

Episode 38: Are You Ready For Some Astronomy?

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Travis: Welcome to show number thirty-eight of Slacker Astronomy; a podcast about astronomy and just about anything else that floats over our heads.

Pamela: Each week we bring you a recent news event from the world of astronomy. And when there is nothing to report, we'll continue work on our replacement for the loss of Monday Night Football.

(MNF theme: opening fan fare then in background. All speech in announcer voice.)

Travis: Welcome to Monday Night Astronomy! I'm your host, Travis Searle.

Pamela: And I'm Pamela Gay. Tonight we have two competing schools of thought fighting it out in a debate over the trigger of cataclysmic variable star outbursts. This is a debate that has been raging in the halls of academia literally for decades. A rivalry that recalls thoughts of the Red Sox and Yankees, Liverpool and Manchester United, the Wallabies and the Kiwis and other storied contests through the ages.

Travis: On one side we have the disk instability model led by their chief proponent, Dr. Lad Infinitum. His strengths are in his grad students who man the line. His recruiting skills are legendary.

Pamela: But he is a little weak in his numbers, Travis. He has been flagged in the past for incorrect rounding and is slow at carrying the one. I like the way his opponent stacks up tonight. The mass transfer model may not be as much of a crowd pleaser, but they put in a strong effort in every game and will never give up.

Travis: Their leader, Dr. Ivana Beahsinger is known for unusual tactics. Regardless of the situation, you can count on her to spur the conventional.

Pamela: Today's referees are known for their own strong opinions. Both have special interests in the field. I think the key to winning will be who can cite the referee's own papers the most in the first 5 pages.

Travis: No doubt about it. Monday Night Astronomy is brought to you by Gucci, introducing a new line of pocket protectors. (optimistic cheerful) "Gucci! Proud sponsor of Monday night astronomy because we lost a bet with Armani. In stores everywhere."

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Pamela: Well I don't see that solving ABC's ratings problems.

Travis: We definitely need to work on it some more.

Pamela: Happily, we have a good show today. We return to a topic we covered last winter: the Earth's aurora.

Travis: About two years ago the Chandra X-Ray observatory began a four-month program to observe the Earth's aurora from space. This alone is a unique occurrence. Usually space telescopes avoid the Earth like Enron executives avoid tax laws - especially billion dollar ones.

Pamela: But Chandra is in a unique orbit that is very eccentric. It is shaped like an elongated egg with the Earth near the narrow end. When Chandra is furthest away from the Earth it is over 140,000 kilometers away. Compare that with the 600-kilometer orbit of Hubble.

Travis: While Chandra was at this point in its orbit, called the apogee, they pointed it just off the northern pole of Earth for twenty minutes. During those twenty minutes, the sky above the North Pole slowly moved through the field of view.

Pamela: Where Chandra saw Santa training for his big day.

Travis: No, it saw the aurora borealis, or northern lights.

Pamela: Our listeners in Canada can be forgiven if they ask "Pshaw! What's the big deal, eh? It's only the northern lights."

Travis: While it may not be on par with a Canadian-Maple Leaf game on National Hockey Night, it is a big deal to atmospheric scientists of two types: those who study Earth's atmosphere, and those who study Jupiter's atmosphere. The head author on a paper publishing these results is an expert in auroral activity on both.

Pamela: Our third test episode of Slacker Astronomy was on the subject of auroras on Earth, Jupiter and also Saturn. You can download it off our XML feed or get it from slackerastronomy.org. Search for aurora.

Travis: Chandra first observed auroral activity on Jupiter many years ago. Some of those observations were of low energy X-Rays. However, up until now no one had ever observed the Earth's own aurora in low energy X-rays. So Dr. Ron Elsner and Dr. Anil Bhardwaj at NASA's Marshall Space Flight Center led a team to point Chandra at Earth.

Pamela: They wanted to compare our aurorae to Jupiter's. Our knowledge of Jupiter's aurorae and Earth's aurorae are very complimentary. For example, we know a lot about the source of Earth's aurorae: the solar wind. But we don't know much about the source behind Jupiter's aurorae. So by looking at similarities of the two, we can fill in gaps in Jupiter's knowledge using what we know of Earth's aurorae.

Travis: On the flip side, we know a little about the low energy X rays in Jupiter's aurorae. However, until now we didn't even know if such a low energy aurorae even existed on Earth! So our knowledge of Jupiter's aurorae helped tell us a little about our own.

