

A broken telescope just discovered 104 new planets

BY RACHEL FELTMAN
THE WASHINGTON POST

Whenever you feel like things are just too tough, remember what K2 has been through. The space robot formerly known as Kepler should have been put out of commission by a 2013 hardware failure, but some genius engineering gave it a second life. Instead of joining the ranks of defunct satellites and other space debris, the exoplanet-hunting spacecraft has kept doing what it does best: Sifting through heaps of glittering, distant stars to find the treasures that orbit around them.

And on Monday, NASA announced a record-breaking haul: K2 has confirmed the existence of 104 planets outside our solar system. The find includes a group of four exoplanets orbiting the same star — a band of potentially rocky worlds that may be Earth-like.

That's a drop in the bucket for the Kepler mission overall — the spacecraft already has confirmed more than 2,000 planets, many of them potentially habitable — but this is the largest dump of planetary confirmations made in the secondary K2 mission.

For the first few years of its mission, Kepler used three of its reaction wheels to keep it centered precisely on a single swath of the night sky. It was looking for fluctuations in starlight — dims and flickers and winks — made by planets as they passed in front of the 150,000 stars in Kepler's field of vision. Then one of those reaction wheels failed. Without it, the

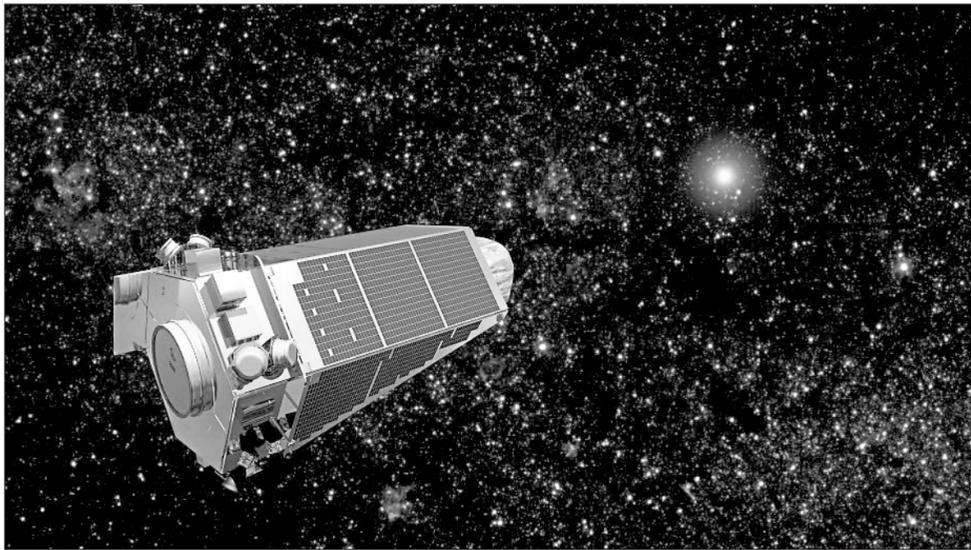
spacecraft was unstable, and any outside force could knock it totally out of position.

Instead of calling it quits, the mission scientists transitioned into a second wave of observation called K2, which started in 2014. K2 uses the physical power of the sun to keep Kepler from being unwieldy. The light from the sun acts as a virtual third reaction wheel, physically pushing against the craft's solar panels as the three physical reaction wheels push back. The tension keeps the telescope in place, but it has to be repositioned every 80 days to keep the solar forces hitting it in just the right place.

Most of the "new planets" discovered by Kepler are just new analysis of data collected during Kepler's main mission. But the intrepid second mission occasionally has its own successes to celebrate.

Some of the haul's most interesting planets — a quad of potentially rocky worlds about the same size as Earth — wouldn't even have been found without K2's unique handicaps.

