SPECIAL SERIES

Joe's Big Idea

The Scientist Who Makes Stars On Earth

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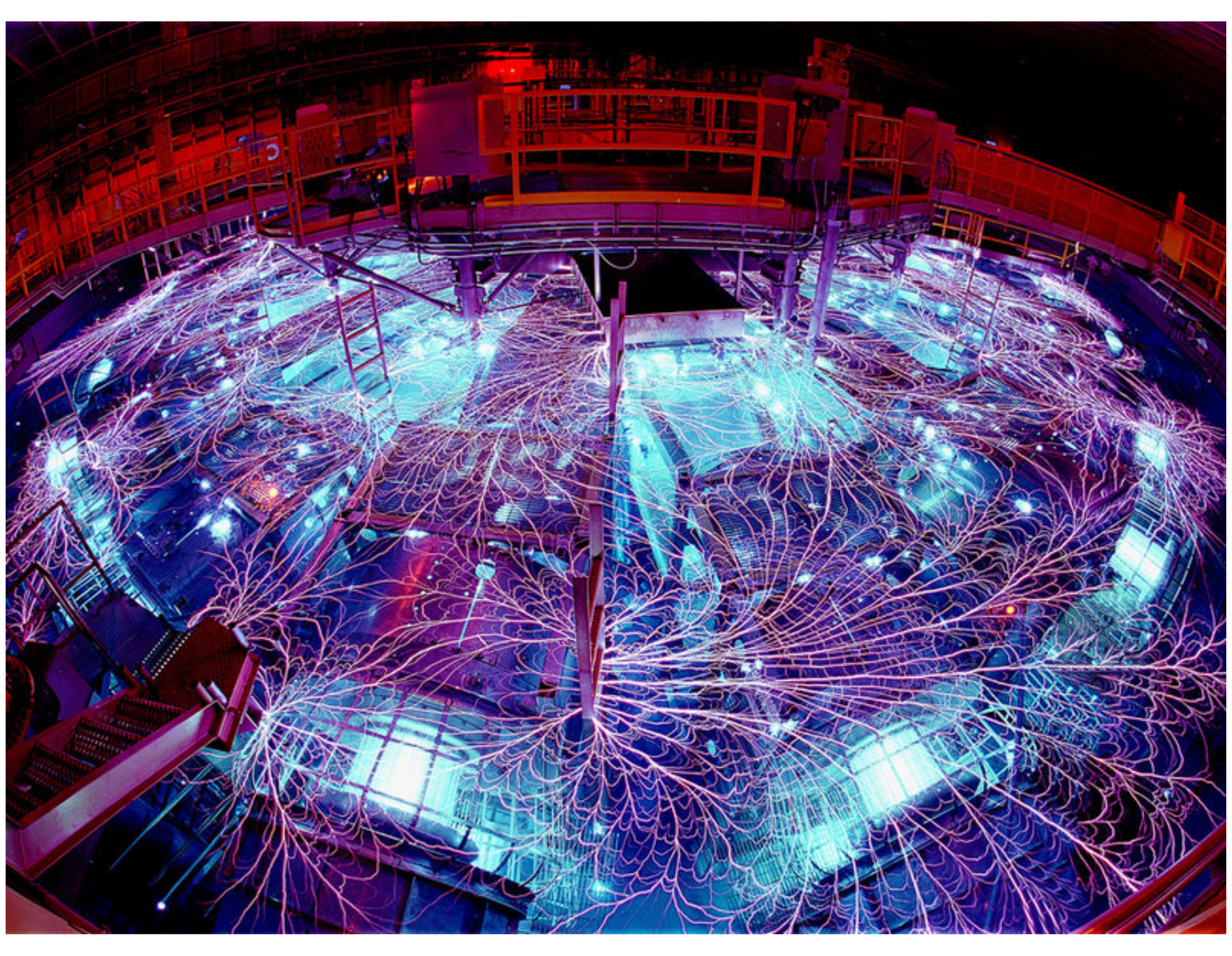
Heard on All Things Considered

JOE PALCA

4-Minute Listen

+ PLAYLIST

An astrophysicist is using something called the Z machine at Sandia National Lab to recreate the conditions on a white dwarf star — only for a few nanoseconds, but still, enough to study.



