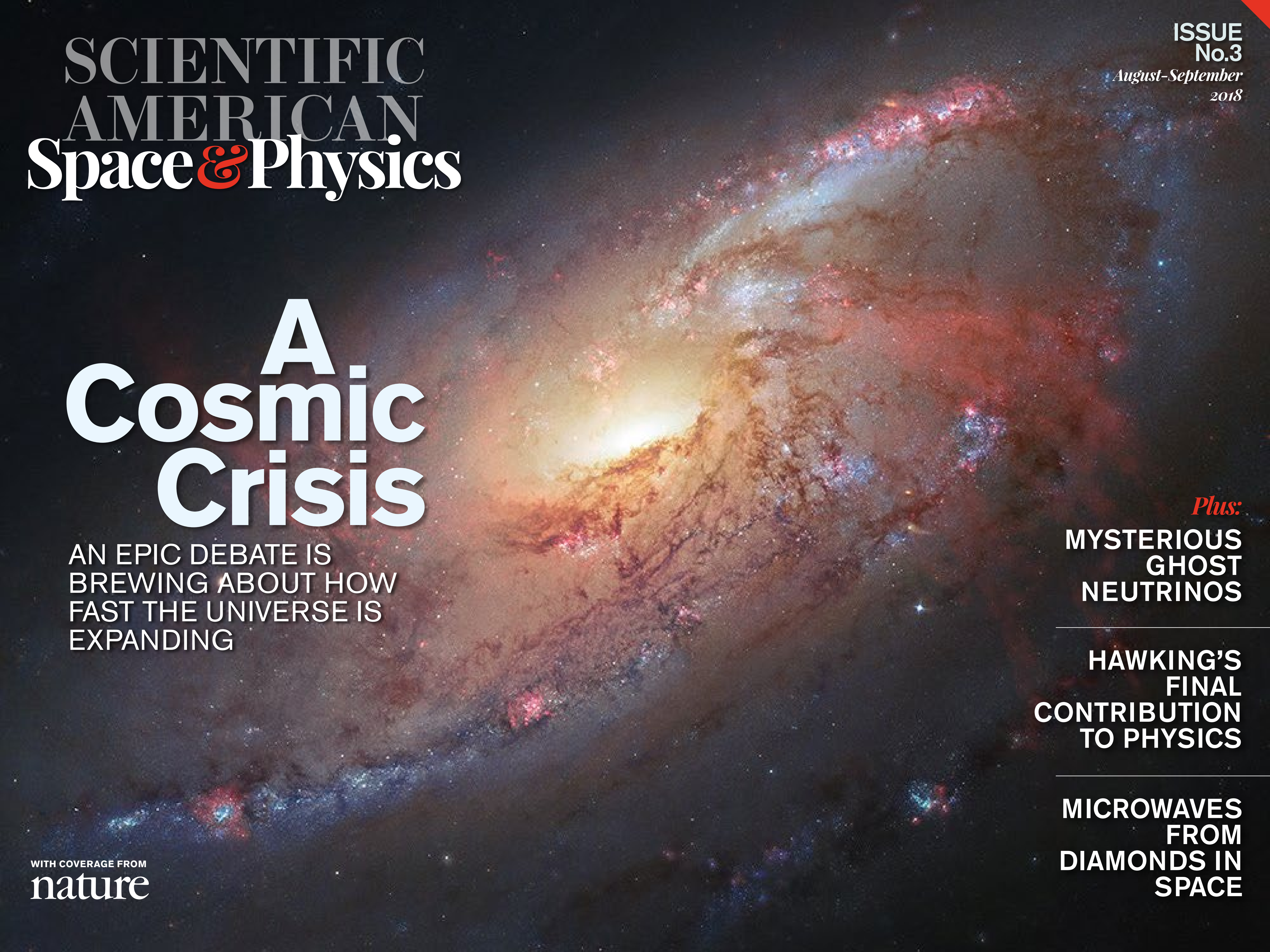

SCIENTIFIC AMERICAN Space & Physics

ISSUE No.3
August–September 2018

A Cosmic Crisis

AN EPIC DEBATE IS BREWING ABOUT HOW FAST THE UNIVERSE IS EXPANDING

Plus:

MYSTERIOUS GHOST NEUTRINOS

HAWKING'S FINAL CONTRIBUTION TO PHYSICS

MICROWAVES FROM DIAMONDS IN SPACE

WITH COVERAGE FROM nature

Sheri Wells-Jensen is an associate professor in the department of English at Bowling Green State University. Her research interests include astrobiology, linguistics and disability studies.

SPACE

The Case for Disabled Astronauts

In some situations, spacefarers with visual or other impairments could actually make a mission safer

STEVE BRONSTEIN GETTY IMAGES

EVERY SIX-YEAR-OLD wants to be an astronaut. This career goal is right up there with firefighter, detective, cowboy and ballerina. Before long, though, most recognize that they do not meet, and will in fact never meet, the nonnegotiable physical requirements for the job. They are too tall, or they have a weak knee, flat feet or some other slight but uncorrectable physiological irregularity that means they do not have what Tom Wolfe called "the right stuff."

