

Orbiting Rainbows (set in November 2029)



Mitch Harvey swung off the Oak Drive exit of Freeway 210 and drove to the parking lot at the rear of JPL. He parked his old and battered 2015 Kia Rio at the back of the lot, eying with envy the latest Teslas in the named slots by the lab entrance.

He tapped his forefinger on the entry pad and the door slid back with a hiss, his sweat having been recognized by the DNA access library. He was in the fifth week of his internship and couldn't quite believe that he was allowed in.

He'd had several interviews before being accepted. In one, he was asked "What sparked your interest in astronomy?"

"Well, my Grandmom used to teach at UCLA and asked me what I wanted to do. I told her that my real interest was astronomy, but it didn't seem a very exciting career. After a pause, her response was to ask me if I had ever heard of Carl Sagan?"

To cut a long story short, she told me to find on Our Tube a recording of his Christmas Lectures at the Royal Institution in 1977. That's what – 52 years ago!

There was a really funny bit about the camera on Viking 1. It used a nodding mirror to scan a vertical strip and took 30 minutes for a 300° panorama. Could it detect life on Mars? They put the camera on the Main Street in Mars, Pennsylvania with the High School Marching Band streaming past. The camera was so slow that it only saw an empty street and the shop fronts opposite! After that, I was hooked on the search for extra-terrestrial life."

Ten days later, he was offered a placement with Dr Maddy Lopez, to work on Project Arcus. Maddy was frighteningly clever and twice his age. When he started, she gave him a quick run-down on the project.

"We are looking for planets outside the solar system – exoplanets. The first was discovered in 1992. We've been searching for them, particularly using telescopes such as Kepler. Kepler was launched in 2009 and detects planets by measuring the dip in brightness of a star as a planet crosses its face. We've found so many¹ that we think that there is at least one planet for every star.

The question is 'how many of these can support life'? There's a raft of criteria for this: presence of liquid water or ice; temperature; key chemical and organic elements, and several more.

Can we measure these at inter-stellar distances? Project Arcus is part of the answer. Arcus, which is Latin for rainbow, is a high resolution optical and microwave sensor. It began as a NASA project from the mid-10s called Orbiting Rainbows.

As background, there's just a bit more science. The resolution of a sensor depends on how large its aperture is compared with the wavelength it's capturing. Generally, big is better; very big is better still. The real problem is that very big is very difficult on earth and pretty much impossible in space.

Orbiting Rainbows took a different approach. What if you could marshal a cloud of small reflective particles, in space, so that they could be used as a giant telescope mirror, or microwave receiver, or radar dish?

¹ 2,111 by 2nd May 2016

The particles are held in place using photonic pressure from lasers and some clever controlling software. Orbiting Rainbows demonstrated the principle and Arcus was funded in 2025 and launched last year. We've just begun collecting data."

"Arcus?"

"Oh, Arcus is Latin for rainbow. The particles are like raindrops reflecting sunlight"

"What do I do?" Maddy explained that he had to run the planned data collection sequence for each exoplanet in turn. The system would report back on progress and he was to contact Maddy if any alerts came up on the control screen.

"Meantime, you also review the data we already have. There's a vast amount in every sequence, so we use data-mining (or DM) to interrogate it. If there are any special features, a buffered dataset is extracted with some metadata indicating why it's of interest."

Mitch helped himself to his customary start-of-shift coffee, logged in on the system and started the collection task. Once data collection had begun, he opened the DM file. There was a new file 'Kepler-186 f' with a sub-folder entitled '10-26-2029 1303UTC Optical Spectrum Structured Data

He didn't know what this meant; except that he had collected the data the previous week. He opened the file, finding a raft of tabular data of brightness versus wavelength. He right-clicked on the Processing Tools Menu and asked for a graphical display of the data.

Seeing the results, he nearly dropped his coffee. He reached for speed-dial. "Maddy, come and have a look at the data from DM that I just downloaded!" As she burst in, he swivelled round, pointed at his screen and said "Look at this! I've got something, but I've no idea what!"

She glanced at the screen and said excitedly "Looks like you've got a rainbow!" