# Calibration

## Conflicting messages.

Fredda was calibrating her new wrist monitor when we saw the signal. According to the monitor, her daughter Wanda was at the home of Fredda Souci, Honokaa, Hawaii, and had been there for the past three hours. Fredda was delighted.

These monitors are anti-theft devices for kids. Install the transponder under the skin and it ties into both public databases and GPS tracking, so that the vigilant mother knows whose house, whose restaurant, sometimes even whose vehicle, her child occupies. What abductor stands a chance?

But you can imagine what a clever 16-year-old would think of it. Wanda's very clever, talented with both hardware and software; the kindest things she called the monitor were "babysitter" and "chastity belt".

We weren't actually looking for a signal; we were examining images from a long exposure of NGC 7742, some 22 megaparsecs away in Pegasus. Working at Keck is sometimes like being the janitor of a time-share condominium, always fixing the place up for somebody else's vacation. Once in a while, though, there are short gaps between observing projects, during which you can get your own work done.

Tearing herself away from her wrist monitor, Fredda noticed that there was an unexpected blob next to the galaxy. As it wasn't catalogued, we guessed it was a flaw in the system.

But of course we checked. After Fredda's monitor verified that Wanda was attending a school play, we observed the galaxy again, in real time. There was, indeed, something new there.

It was blinking.

My first thought was of some impossibly huge pulsar. Never mind how crazy that sounds; the reality was worse.

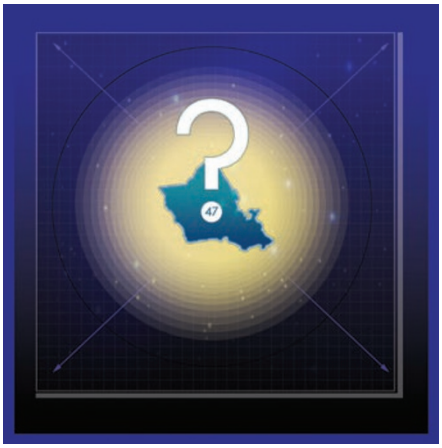
Because it stopped blinking; it vanished. Then, as we watched, it began again.

The pattern was invariant. The light flashed exactly 47 times, at apparently uniform intervals; then it stopped for about the same period of time; then it started up again. It was blinking at magnitude 16.2 — implying, at this distance, an absolute magnitude of –15.5. Ridiculous.

After watching this pattern a few dozen times, we posted a bulletin asking for confirmation. Suarez in Las Campanas confirmed within the hour; several others came in during the night. Fredda checked her monitor to make sure Wanda was in bed, then went home, muttering about quasars and gravitational refraction.

By morning, Mendelsohn at Palomar confirmed that the interval between each of the 47 pulses was 0.308091 seconds. Tanaka at Ayabe reported that the light in these pulses, allowing for distance and shift, was pure hydrogen-α. There was not a trace of any other wavelength.

That raised some eyebrows. At the very least we should have seen some evidence of different hydrogen signatures. We didn't. While he was at it, Mendelsohn remarked that 47 is a prime number, suggesting that the source was artificial.




JAQEY

Talk about far-fetched: a culture that could manipulate something like a few hundred supergiants and use them as a traffic light? Why?

I began to sort the information and analyses coming in, with intermittent help from Fredda as she fretted over why Wanda seemed to be at a restaurant in Hilo when she'd said she was going to be at a friend's house.

Within twelve hours, Laska in Krakow dropped the biggest bombshell: 0.308091 seconds, the time period between the pulses, is $1.40737 \times 10^{14}$ times the period of the hydrogen-α wave. And 140,737,488,355,327 happens to be the binary number expressed by 47 ones.

Oh.

The number of flashes expressed the relationship between the wavelength and the intervals. Someone was telling us that they knew they were sending a signal.

You, who are reading this in the quiet of your own office over a cup of tea, have probably spotted the flaw. We didn't, not for 20 more hours. Fredda would have — it's the sort of thing she notices — but she was distracted by Wanda's refusal to explain the anomalies in the monitor's reports of her whereabouts. Wanda's attitude was that, since Fredda had placed this device on her, Fredda could bloody well interpret the results.

It was Cutler in Pasadena who pointed out the flaw. The light we were seeing wasn't the true wavelength of hydrogen-α because, of course, it was red-shifted as you'd expect a source at that distance to be. But the interval between the pulses wasn't Doppler-shifted at all. It was exactly 0.308091 seconds. Red-shift doesn't pick and choose its phenomena; the intervals should have been shifted as well — they should have been longer.

The light was Doppler shifted; the intervals weren't. Therefore the red-shifting of the source's light wasn't due to the motion of the source, but to something else.

Christopher in Oxford suggested that we had found evidence of "tired light". You can imagine the storm resulting from the resurrection of that old monster — the notion that some unspecified substance or quality in intergalactic space somehow saps photons of their energy. The theory has never actually been disproved with contrary evidence, but universal expansion explains so many other things that jumping to a "tired light" conclusion was patently absurd. Christopher retorted that what was "patently absurd" was to ignore experimental evidence.

The online debate raged for hours. We dreaded what would happen if we made a public announcement so apparently disastrous for general relativity, for the Big Bang, for practically anything bigger than a microwave oven. The creationists would have a field day.

Fredda had been very quiet. Now she looked up from her monitor, which told her that Wanda was in a brothel in Honolulu.

"The senders of this signal …" she began.

"Yes?"

"Why do we assume that they weren't lying?"

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