The Z machine is located in Albuquerque, N.M., and is part of the Pulsed Power Program, which started at Sandia National

Randy Montoya/Sandia National Laboratory

Transcript

AUDIE CORNISH, HOST:

From NPR News, this is ALL THINGS CONSIDERED. I'm Audie Cornish.

On the outskirts of Albuquerque, New Mexico, scientists are doing something astonishing. They're creating a white dwarf star - not a whole star but enough of one to study in minute detail. As part of his series, "Joe's Big Idea," NPR's Joe Palca introduces us to the astronomer behind this exotic project and explains why he's determined to learn all he can about this interesting stellar object.

JOE PALCA, BYLINE: To understand what drives Don Winget's fascination with white dwarf stars, it helps to go to his ranch in Liberty Hill, Texas. This is where Winget indulges one of his passions, horses. He trains them and he's good at it. He's studied with chief riders from the Spanish Riding School in Vienna. And if you let him, he'll talk your ear off about the fine points of riding. He watches intently as his daughter rides one of his horses in the paddock.

DON WINGET: Oh. Canter-walk is very difficult.

PALCA: Winget lives for those exquisite moments when a horse does a move exactly right. And the more of those moments, the better.

WINGET: Once a week, maybe, will be a really amazing moment. Maybe once a day, if you do it right and you're lucky. And it's an addiction. You do it once and you're so high, you want to do it again.

PALCA: Horses are one source of the high Winget craves. Another is astronomy. He's hooked on the feeling that comes with discovering something new about the nature of stars.

WINGET: You get to know something about the universe no human being that's ever lived before has ever known. That's profound.

PALCA: These days, to feed his addiction, Winget's been traveling from his home base at the University of Texas at Austin to New Mexico, not to observe stars through a telescope but to study them with something called the Z machine. The Z machine is a pulsed-power generator. It works by concentrating millions of volts of electricity and then releasing them all at once in a single shot. Joel Lash is senior manager of the Z machine at the Sandia National Laboratories. I asked him if you could think of the Z machine as an extremely powerful spark generator.

JOEL LASH: Yeah, that's a great way to think about it. What pulse power does is compress electrical energy in both time and space.

PALCA: And when you release that energy, you create extreme heat, although only for a few hundred billionths of a second. Today, the Z machine will be used to heat a small vial of hydrogen atoms to the temperatures they'd reach at the surface of a white dwarf star.

Before he started using the Z machine, Winget would study the physics of these stars with data from telescopes. But a few years ago, a colleague told him about the extreme heat the Z machine could produce and he realized it was essentially making a tiny star.

WINGET: Holy crap, Batman. That's a white dwarf star. It looks just like one. Can we really do that? And the answer is yes, we can. And that's what we're doing.

PALCA: Winget says the Z machine is changing astrophysics. Instead of just watching stars, he can actually make different kinds of white dwarf stars and see what that does to the way they behave. It's nearing the time for today's shot. Winget's sample of hydrogen atoms is sitting in the center of the Z machine, waiting to get zapped. The shot is a pretty dramatic event. I'm told I'll feel the whole building shake when it fires. Winget says the best place to watch is at a doorway down the hall from the control room.

(SOUNDBITE OF HIGH-PITCHED TONE)

PALCA: It's a fine spot, except for one thing - an annoying, high-pitched whine. And since it's so annoying, I asked NPR's outstanding audio engineers to digitally remove it. That's much better. A walkie-talkie crackles to life.

UNIDENTIFIED MAN: Charge complete. Arming to fire.

PALCA: It's show time. Winget has some last-minute advice.

Don't blink.

(SOUNDBITE OF EXPLOSION)

WINGET: Yeah.

PALCA: All right.

WINGET: Yeah. Another great shot.

PALCA: Winget can't wait to race off and see the data generated by today's shot. I know a lot of scientists and inventors will recognize just how he feels.

WINGET: I want to understand. I want to think about things. I want to solve problems and understand things that nobody who's ever lived before has ever understood. That's what drives me.

PALCA: Joe Palca, NPR News.

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