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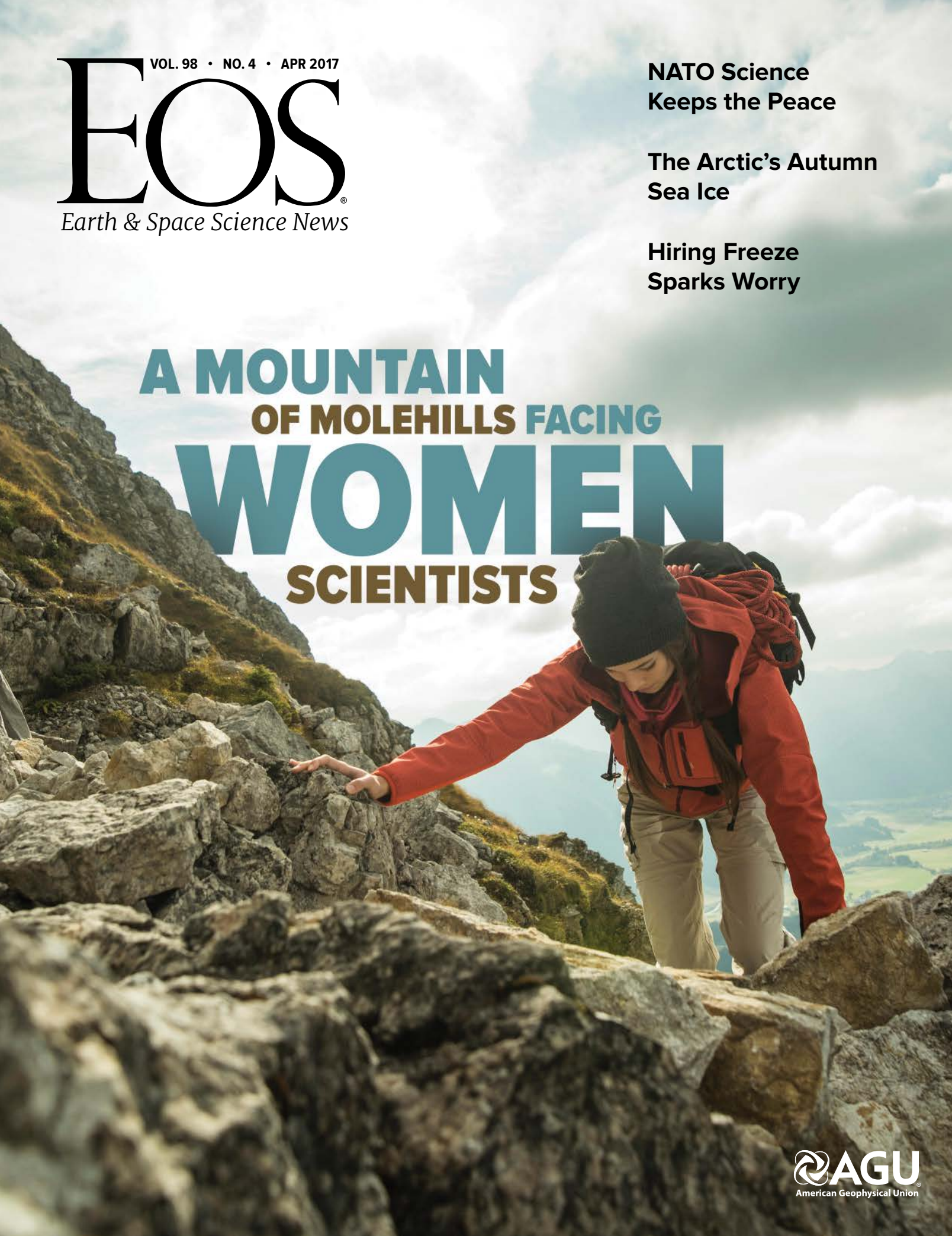
# EOS

*Earth & Space Science News*

**NATO Science Keeps the Peace**

**The Arctic's Autumn Sea Ice**

**Hiring Freeze Sparks Worry**



# A MOUNTAIN OF MOLEHILLS FACING WOMEN SCIENTISTS

AGU
American Geophysical Union

as meteorologists and people tracking satellites, would fall into that category. During the confirmation hearing for commerce secretary, nominee Wilbur Ross said that properly staffing the NWS is important and that if confirmed, he would do his best "to quickly fill all essential positions" there.

Scott Smullen, acting director of NOAA communications, told *Eos* that "it's not yet certain how this [freeze] memorandum will specifically affect our workforce and operations, which [are] mainly focused on protecting life and property and supporting the economy. At this time, we will not speculate on potential impacts, and all official guidance will be provided to our workforce as soon as possible." He said that NOAA currently has between 1100 and 1200 full-time job vacancies.

PEER's Ruch said that as far as he knows, agencies such as the U.S. Geological Survey and NSF "are not suffering from direly thin staff levels." Spokespeople from both of those agencies and NASA told *Eos*, before this magazine went to press, that their administrators were assessing the impacts of the freeze memo.