Because there are thousands of applicants for each spot, space agencies can afford to be picky. It is not unlike the policy imagined by classic science fiction author Robert Heinlein, where those in change "can turn down a ship's captain just for low blood sugar before breakfast and a latent tendency to be short-tempered therefrom until he has had his morning porridge."

But this unapologetic demand for physiological near-perfection is not only unnecessary; it will actually become a serious liability as mission durations increase. Survival chances for any long-term mission will be dramatically improved by loosening these restrictions until all people, regardless of disability, are eligible to be astronauts.

I say this not because of some ineffable theoretical advantage of "diversity." I will use the example here of a totally blind astronaut, but a similar case could be made for other physical disabilities.

A blind person on a space station probably seems, *prima facie*, very frightening given that her colleagues might have to depend on her in an emergency. But blind adults are successful parents, teachers, scientists and chefs, and do not have more accidents than sighted people; there is no inherent danger associated with a blind person doing his or her job.

The key to success here lies in adapting instruments to output information in braille and/or audio along with visual displays. Joshua Miele, a researcher at the Smith-Kettlewell Eye Research Institute in San Francisco, notes that "creating an effective accessible interface is mostly a matter of understanding users and usability and incorporating that from the beginning. While it takes planning and good design, it's not rocket science."

Neither is it a new idea. Spacecraft are designed with redundancy: extra oxygen tanks, backup computers and failsafe after failsafe. Accessible instrumentation adapted for a blind astronaut—which would also serve a sighted astronaut in the dark—is just one more layer of protection against mission failure.

On a spacewalk in 2001, Canadian astronaut Chris Hadfield was temporarily blinded by a combination of soap and tears inside his helmet. The real problem was not that he was unable to see; it was that the current spacesuit design forces astronauts to over-rely on hand-eye coordination to the exclusion of other useful sensory information. For blind astronauts, the priority would be to design suits with better flexibility and increased tactile feedback, so the hands could be used more easily to explore and manipulate tools.

If humans functioned like robots, impartially absorbing all sensory input, there would be less advantage in employing a blind astronaut. But humans are not robots. Cultural and evolutionary factors have shaped how our brains prioritize perceptual information. For example, although blind people do not generally have measurably superior hearing, a blind person is *attentive* to audible input in a way that sighted people are not. If a blind and a sighted scientist are standing together in a park and a small bird flies overhead, the blind scientist might say: "Did you hear that bird?"

The sighted scientist might have *seen* the bird and noted its presence but failed to note the sound of its wings because that sound was unnecessary to his understanding of the situation. This offers no advantage in the pacific environs of the suburban park, but in life-or-death situations, the presence of a crew member who attends to nonvisual cues could save lives.

After all, in a serious accident, the first thing to go might be the lights. This generally means that the first thing a sighted astronaut must do for security is ensure visual access to the environment. He hunts for a flashlight, and if emergency lighting comes on, his eyes take a moment to adjust. Meanwhile, the blind astronaut is already heading toward the source of the problem. In the fire aboard the Russian Mir space station, in 1997 the crew struggled as smoke obscured their view. The blind astronaut, while still affected by the lack of good air, would not be bothered by either dim lighting or occluding smoke. She would accurately direct the fire extinguisher at the source of heat and noise.

As an armchair space observer, I mean no criticism of those involved in that accident; they did well, and we are all glad they survived. But it is our obligation to note ways in which spaceflight can be made safer, and they would have been safer with a blind crewmate aboard.

Another consequence of the systematic inclusion of blind astronauts would be altered procedures. One problem the Mir astronauts faced was that they could not find one of the fire extinguishers. The needs of a blind crew would necessitate rigorous policies designed to prevent disorganized clutter.

Of course, astronauts would still lose bone mass and be exposed to heightened levels of radiation, and a large decompression accident would still kill pretty much everyone. But some kinds of effects would be mitigated. A blind astronaut would not feel the nausea caused by the lack of a visual horizon or be disoriented by the profoundly intimidating view during space walks. Similarly, there would be little reason to worry about the damage microgravity does to vision as fluid accumulates in the eye, distorting the eyeball and in some cases pressing on the optic nerve.

Furthermore, when a crew spends extended time in space, there is always the possibility of injury or disease *resulting* in disability. The transition from active, confident, able-bodied person to active and confident person with a disability is a cognitively and emotionally complex task. Far from home, with no hope of replacement, a newly disabled pilot or scientist will find this necessary transition much more feasible if adaptive equipment is already in place and there are active and confident disabled crew members present to assist.

No otherwise-qualified disabled candidate should be automatically excluded from long-term space missions. In fact, for the good of the overall mission, I would strongly urge that disabled candidates be given a slight preference.