

THE APPLIANCE OF SCIENCE IN AN OUTBACK KITCHEN

A search for the source of mysterious signals at the Parkes Observatory had puzzled CSIRO astrophysicists for years, until the answer came in a flash, writes Viviane Richter.

Parkes Observatory hosts one of the largest single-dish telescopes in the southern hemisphere, upgraded many times since it started operating in 1961.

Airport layovers are rarely exciting. But during a stop in Singapore in March 2015, astrophysicist Emily Petroff gasped as she read an email from collaborators in Melbourne that finally revealed the answer to a mystery she'd been trying to solve. "I knew it!" she said as she realised the explanation was "perfect".

Astrophysicists at the CSIRO Parkes Observatory, a remote Australian radio telescope facility, had been puzzled for years by strange radio signals appearing on their telescope data.

While Petroff was travelling, the observatory's operations scientist, John Sarkissian, and director of operations, John Reynolds, had been trying to identify the source of the signals by running an experiment in the kitchen.

Colleagues at Swinburne University of Technology, in Melbourne, astrophysicists Andrew Jameson, Ewan Barr and Evan Keane, analysed the signals detected by the telescope and at last confirmed the source that had long been baffling some of the world's leading astrophysicists.

They'd emailed Petroff their findings and on her flight back to Melbourne, she wrote most of the paper that later reported the discovery in *Monthly Notices of the Royal Astronomical Society*, one of 280 CSIRO papers included in

the Nature Index last year. The puzzle emerged in 2011 when Sarah Burke Spolaor, then a PhD student at Swinburne, noticed unusual signals while sifting through telescope data in search of fast radio bursts (FRBs) — incredibly bright radio signals, believed to have travelled from other galaxies.

Astrophysicists study FRBs because they are thought to hold information about the origins of the universe.

Burke Spolaor later coined the term "perytons" for the unexplained signals, naming them after mythical creatures with the features of stags and birds. They had a similar signature to FRB signals, but registered so brightly on telescope receivers it was obvious they had to come from somewhere on Earth.

Astronomers worried too that the signals they were interpreting as FRBs may also be coming from a source on Earth. "Until the peryton mystery was solved, there was no way we could feel confident that what we were looking for were FRBs," says Petroff, who led the hunt for the perytons' source as part of her PhD work.

A breakthrough came in January last year. Swinburne's Jameson had recently created a real-time detection system designed for FRBs, that also proved useful for picking up perytons. The team detected three perytons

in a week and Petroff called the observatory scientists in the hope of identifying a possible source — perhaps construction, a film crew or anything else out of the ordinary. None of these had occurred. However, the Parkes scientists said a new radiofrequency interference monitor, that could track the exact frequency of the perytons, had recently been installed at the observatory. "That was the key," Petroff says. "We needed a new way of looking at it."

Sure enough, the monitor had picked up the perytons detected by Jameson's system, and crucially it revealed that the bright flashes had a frequency of 2.5 gigahertz. This narrowed the source to electrical devices such as WiFi, cell phones and microwave ovens.

There is no Wi-Fi at Parkes, and there were few cell phones around in 1998, when the first peryton was detected. Petroff's team was confident they'd at last resolved the mystery.

The two microwave ovens on site were the culprits. But, deliberately recreating a peryton was challenging. Dozens of microwave cycles remained unregistered on the telescope's receiver for weeks.

That was until 17 March 2015, when Reynolds made an off-the-wall suggestion to open the microwave door before the cycle had finished. Bingo. A peryton showed up bright as day on the telescope receiver. ■