"Kepler's original mission observed a small patch of sky as it was designed to conduct a demographic survey of the different types of planets," Ian Crossfield, a Sagan Fellow at the University of Arizona's Lunar and Planetary Laboratory, said in a statement. Crossfield is the lead author of the study announcing these newly confirmed worlds, published this week in *Astrophysical Journal Supplement Series*. "This ap-



NASA

NASA's Kepler spacecraft is seen in an undated artist's rendering. During a scheduled contact in April, mission operations engineers discovered that the Kepler spacecraft was in Emergency Mode and the mission has declared a spacecraft emergency. The spacecraft is nearly 75 million miles from Earth.

proach effectively meant that relatively few of the brightest, closest red dwarfs were included in Kepler's survey," he explained.

Because small, cool red dwarfs are so common in the galaxy — they make up about 75 percent of the local star population — scientists think they might be a good place to look for life. They're old, meaning that planets around them have had plenty of time to evolve life of some sort, and we have a lot of them close by.

"The K2 mission allows us to

increase the number of small, red stars by a factor of 20, significantly increasing the number of astronomical 'movie stars' that make the best systems for further study," Crossfield said.

The M dwarf star K2-72, which sits 181 light years away, fits that description: It's just half the mass of our own sun and not as bright. But because the four could-be-rocky worlds discovered around it orbit so close, some of them might be in the star's habitable zone, the range in which liquid

water could be found.

The planets were confirmed using follow-up observations from the North Gemini telescope and the W. M. Keck Observatory in Hawaii, the Automated Planet Finder of the University of California Observatories and the Large Binocular Telescope operated by the University of Arizona. Like other K2 finds, these nearby worlds will make great study targets when NASA's much-anticipated James Webb Space Telescope launches in 2018.

Study: Maine among states with most corrosive groundwater

BY PATTY WIGHT
MPBN

According to a new study by the U.S. Geological Survey, Maine is one of 11 states that has the highest prevalence of potentially corrosive groundwater, which can leach heavy metals such as lead from old plumbing and fixtures. And that means more than half a million Mainers who rely on private wells should get their water tested.

On its own, corrosive groundwater isn't necessarily bad, said Joe Ayotte of the U.S. Geological Survey. It has a low pH, meaning it's acidic.

"Low pH in general is not particularly harmful," he said. "A lot of the things that we drink are low in pH. Think about lemonade."

But you might not want to drink that lemonade if it came to your glass through old pipes and fixtures. Because when corrosive groundwater passes through old plumbing, it can leach out heavy metals.

Ingesting lead can cause neurological and other health problems. Given the health risks, the U.S. Geological Survey studied ground-

water corrosivity across the U.S.

Ayotte said half of all states have a high prevalence of potentially corrosive groundwater, and 11, including Maine, have a very high prevalence.

"Maine, New Hampshire, Massachusetts, basically all of New England, maybe with the exception of Vermont, has the highest potential," he said.

Those who should be most concerned are people with private wells. That's because public water systems are regulated and water is often treated to control corrosion, but private wells are unregulated. For the more than 500,000 people in Maine who depend on well water, it's up to the owner to make sure the water is safe.

"For private wells, private domestic wells, people really need to have their water tested. It always comes back to that," Ayotte said.

The problem is many private well owners don't test their water, according to Emma Halas O'Connor of the Environmental Health Strategy Center.

"That's really not working when it comes to arsenic, which the Maine CDC has kept track of," she said. "We know that only

about 45 percent of people on well water are testing their water for arsenic."

In 2010, a different U.S. Geological Survey study found about one in 10 wells in Maine have arsenic above federal standards. Arsenic has been linked to certain cancers as well as developmental disabilities.

O'Connor said the state needs to do more outreach and education.

"You have to actually know to order a comprehensive water test in order for arsenic and lead to be tested," she said. "Those are not chemical contaminants that are part of the standard drinking water test."

Gov. Paul LePage vetoed a bill last year that would have expanded outreach and education on well water testing. The LePage administration also failed to reapply for a federal grant to support similar efforts.

In an email, a Maine CDC spokesman recommends well owners who suspect their water is corrosive test for lead and copper.

