Episode 44: **As Simple as That**

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Travis: Welcome to Slacker Astronomy; a podcast about astronomy and just about anything else that floats over our heads.

Pamela: Every week or so we bring you a news event from the world of astronomy, and when there is nothing new to report, we'll continue our training for the 2010 astronomy Olympics.

(Olympic fanfare)

Travis: (announcer) We are here today at the 42nd Astronomy Olympiad, held this year at Joe's Clam and Crab Shack in Woeboken, New Jersey.

(advertisement) "Joe's Clam and Crab Shack! Because you can't have Cancer without the Crab!"

Travis: (announcer) Our first contest of the night is the pick an astronomer out of the crowd event. First up is Vincent Virgo. He must look over a large crowd and identify the astronomer. Here he comes. He walks up the podium and glances over the crowd.

Pamela: He looks nervous, Travis. I think maybe he was out observing last night and didn't get his rest.

Travis: It looks like he's made a decision. The person he's pointing to is white, balding and with grey frazzled hair. I don't think he got it, Pamela.

Pamela: That's right. He played it conservative and it may have cost him. If he had trained properly, he would known that over a third of astronomers under 30 are female. This is no longer an exclusively men's sport.

Travis: Yup. The judges have now ruled and indeed he got it wrong. That was not an astronomer after all; it was a physics teacher. This year the organizers said they were going to play it tough and throw in some distractions.

Pamela: Ralph should be happy he didn't choose the astrologer, though. That got someone banned for life a few years ago.

Travis: I remember the scandal. That was quite an embarrassment to the world of astronomy.

(end announcer voice)

Pamela: And, maybe we should jump right into our news event before *we* become an embarrassment to the world of astronomy.

Travis: Good idea. Today we cover an event that occurred on February 13th. It was important enough that many astronomers stayed up late to cover it.

Pamela: Which probably led to many a tired astronomer on the next day, which happened to be Valentine's Day in the US.

Travis: Many spousal permission units were used up by this event I can tell you.

Pamela: So what is it that is so worthy of disturbing both the Olympics and a holiday? It's an outburst of the star RS Ophiuci. Usually this star shines at a brightness around magnitude 10-11, which means you need a telescope to see it.

Travis: Within a day RS Oph grew in brightness to the level that it could be seen with the unaided eye, even from suburban, light polluted areas.

Pamela: This type of an event would normally be called a nova, which means new star. Except that there is something special about RS Ophiuci. It's not a rookie nova, in fact it's done it before. The last time was in 1985. So it's been quiet for 20 years then, bam, it goes off just like that.

Travis: Just like that?

Pamela: Well, not quite just like that. It wouldn't be worthy of a SA story if it was as simple as THAT.

Travis: So what's so special about this rising star?

Pamela: Well, my friend, RS Ophiuci is a dwarf nova. This means the bright light we call RS Ophiuci is actually two stars. One is a white dwarf, an incredibly dense star about the size of the Earth. By number, most stars will collapse into white dwarfs after they stop fusing material in their cores.

Travis: Orbiting the white dwarf is a red giant, which is what most stars expand into before they become a white dwarf.

Pamela: Not all stages of a star's life are the same length. After going through proto-stellar infancy, stars settle into a long lasting, core hydrogen burning adulthood on the main sequence. Our Sun is a middle-aged star, having made it halfway through its main sequence lifetime. Eventually it will become a red giant, and after a comparatively short red giant retirement, it will collapse into a white dwarf.

Travis: So the two stars in the RS Ophiuci system represent two stages in the evolution of a medium sized star like our Sun.

Pamela: Red giants are big and red.

Travis: Score one for unoriginal names.

Pamela: White dwarfs are small and white.

Travis: Score 2 for unoriginal names.

Pamela: Like many giants, red giants seem to always be getting bigger. In this case, the outer envelope of the star is spilling over onto the white dwarf. As the material falls on the white dwarf, it flattens out like a pancake and forms a disc of accreted material around the dwarf star.