### Impact on NSF

Dave Verardo, president of local chapter 3403 of AFGE, which represents NSF employees, expressed concern that the freeze might impair NSF's ability to best serve the science community on behalf of the American public. If NSF lacks enough people to manage the merit review system, for instance, that process could slow down, he said.

Verardo added that NSF is already a fiscally lean organization, with about 96% of its budget getting passed through to congressional constituents as research grants.

Because the freeze order is not very specific, it's unclear how it will affect NSF, Verardo said. Although the freeze probably will have a direct effect on hiring new people, he does not know if it will affect new "rotators," including NSF assistant administrators, who temporarily work for NSF through Intergovernmental Personnel Act (IPA) assignments. Bill Easterling, a rotator under the IPA who will become NSF's assistant director for geosciences on 1 June, told *Eos* that his appointment will not be affected by the freeze.

Whatever other impact the freeze order might have, it has hurt the morale of NSF employees, Verardo said. "People feel that the freeze is reflective of a negative view of the federal workforce by the president. They're not sure if there is an economic reason behind it or if there is an ideological reason behind it."

By **Randy Showstack** (@RandyShowstack), Staff Writer

# Seven Earth-Sized Planets Seen Whizzing Around One Cool Star

NASA/JPL-Caltech

*An artist's representation of a view from the surface of one of TRAPPIST-1's planets. In late February researchers announced that they had discovered seven exoplanets, all within the temperate zone of their parent star, where liquid water could exist and perhaps foster conditions for extraterrestrial life.*

Forty light years away, seven Earth-sized planets circle a small, dim, "ultracool" dwarf star, orbiting up to 20 times per Earth month. These exoplanets, four of them previously unknown, "are the best targets so far to search for signs of life" outside our solar system, said Julien de Wit, a planetary scientist at the Massachusetts Institute of Technology in Cambridge and coauthor of a recent *Nature* paper (see http://bit.ly/7exoplanets) about the planets.

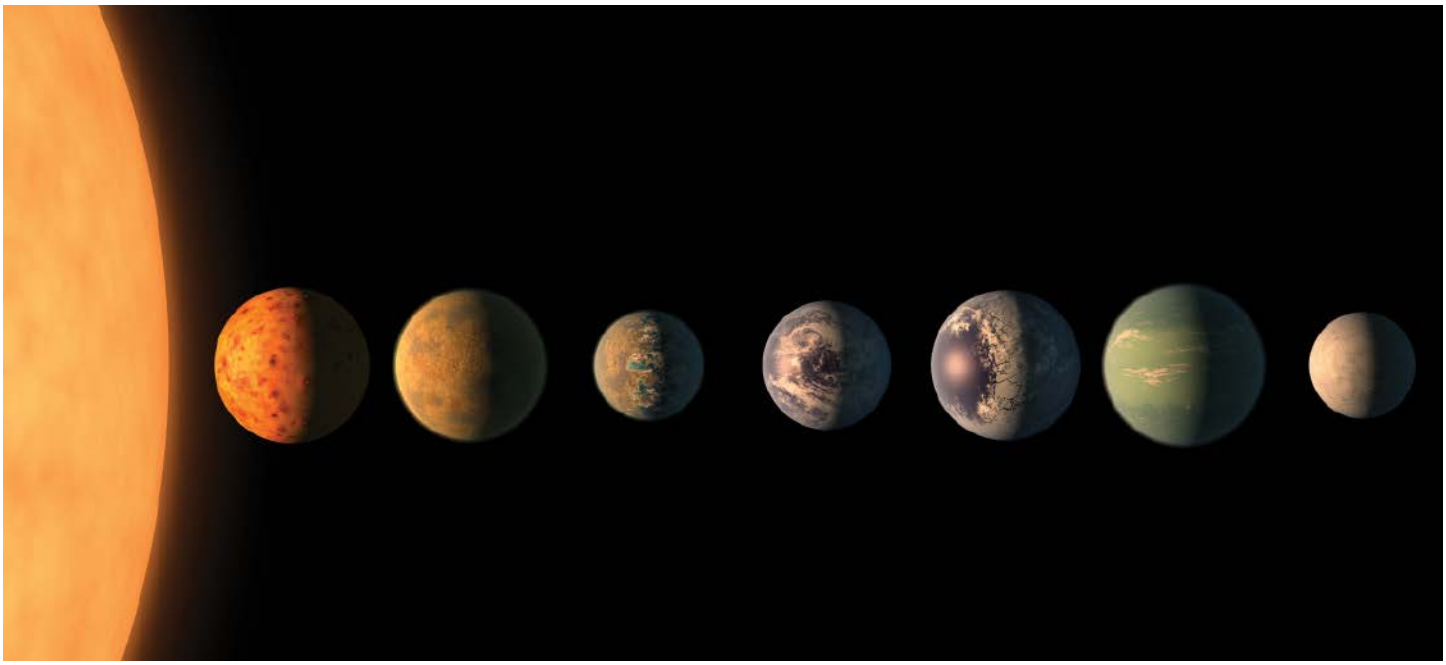
These remote worlds orbit close to their dim star, so enough energy may reach the outermost planets to provide liquid water. In addition, the orbits do not dip very much below or above the plane of the star, allowing for the star's gravity to push and pull the planets enough to perhaps produce heat. There might even be enough internal heat to generate strong volcanic activity on some of the planets, de Wit said.