This article appears through a media partnership with Maine Public Broadcasting Network.

Book

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in [this book] that I didn't know until I did the research."

For example, male foxes are called dogs, male Canada geese will defend eggs fiercely and sometimes even attack moose and baby bears weigh between 8 ounces and a pound at birth.

Stevens gained access to some of the young animals he photographed through a friend who is a wildlife rehabilitator.

He has no trouble identifying his favorite photo shoot during the production of the book.

"The one thing I wanted to do really bad was to see a baby bear," he said. "I teamed up with Randy Cross [from the Maine Department of Inland Fisheries and Wildlife] and was able to go on a bear den visit, which was the most incredible thing I've ever in my life. I was floating in the air on that one."

The experience has also opened his eyes to the possibility of a new book.

"When I went with them, all I wanted to do was get a picture of a baby bear. But then after just being with [the crew] for one day, now I want to do a book about visiting a bear den," Stevens said. "I learned so much about bears in a day. It was incredible."

Stevens said his books are available in 30 stores around the state and locally can be found in Bangor at The Briar Patch on Central

Street and the Maine Discovery Museum on Main Street. Those interested in ordering a book from him directly can also reach him at mefocus@myfairpoint.net.

Since he began producing books two years ago, Stevens says he has sold about 4,000 copies. He has sold 400 copies of "Babes in the Woods and Waters" in three weeks and expects it to wind up being the most popular thus far.

And while he's enjoying publishing the books, he has learned there's a spinoff that has been equally rewarding.

"Another exciting thing that's going on in my life is that I've been asked to do a lot of school visits as a visiting author," he said. "This year I had 10 different schools that invited me to come visit them, to talk with the kids about my craft and about animals. I never realized that I would really, really love doing that. So I'm trying to urge teachers and people in the area to contact me about next year."

And speaking of next, Stevens is already mulling the books that will follow.

"All the time I've been doing the animal books, I've been getting ready to do one called 'Barnyard Babes,'" he said. "I've been going around to farms this spring and catching baby animals at a very early age — sometimes 2 or 3 days old."

That book may appear this fall. And after that?

"Next year we're talking about doing an eagle book, and I'm definitely doing a puffin book," Stevens said.

Cyclists

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misses or getting seriously hurt."

According to data supplied by the Maine Department of Transportation, there were 1,044 roadway bicycle crashes in Maine between 2011 and 2015. Seven of those were fatal, with 978 causing personal injury to the cyclist.

In April, 34-year-old Joseph Lamothe died after being struck by a pickup while riding his bike on Route 196 in Lisbon. In May Rep. Mattie Daughtry was hit and injured while riding her bike in Brunswick when a vehicle turned into her path.

John Grenier owns Rainbow Bicycles in Lewiston and said road-riding conditions have turned some of his longtime roadies into trail riders.

"I'm seeing an older crowd of people getting into mountain [and] trail biking," Grenier said. "They are telling me they feel safer off road."

Grenier said he and fellow riders are noticing more close calls with vehicles than in years past.

"When we get passed [by cars] or pull up next to a car at an intersection, we are seeing a lot of drivers texting or doing things with their phones, and that makes a lot of us riders uncomfortable."

At the same time, Grenier said cyclists seem to be getting honked at and yelled at more these days by drivers "who seem to have a short fuse," he said.

"We keep hearing over and over that we should not be on the road," Grenier said. "And I agree, we should not be if we are not following the law, but we do have every right to share that road in

a lawful way."

Grenier believes there is a perception on the part of some drivers that cyclists are out on the road "playing" on their "toys," when in fact many are using their bikes as a major form of transportation to and from work or school.

"When some drivers see us out there wearing our lycra, they assume we are just out to have fun and how dare we slow them down," Grenier said. "Some of them seem to want to teach us a lesson by aggressively passing us — every cyclist has a story to tell about that."

Education for cyclists and motorists is the key to solving many of the issues, Grenier said.

"I think we are making progress," Brian Allenby, communications director with the Bicycle Coalition of Maine, said. "But it just takes one bad cyclist to change motorists' opinions of all cyclists."

