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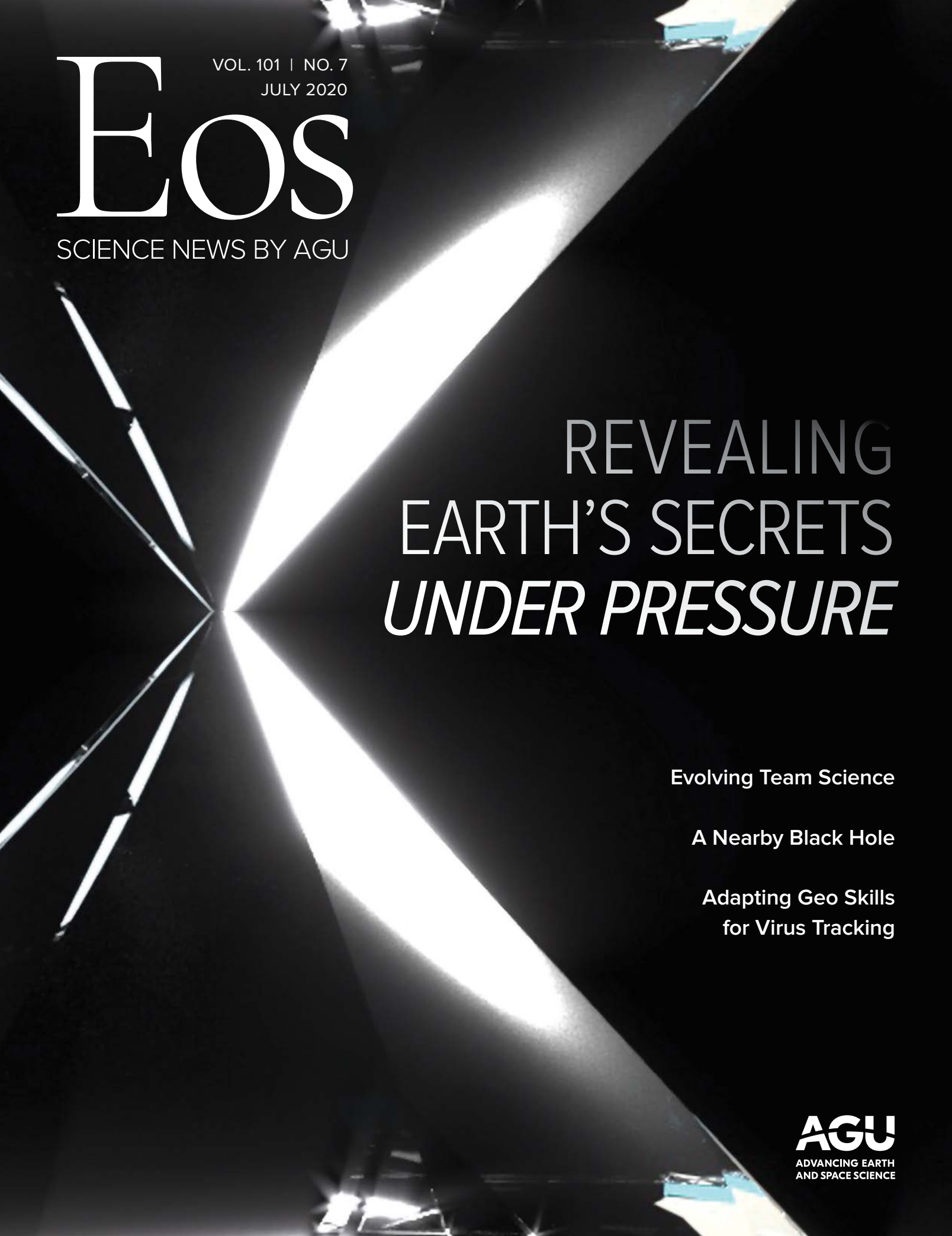

REVEALING EARTH'S SECRETS *UNDER PRESSURE*

Evolving Team Science

A Nearby Black Hole

Adapting Geo Skills for Virus Tracking

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ADVANCING EARTH AND SPACE SCIENCE

The Closest Black Hole Is 1,000 Light-Years Away

Supermassive black holes—millions or even billions of times more massive than the Sun—anchor the centers of most galaxies. But smaller black holes, at just a few solar masses, should theoretically pepper galaxies in droves. A few hundred candidates have been found in the Milky Way. Now researchers have spotted another one of these stellar mass black holes, and it holds a special honor: It's the closest black hole to Earth yet discovered. The findings shed light on the dynamics of supernova explosions that go on to create black holes, the team suggested.

