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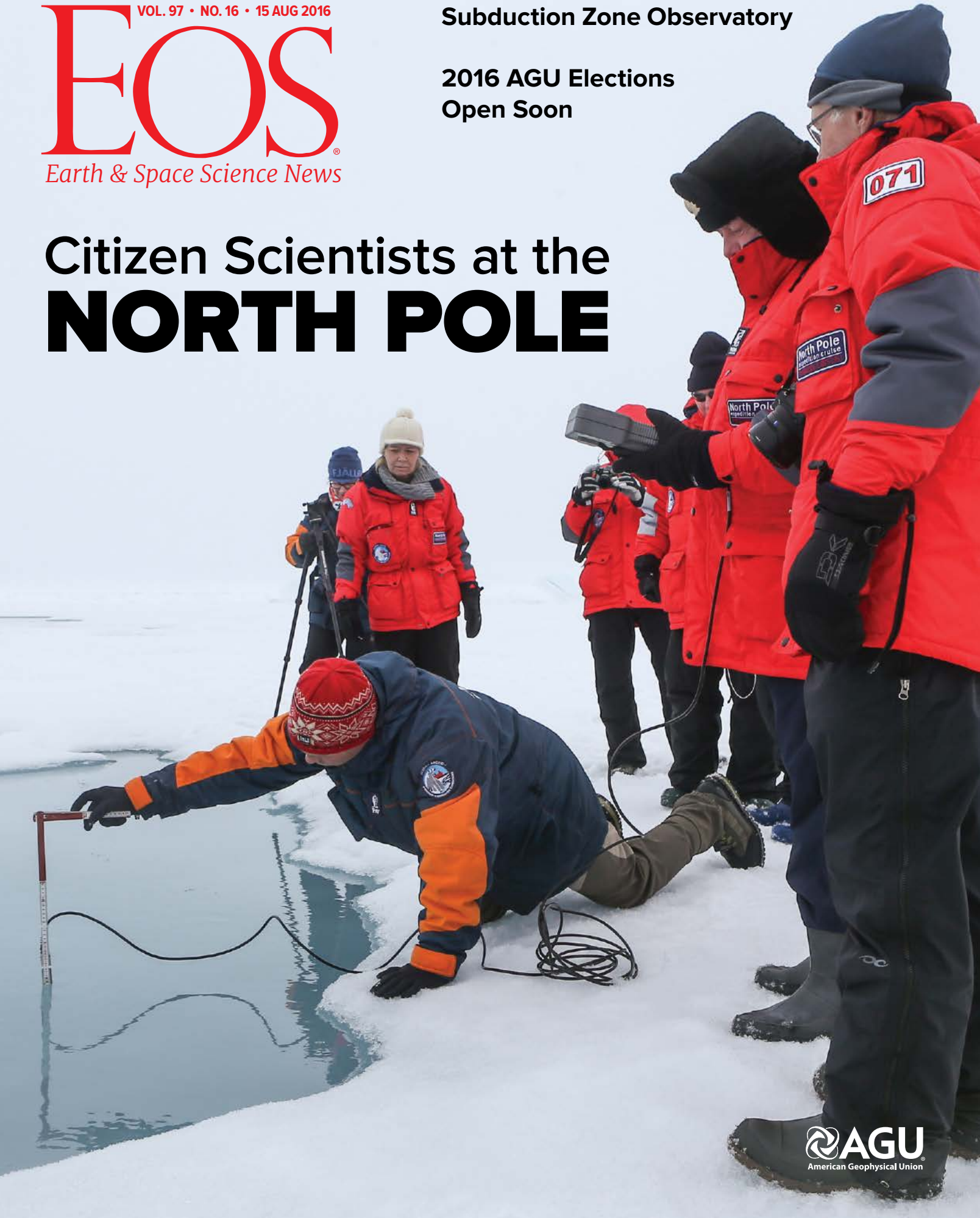
# EOS

Earth & Space Science News

Subduction Zone Observatory

2016 AGU Elections Open Soon

# Citizen Scientists at the NORTH POLE




AGU
American Geophysical Union

The researchers confirmed this by running models of ozone depletion with and without the input of gases from volcanic eruptions. Large volcanic eruptions spew hundreds of thousands of tons of sulfur dioxide into the atmosphere, which reacts with water vapor to form sulfate aerosols. Along with slightly cooling the planet, these sulfur aerosols provide a surface on which ozone-destroying chemical reactions happen. This phenomenon has been well documented after every major volcanic eruption, including those of Mount Pinatubo in 1991 and Mexico's El Chichón in 1982.

Therefore, although the researchers continued to observe a drop in atmospheric chlorine in their models, Calbuco's 400,000 tons of sulfur dioxide led to an increase in polar stratospheric clouds and thus ozone destruction.

### Ozone of the Future

"It's good to see some sign of improvement," Susan Strahan, an atmospheric scientist at NASA Goddard Space Flight Center in Greenbelt, Md., told *Eos*. Strahan wasn't involved in the research.