Through ongoing projects such as the "Share the Road" campaign, community-based educational outreach programs and ongoing advocacy with state and municipal governments, the coalition is working to make Maine a bike-friendly state.

"Maine is a great cycling destination," Allenby said. "The coalition is always working to make sure the roads are safe and that communities are the department of transportation are always thinking about bicycling when planning roads."

Cycling can also have a major economic impact, Allenby said. In September hundreds of cyclists will take part in the annual BikeMaine, covering hundreds of miles in Washington County, where they will lodge, eat and spend money shopping.

"When you put facts like that

out in front of people and what cycling can mean for the state, that has a huge positive impact for the sport," Allenby said. "One of our biggest tasks right now is getting that data out there."

From what he can see, Washington County drivers seem to be on board with the upcoming ride.

"When our bike team was out there previewing the route, they said they had never been waved to by so many people driving cars," he said. "The people were really friendly and kind."

Allenby said he, too, has seen his share of aggressive drivers during his 12-mile commute to work through Portland, but they're rare and often seem to cause embarrassment on the part of the driver when they make eye contact.

"Distracted driving is my biggest concern," he said. "If you are aware of your surroundings as a cyclist and practice legal, thoughtful riding, you can take the danger out of most situations, [but] those distracted drivers really do concern me."

Darling agrees but said most of the drivers he comes in contact with seem to be aware of cyclists on the road.

"I think there definitely is a heightened level of safety awareness between cyclists and drivers on most of the roads," he said. "But both need to be respectful of the other."

Tasse believes the education efforts on the part of the coalition are helping and that there is room for cyclists and drivers on Maine's roads.

"I think we are in a holding pattern when it comes to safety," he said. "Mainers are good folks who understand the people out there riding bikes are their friends, neighbors, kids' principals or their doctors."

Holyoke

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stole an uncooked rib eye right off the stove at a friend's home.

It should be noted that we now enroll any dog in our home in pet insurance the moment they arrive with us.

The only thing I can compare with this is the time my old dog, Pudge, gobbled down a bunch of tomatoes and hot peppers that we'd just harvested from the garden. We called it his "make your own salsa" trick.

From BDN colleague Emily Burnham: Not just one roll of toilet paper. An entire family-sized package of toilet paper. Cheerfully sprinkled throughout the house. Also, lip balm, DVDs, a plate of just-cooked breakfast left unattended on the coffee table for 45 seconds, part of a TV remote, a phone charger and FIVE PAIRS OF SHOES, including the soles out of \$150 boots from Valentine Footwear. Shoes are now put away on shelves or behind closed doors.

Emily, you've been holding out on us. All this time, you've been telling your office mates that your dog is a perfect little gentleman. Thanks for sharing — finally.

From former BDN outdoor reporter Misty Edgecomb: Half a chocolate birthday cake (with no ill effects), a Christmas pastry from a neighbor (including the

paper plate and plastic wrap) and a copy of "The Five Little Peppers and How they Grew."

Misty, see also: My comment on making your own salsa.

From BDN colleague Chris Cousins: When I was a kid my mom made a 2-pound meatloaf and left it in the oven with the door open a crack to cool while she went to pick up a gallon of milk. We came back and the meatloaf was gone. Muttley didn't move for like two days.

The things you learn. Holyoke has always seemed pretty cool to me. The fact that he actually had a dog named "Muttley" makes him even cooler in my book.

From Dan Harnum, Detroit, Michigan (and Sitka, Alaska): Our mastiff, Loki (should've known by the name we gave him), liked to magically enter the girls' playroom and eat Barbie dolls and assorted Barbie paraphernalia. Our back yard was littered with dog poop adorned with heads, shoes, clothing. Rather eerie to notice a dog turd staring at you.

Leader in the clubhouse: Dan Harnum. Thanks for playing.

And again, from Jana Watson, the final words on the matter

There should be a support group.

Indeed.

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