

Episode 39: Echo and the Zwickyman CastDate:

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- Travis: Welcome to show number thirty-nine 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 new to report, we'll update our Stellar Dead Pool of nearby stars expected to go supernova.
- Travis: So far there are four candidates in our list. We have the pistol star, expected to go boom in 1-3 million years. Then we have Eta Car, which we did a show on a couple of months ago, that is expected to go bye-bye within a million years.
- Pamela: Filling out the top four are a pair of stars tied for the top spot. Both Betelgeuse, the bright red star in Orion, and Rho Cassiopeia could go supernova anytime within a few thousand years.
- Travis: There are undoubtedly many more, including some hidden by dust in the galactic bulge. So we'll work on filling out the list during our slow weeks. This is the season of lists after all: lists of naughty and nice, lists of New Year's resolutions,
- Pamela: And hopefully your resolutions are more naughty than nice.
- Travis: We should add that despite what you may see on Fox or the Discovery Channel specials, none of these potential supernova stars pose a danger to us. They are so far away that they don't pose any known threat to life on Earth. But they will put on one spectacular show. They'll be bright enough to see even in the daytime sky.
- Pamela: Stellar astronomers will love it, but extragalactic astronomers will hate it. Imagine the light pollution such a star will emit at night! Perhaps we will need to use Mr. Burn's contraption to block out sunlight on this thing:
- (simpsons clip from aaron)
- Pamela: For today's show, we have news from supernovae just outside of our own galaxy. This week's supernova of note are in the LMC, or Large Magellanic Cloud, a small nearby galaxy that can be seen from the southern hemisphere.
- Travis: For over a decade astronomers have been taking pictures of the LMC night after night. The project was called Macho and is now called Super Macho.
- Pamela: Soon to be followed by Fiesta Macho and Macho Supreme.
- Travis: The primary goal of the project is to look for dark matter surrounding our galaxy. The LMC is close enough that with small telescopes we can make out many of its individual stars. So it is a good place for one stop shopping when looking for sudden changes in a star's brightness that could be caused by dark matter passing in between

a star and us.

Pamela: A star's brightness may go down if the matter eclipses the star or it may go up if the matter causes a gravitational lensing effect.

Travis: Many important secondary discoveries have been made with the Macho data, including the discovery of extrasolar planets, new variable stars, brown dwarfs and yes, even some dark matter has been detected.

Pamela: In a paper released in late December, astronomers announced another secondary discovery in the Macho data: the discovery of supernovae echoes. These echos form arcs of light centered on LMC supernova remnants that are hundreds of years old.

Travis: The lead author is Armin Rest of the National Optical Astronomy Observatory. He and his team utilized images of the LMC taken years apart. By subtracting the oldest images away from the newest images, they could see what had changed with time. The resulting images showed only light that wasn't in both images.

Pamela: This is a common technique among supernova and variable star hunters. But instead of finding new stars they found long arcs of dim light. Tracing the arcs backward, the team found that they each originated from one of three known, centuries old supernovae remnants in the LMC.

Travis: What we are now seeing is some of the supernova light reflected off interstellar gas and dust, similar to the way echos bounce off walls. A diagram showing how this works is available in our show notes at slackerastronomy.org and also has been embedded in this MP3 as album art.

Pamela: As the light moves through the galaxy it will continue to light up other objects normally too dim to be seen. In theory, telescopes should be able to detect the spectra of the objects to find out what they are.

Travis: Following and studying the light echos may provide new clues about the structure of galaxies and their evolution. But it will be a challenge that will probably require use of some of the largest and most advanced observatories.

Pamela: Interestingly, this was first predicted way back in 1940 by Fritz Zwicky. He was an eccentric Swiss-American astronomer who predicted that supernova would have light echos. He also was the first to predict the phenomenon of gravitational lensing.

Travis: Zwicky wasn't the nicest guy around. He used to accost unfamiliar students at Caltech by asking "Who the hell are you" And this was way before Bart Simpson made it fashionable.

(bart clip?)

Pamela: Along with getting spectra of these newly discovered light echos, another task on the astronomical to do list is for astronomers is to look for light echos from other famous supernova, such as the supernovae recorded by Chinese observers exactly one thousand years ago in 1006 AD. If astronomers succeed, you can bet that you'll hear about it in your favorite science news outlet.

Travis: Astronomy should be on the evening news, not relegated to the back pages or cable

channels over 200. I think astronomers need to start hiring publicists!

Pamela: I know the first thing they will suggest: plastic!

Travis: I don't think they produce enough plastic on Earth to make *us* sexy.

Pamela: I didn't mean plastic surgery, I mean credit card kind of plastic! Making an astronomer into a Star is expensive!

Travis: Okay we'll do what all good middle managers do and pass the buck. If one of our listeners donates 100,000 dollars to us, then we'll do an Extreme Makeover of an astronomer.

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

Travis: And remember this week Pamela, Aaron and I will be at the American Astronomical Association meeting in Washington, D.C. This is going to be the largest meeting in the 107 year history of the AAS. Check slackerastronomy.org for a blog of the meeting, updated many times each day.

Pamela: Thanks for listening. This is Pamela for Travis and our author Aaron wishing you clear skies and good luck on your New Year's resolutions.

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

(oceanside clip)