Pamela: If Jupiter didn't have a low-energy, X-ray aurora, it is difficult to say whether we ever would have looked for one here on Earth. It's also doubtful that Chandra's time allocation committee would have approved of such an observation without the Jupiter evidence. So this is one example of where investigation of other planets really does

tell us to look for new things about our own Earth. Science ties us all together.

Travis: So now we have images showing the Earth's aurora in low energy X-rays. What can they tell us?

Pamela: First, they found that the low energy x-ray auroras vary quite a bit. We have some pictures on the show notes of our web site. Also, if you are listening in iTunes, or have an iPod Photo or Video, you can look at the album art to see the pictures.

Travis: By the way, if you do that let us know at info@slackerastronomy.org. We're interested in whether we should do things like this in the future.

Pamela: That the aurora varies is hardly a discovery worthy of a Slacker Astronomy episode. Anyone who has seen an aurora can tell you how dynamic they are.

Travis: Well, beyond the obvious they did discover something neat. The Earth's low energy X-Ray aurora is caused by Bremsstrahlung radiation, which peaks at midnight local time.

Pamela: "Bremsstrahlung" means "braking radiation" in German. This is radiation caused by the release of photons when particles are changing speeds, usually by deflection. In this case, it is caused by the precipitation of mainly ionized Oxygen, Nitrogen and Carbon atoms from the upper atmosphere into the mid-level regions of the atmosphere.

Travis: This is believed to be the same cause of the soft X-ray radiation at Jupiter, except that Nitrogen is replaced by Silicon. Researchers are not 100% sure this is correct, though. It could also be caused by solar wind particles colliding with ionized atoms in the atmosphere.

Pamela: To be sure, they plan to observe the aurora again using a more precise instrument on Chandra. This instrument, called ACIS, will be able to look for specific spectral lines in the X-Ray light to confirm the hypothesis.

Travis: An interesting and serendipitous element to these observations occurred on January 24, 2004. By chance, on that day an atmospheric monitoring satellite passed within the field of view and through the auroral region during one of Chandra's exposures.

Pamela: The satellite, DMSP F13 is a Department of Defense Weather satellite declassified and opened to scientists in 1972. On board it has an instrument to make measurements of electron energy and spectra at a fast rate of about one measurement per second.

Travis: So researchers were able to get their hands on direct measurements of the environment around the aurora while it was underway and being observed by Chandra. The results support the Bremsstrahlung theory.

Pamela: Don't say your defense dollars are wasted!

Travis: Well, not **our** defense dollars, more like our parent's defense dollars.

Pamela: Likewise, perhaps that means that our children will benefit from the current defense buildup.

Travis: No one benefits from that except stockbrokers and generals.

Pamela: So we have new knowledge of our atmosphere thanks to Jupiter, to a space telescope in a weird orbit, to innovative researchers and to a 35 year old defense satellite.

Travis: And you have the knowledge now.

Pamela: No thanks to Slacker Astronomy.

Travis: No respect and no thanks, that should be our motto.

Pamela: Better than our not caring motto.

Travis: Eh, it doesn't matter. Who cares about our mottos anyway?

Pamela: Apparently a reviewer on iTunes does.

Travis: Anyone who has time to write a review attacking our motto must be very bored.

Pamela: They must be a listener then.

Travis: Indeed.

Pamela: But there will be much to be excited about in the next couple of months. The largest meeting EVER of the American Astronomical Society is coming up.

Travis: Over 2,500 astronomers will gather in Washington D.C. January 8-12 to share war stories and brag about their accomplishments.

Pamela: You know we may have enough people to storm the capital building and demand improved science funding.

Travis: I'm not so sure. A few secret service men and women can probably easily handle 2500 geeks.

Pamela: Not all astronomers are geeks you know. You are perpetuating a stereotype!

Travis: The best way to eliminate a stereotype is not to deny it, but to embrace it. That removes its power from those who seek to use it for harm.

Pamela: Wow, you're being wise. I like this side of you.

Travis: It's the holiday spirit.

Pamela: The egg nog?

Travis: The spirits IN the egg nog!

Pamela: The best kind.

Travis: All three of us will be attending this meeting. We'll be covering press conferences, interviewing astronomers and recording shows. Aaron will also be doing a daily blog of the convention on the slackerastronomy.org web site. So be sure to visit the site every day during the meeting.

Pamela: Thanks for listening to this episode of Slacker Astronomy. As always, show notes and pictures are on our web site. Send feedback to info@slackerastronomy.org.

Travis: I'm Travis for Pamela and our author Aaron, thanks for listening.

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

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