The seven planets serve as "true Rosetta Stones" for studying exoplanets, de Wit added. They offer observers a "winning combination" of revealing information because they regularly pass between the star and Earth, throwing doors wide open for detailed atmospheric studies, he continued.

### The Transit Method

To find the seven bodies, the team used the most common method by which scientists find exoplanets: the transit method. The scientists observed the star, called TRAPPIST-1, via ground-based and space-based telescopes, looking for dips in its brightness. A periodic dip in the star's brightness means that something, like a planet, moves between the star and Earth on a regular basis.

Recently, exoplanet hunters have focused attention away from observing stars like our Sun—large and bright—to the smallest, coldest stars to look for planets. Michaël Gillion, lead author of the 22 February paper, said that this is because the light from Sun-like stars often drowns out any signal from small, rocky, Earth-sized planets. Instead, many scientists began to wonder, Why not look where our current technology can clearly see? This would be around small, ultracool dwarf stars like TRAPPIST-1, which is one ninth the diameter of our Sun and only half as bright.



NASA/JPL-Caltech

*An artist's representation of the seven TRAPPIST-1 planets, based on new measurements of their masses and diameters.*

Following this logic, the researchers used the ground-based Transiting Planets and Planetesimals Small Telescope (TRAPPIST) at the European Southern Observatory's La Silla site in Chile. Last year, the researchers spotted the three outermost planets but suspected that there were more because previous exoplanet discoveries from the Kepler mission "show that multiplanet systems are very common," said Katherine Deck, an astronomer at the California Institute of Technology in Pasadena and coauthor of the paper.

So the researchers turned to the Spitzer Space Telescope, which observes the solar system in infrared light—light with wavelengths longer than the human eye can see. For 20 days, Spitzer observed the TRAPPIST-1 system, watching the star's brightness decline, then rise again as planets passed by.

Combining the Spitzer data with more ground-based measurements, the researchers observed 34 different transits, from which they teased out not three planets but seven. Although the team hasn't defined the orbital period of the outermost planet, the orbits of the other six range from 1.5 to 12.7 Earth days. Because the star is so small, "the signal of TRAPPIST-1's planets is about 80 times larger than what it would be if they were orbiting our Sun," de Wit said. Only Jupiter passing in front of the Sun could produce as pronounced a dip in solar intensity for an observer watching our solar system from a similar distance, the researchers noted.

The transits provided researchers with diameter estimates, calculated from the degree to which the starlight diminished as the planet passed between the star and Earth. Larger-diameter bodies obscure more of the stellar surface, causing proportionately more dimming.

The researchers also looked at how the planets gravitationally tugged on one another as they orbited TRAPPIST-1, which "causes the timing of their transits to change a little," de Wit said. Sometimes the transits come early, sometimes late. By measuring these variations, the researchers can start to determine the masses of the planets. In a year or so, he continued, they should be able to pin down the masses fairly precisely.

### Search for Life

Because of the proximity of the planets to their star, the team suspects that the innermost planets exhibit a runaway greenhouse scenario, much like Venus. This means that liquid water is unlikely to be sustained on their surfaces.

> "In our search for planets like Earth and possible extraterrestrial life, it really pays to concentrate on the smallest stars."

The outer three planets, however, could orbit far enough from their star to harbor liquid water. To investigate further, the researchers plan to take a closer look at the exoplanets' atmospheres. Researchers investigate exoplanet atmospheres by examining patterns in the star's light as it passes through the atmosphere. If the planet has an envelope of gases surrounding it, the light's signature will indicate that.

Researchers note that when the James Webb Space Telescope launches next year, they could have an unprecedented opportunity to observe seven newfound atmospheres to search for possible biological signatures such as methane, ozone, and carbon dioxide. Already, the Hubble Space Telescope has determined that two of the TRAPPIST-1 planets probably do not host hydrogen- and helium-dominated atmospheres—if they do, it would bar habitability.

"We already knew that Earth-like exoplanets are common in the Milky Way, but this new finding suggests that they are even more abundant," said Ignas Snellen, an astronomer at the Leiden Observatory at Leiden University in the Netherlands who wasn't involved in the new research. These observations show that "in our search for planets like Earth and possible extraterrestrial life, it really pays to concentrate on the smallest stars."

By **JoAnna Wendel** (@JoAnnaScience), Staff Writer