But because of how much temperature can affect the size of the ozone hole year by year, Strahan says it has often been difficult to pick out a signal of healing from the noise.

"We atmospheric scientists are anxiously awaiting the day when we can conclusively look at the observations of the ozone hole and say, 'Yup, it's definitely getting smaller and, yup, it's because of chlorine [decrease].'" The paper's results are "a small piece of the puzzle, and we expect that in years to come we'll see stronger evidence."

In 2009 scientists at NASA created a vision of a world without the Montreal Protocol. In their "World Avoided" simulation, the researchers predicted that by the year 2065, the ozone hole not only would have stuck around all year, but also a twin would have formed over the North Pole (see http://go.nasa.gov/29GbTF3). In that scenario, people in midlatitude cities would suffer sunburns after 5 minutes outside, and DNA-mutating radiation would increase 500%.

Instead, Solomon expects that the ozone hole will shrink and eventually seal up by midcentury.

Science was helpful in charting a path away from these molecules for countries to follow, Solomon explained. "Now we've actually seen the planet starting to get better," she said. "It's a wonderful thing."

By **JoAnna Wendel,** Staff Writer

# Exoplanet Found in Curious Triple-Star System

A newfound exoplanet orbiting within a triple-star system has scientists scratching their heads.

Located some 340 light years from Earth, the gas giant called HD 131399Ab weighs in at about 4 times the mass of Jupiter, gets illuminated by not one but three stars, and takes 550 Earth years to complete one loop around its central star.

That star, dubbed HD 131399A, exceeds our Sun's mass by 80% and orbits a center of mass shared with a smaller star, HD 131399B, which is itself orbited by yet another star, HD 131399C.

Each of the stars exerts gravitational force on the exoplanet. For much of that giant planet's half-millennium orbit, someone on its surface would see triple sunrises and sunsets, its discoverers said.

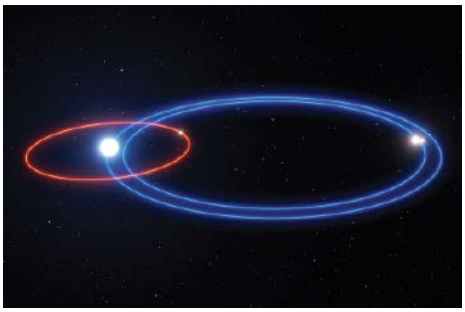
That spectacle may sound like a treat, but for about a quarter of the giant planet's orbit, the paired stars set while the big star rises (and vice versa), brightening up the exoplanet with constant starlight, said Kevin Wagner, a first-year Ph.D. student at the University of Arizona in Tucson and lead author on a paper reporting the discovery of the exoplanet. He and his colleagues published their findings on 7 July in *Science* (see http://bit.ly/Jovian-3stars).

Unlike many other recently discovered exoplanets, the researchers found HD 131399Ab with direct imaging, meaning that they observed and studied light from the planet itself. It was the first exoplanet discovered by the team in a new search for exoplanets made with the Very Large Telescope in Chile's Atacama Desert. The researchers used the telescope's new auxiliary Spectro-Polarimetric High-contrast Exoplanet Research (SPHERE) instrument, which is designed specifically to capture telltale infrared radiation from exoplanets while blocking out the light from surrounding stars.

### Precarious Orbit

The planet isn't the first found in the middle of a three-star dance, but its position relative to the stars piqued the team's curiosity.

Generally, planets in three-star systems orbit close to one star while the other two stars orbit much farther away. In another three-star system, called 51 Eri, the planet orbits a star at 13 astronomical units (AU) while the other two stars orbit at 2000 AU. HD 131399Ab, however, orbits at 80 AU—that's twice the distance from the Sun to Pluto—while the twin stars HD 131399B and HD 131399C reside about 300–400 AU from the central star.



ESO

*An artist's representation of a newly discovered triple-star system. Planet HD 131399Ab orbits on the red line around the star HD 131399A, whose orbit is represented by the outer blue curve. The other two stars, HD 131399B and HD 131399C, swivel around a center of mass represented by the inner blue curve. Stars A, B, and C all orbit around a shared center of mass.*

That means the planet is trapped in a precarious balance, in a fragile orbit amid the stars' powerful gravitational fields. If it were a bit closer to stars B and C, Wagner said, it would have been flung long ago into space.

Wagner noted that HD 131399Ab doesn't look like it could have formed in its current position. Planets and stars form from collapsing clouds of dust that flatten into protoplanetary pancakes full of growing chunks of material. So "the other stars would have disrupted the disk at about the same location that we see the planet now," Wagner said. But with only a brief glimpse of the planet on its 550-year orbit, scientists know too little to determine how the planet got to its current position, he added.

The researchers plan to investigate the system more closely to learn about its origins. In the meantime, Wagner said, HD 131399Ab "tells us that there are systems out there that are kind of weirder than we can imagine."

Visit https://youtu.be/SrzJEkovZLw to see a simulation of the newly discovered solar system that shows the motion of the stars and exoplanet.

By **JoAnna Wendel,** Staff Writer