Travis: According to the dominant disc instability model, eventually this accretion

disc builds up so much material that it ignites in it's own chain reaction of nuclear fusion, lighting up like a flattened star, and greatly increasing the brightness of the two-star system.

Pamela: This type of explosive outburst is seen in many different binary + accretion disc systems called cataclysmic variables. Some of these stars will outburst just once, and others will flare up every 100 days or so.

Travis: RS Ophiuci was first noticed in outburst back in 1898 and was later observed as a nova in 1933, 1958, 1967, 1985 and now in 2006. Amateur astronomers discovered almost all of these outbursts, including this recent outburst.

Pamela: This long lull between outbursts makes RS Ophiuchi's novae a once or twice in a lifetime event; making it much more interesting than the four-year periodicity of the Olympics.

Travis: And that's what makes this so special. There are only seven known stars that behave like this.

Pamela: That's right - out of the hundreds of thousands of mapped stars, as far as we can tell, only *seven* are like RS Ophiuci. There most certainly are more, but the outbursts are so rare, and the sky is so vaste, that it's difficult to discover them. They only sure way to do it to sit at a telescope and look at the same set of stars night after night for over 20 years, and who wants to do that?

Travis: Well if its a choice of that or watch the American Idol channel...

Pamela: … also known as FOX -

Travis: ...I'll take the telescope.

Pamela: ...or a bullet to the brain?

Travis: ...telescopes are more fun.

Pamela: ...Very true. The timing of these events reminds us of the Buddhist sand mandalas. They are beautiful and exquisite pieces of art made with colored sand. Buddhist monks painstakingly create them grain-by-grain. And when they are done, they perform a ceremony and then they destroy it. The purpose is to remind people of the impermanence of life, while at the same time recognizing that it is the same impermanence that makes life so valuable in the first place and why one should appreciate the here and now.

Travis: Think of the Olympics, or the World Cup for that matter. They are so popular because they occur infrequently - every four years. If they occurred annually, do you think they'd get the same attention?

Pamela: After the mandala is destroyed, the sand is collected and poured into a river as a gesture of giving back to nature. Novae do the same thing as their outburst material is deposited back into the galaxy, ready to become a star again in the future.

Travis: This RS Ophiuci outburst is being heavily monitored by the pros. Jennifer Sokoloski at the Harvard Smithsonian Center for Astrophysics is an expert in

this category of star, called recurrent novae. She has observed it with the Rossi X-Ray Timing Explorer satellite, also known as RXTE.

Pamela: RXTE is one of the workhorse X-Ray satellites having been in space for over 10 years. It observes all sorts of objects from planets to gamma ray bursts.

Travis: Using RXTE measurements, she has determined that the temperature in the disc a few days after outburst was about 116 million degrees Celius. Around ten days later it had dropped down to 70 million degrees Celsius.

Pamela: She explains this as the result of material ejected by the outburst slowing down. She also determined that there is little dust or other material immediately surrounding the star, which may have existed as leftovers from past classical nova-like eruptions.

Travis: This eruption will slowly fade over the next 100 days and then there will be another small brightening 700 days later. This re-brightening is yet another unexplained habit of this star. We've included a copy of the lightcurve from the last outburst in the album artwork for this show and in the show notes at slackerastronomy.org.

Pamela: A lightcurve is a plot of the star's brightness over time. It shows how RS Ophiuchi starts from is faint magnitude during its quiescence between outbursts, and then suddenly brightens when it outbursts and slowly fades back to normal.

Travis: So, just like outbursts must each fade away and the sand mandala's time of beauty is transitory, so too must this episode to come to an end.

Pamela: As always, check out slackerastronomy.org for show notes about this topic and to subscribe to our SA Extra feed, where we host interviews with professionals and other bonus material.

Travis: Clear skies and clear bandwidth. This is Travis Searle on behalf of Pamela and our author Aaron.

Pamela: This has been Slacker Astronomy, a three-person collaboration for you, for fun, for the voices in our heads.