum shows vaporized water in the plume immediately following impact. This is expected as the impact explosion melts and vaporizes ice from the surface. But immediately after the detection of vaporized water the spectrum becomes dominated by frozen ice.

Pamela: This means the impactor vaporized the thin surface and blew out material from beneath it. This blown out material was frozen ice, as expected if the surface is blocking all the heat from the Sun.

Travis: Another interesting finding was a huge increase in molecules containing carbon in the spectrum of the comet after the impact. One of the big questions about Earth's formation is: where did all the water and carbon come from? The existence of both elements in comets supports theories that suggest comets seeded the young Earth with both during an age of heavy cometary bombardment.

Pamela: So while a comet took out the dinos, comets also may be ultimately responsible for their creation.

Travis: The universe giveth and taketh away.

Pamela: It always was a tease...

Travis: Anyone who lives in a cold climate like Boston knows the difference between a heavy, wet, back breaking and soul crushing snow and a happy, fluffy, light, detergent like snow. What would you expect on a comet?

Pamela: Well since it is moving fast, it must be heavy or else it would fall off? Right?

Travis: Nope. Comets are very small in the grand scheme of things. So they have very little gravity. The escape velocity is just a few miles per hour. So with a very hard jump one could literally jump off the surface and into space.

Pamela: So with such low gravity, the ice on the surface is barely held together. It has been discovered to be finer than sand, more like a powder. It is believed Deep Impact left a crater, but no one was able to see it due to the cloud of vapor and dust that covered the impact site. Current estimates based on the size and shape of the plume put the crater size at 200 feet and its depth at 30 feet.

Travis: Images by ground based observatories determined that about 1,000 pounds of material was ejected by the impact, which had a force of around 4-5 tons of TNT.

Pamela: Also, the Spitzer Space Telescope observed the impact and reported the discovery of lots of new molecules and material inside the comet. Most interesting are the discovery of clay and carbonates, the material in sea shells.

Travis: These can only be formed in the presence of liquid water. And comets are usually too cold for liquid water. So it is guessed that these materials could be left over from the early days of the solar system, meaning comets orbited closer to the Sun and may have had liquid or partially liquid surfaces once upon a time.

Pamela: So instead of dirty snowballs, they were just giant, fast, flying mudpies.

Travis: Every 5 year old boy's dream.

Pamela: But we should add that much of this is preliminary. Usually scientists need years to fully work out the details of papers so some of this could change in the future.

Travis: If so we'll keep you informed. But in general most of these discoveries will hold true. It's more likely that more discoveries will be added on to them as the data is inspected more closely and by other minds.

Pamela: We have learned so far about the structure of the comet, its makeup and a little about its history.

Travis: So that bag of water now has some salt and carbon in it, the meaty surface is thin but tight and it began life in Northeast Africa around 7 million years ago.

Pamela: That's slightly better than what we knew before.

Travis: Is it worth Deep Impact's 330 million dollar price tag?

Pamela: At the time, many Federalists thought the Louisiana Purchase was not worth \$15 million.

Travis: And if the day comes that we need to block that comet, then it is necessary to know what they're made of.

Pamela: Frontier astronomy is a fun science.

Travis: Isn't that the only kind of science?

Pamela: There is also pseudo-science in this story. An astrologer in Russia sued NASA claiming that the Deep Impact mission changed the orbit of the planets and distorted her horoscope thus threatening her quote - moral and life values - unquote. The suit was originally dismissed and is now on appeal.

Travis: There is a fun fact in all of this though. The impact did disturb the orbit after all, but only by about 10 centimeters according to calculations by a Russian physicist who dismissed her claims.

(sound of law and order gavel) sample at: [http://wavcentral.com/cgi-bin/log/log.cgi?id=3631&sound=http://65.24.76.65/sounds/televis/law\\_order/logavel.mp3](http://wavcentral.com/cgi-bin/log/log.cgi?id=3631&sound=http://65.24.76.65/sounds/televis/law_order/logavel.mp3)

Pamela: Thanks for listening to another episode of Slacker Astronomy. Show notes are at [slackerastronomy.org](http://slackerastronomy.org) and send feedback to [info@slackerastronomy.org](mailto:info@slackerastronomy.org).

Travis: You know we try to make astronomy fun here at Slacker Astronomy. And it is pretty easy because astronomy on its own is innately pretty darn cool.

Pamela: But sometimes we like to have a little too much fun and we can use colorful language or, shall we say, passionate ideas and innuendo.

Travis: Especially when we're drunk.

Pamela: Which is not often enough!

Travis: I'll drink to that!

<glass clink>

Pamela: We also know that many of our listeners like to share portions of the show with their children or classes. We have received a lot of feedback about this and our hats off to all of you who are trying to teach children about science and imagination. You guys have amongst the toughest and most important jobs in society.

Travis: We want to help you out in any way we can and we're going to start off by creating a ratings system for our shows. That way you can know what to expect before you listen. Also, if you are making a lesson plan or something, you can easily sift through our archives to pull out appropriate shows.

Pamela: We have come up with 3 ratings categories. They are FF for family friendly, OF for office friendly, and JF for Just Fun.

Travis: An FF or family friendly show will have no colorful language and no adult humor.

Pamela: An office friendly show may have some colorful language but not a lot, and

there will be no adult humor at all.

Travis: And JF shows are likely to have a bit more potty humor than you may want to play at work. So far we haven't written one of these shows, but you never know when we'll do a sight seeing tour of Astronomers gone Wild.

Pamela: To check the safety level of an episode, just look in the MP3 tag. We will put FF, OF, or JF at the end of the episode title.

Travis: It's easy to remember. FF is family friendly. OF is office friendly. And JF is Just Fun.

Travis: We hope this helps you find the appropriate places to share Slacker Astronomy.

Pamela: Please Note: we do not expect to change our writing style. All we're doing is adding a label to help you. Let us know if it does.

Travis: And don't forget our Slacker Astronomy extra feed, which has recent shows by Pamela about podcasting science and also the return of the Phantom Astronomer.

Pamela: And that closes out our show. On behalf of our writer Aaron I'm Pamela Gay with Travis Searle.

Travis: Clear skies and clear bandwidth. You've been listening to slacker astronomy, a podcast for fun, for you, for the voices in our heads.

Simpson's sample: burn the observatory