Finding Wallflowers

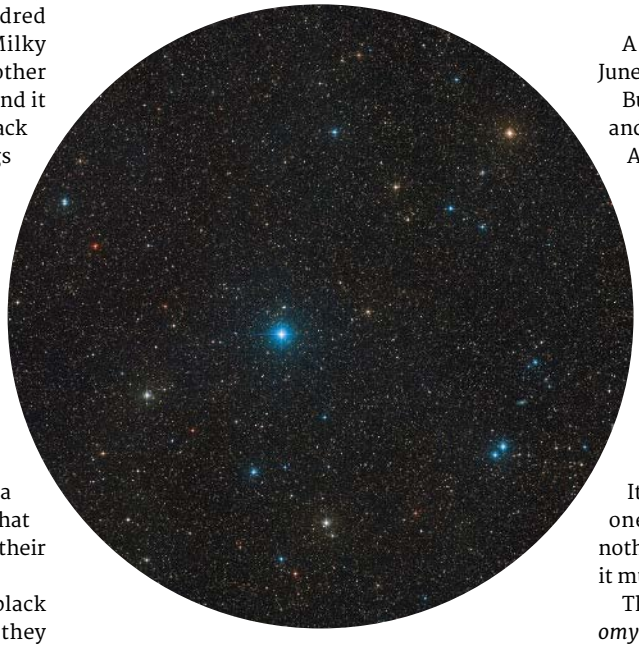
Disks of hot gas and dust glowing brightly in X-rays sometimes encircle black holes. This radiation indicates that a black hole is active and accreting matter, said Thomas Rivinius, an astronomer at the European Southern Observatory in Santiago, Chile. And it's a beacon. "We only find the [black holes] that are violently gobbling up material from their environment," said Rivinius.

It's much harder to spot the many black holes that aren't consuming matter—they don't produce X-rays. But sometimes the universe aligns itself just right to reveal these wallflower black holes. That's what Rivinius and his collaborators found when they examined HR 6819, a seemingly ordinary pair of stars about 1,000 light-years away in the constellation Telescopium.

"There are probably a million black holes in the galaxy that have binary companions that are stars."

In 2004, Rivinius and his colleagues trained a 2.2-meter telescope in La Silla, Chile, on HR 6819. "We thought it was only two stars," said Rivinius.

But to their surprise, the researchers discovered that one of the stars was wobbling in a circle. "One of them was being flung around," said Rivinius. That's the telltale sign of a companion, a nearby object that's tugging gravitationally on the observed



Astronomers found the closest black hole to the Sun in the constellation Telescopium. Credit: ESO/ Digitized Sky Survey 2; Acknowledgment: Davide De Martin

celestial object. So HR 6819 wasn't just a pair of stars—it was three objects: one star on a relatively wide orbit and one star paired with something unseen.

Not a Star, White Dwarf, or Neutron Star

The scientists calculated that the mysterious third object in HR 6819 had to be at least about 4 times the mass of the Sun. That's pretty hefty—a star of that mass would pump out enough light to be visible even if it belonged to the dimmest class of stars, Rivinius and his collaborators estimated. They also ruled out fainter objects like white dwarfs and neutron stars because they're typically of much lower mass. That left one logical conclusion: The unseen object was a black hole.

That idea languished for several years, however, after tragedy struck unexpectedly:

"We thought it was only two stars."

A team member died in a car accident in June 2014. "The study stalled," said Rivinius.

But last year, new results spurred Rivinius and his colleagues to revisit their findings. Another team of researchers had reported finding a black hole using the same method. Rivinius remembered seeing a press release and thinking, "Wait a second—I have something in the drawer that looks exactly the same."

The Closest One

Rivinius and his collaborators estimated that the black hole in HR 6819 was about 1,000 light-years from Earth, making it the closest known black hole. Its proximity implies that systems like this one are common. "Our neighborhood is nothing special," said Rivinius. "If it's here, it must be everywhere."

These results were published in *Astronomy and Astrophysics* (bit.ly/nearest-black-hole).

The existence of HR 6819 sheds light on the supernova explosions that create black holes, the scientists suggested. It's long been believed that such explosions are antisymmetric, meaning that they send matter flying preferentially in one direction, with the result that the black hole is launched in the other direction. But finding a black hole gravitationally bound to a star implies that in some cases, black holes aren't flung from their birthplace. That is, supernova explosions are sometimes symmetric.

Determining what fraction of supernovas are symmetric versus antisymmetric will require a larger sample of black holes. That's entirely possible research, said Todd Thompson, a theoretical astrophysicist at the Ohio State University in Columbus not involved in the research. "There are probably a million black holes in the galaxy that have binary companions that are stars," said Thompson. "That's a very big sample that we should get busy trying to understand."

By **Katherine Kornei** (@KatherineKornei), Science Writer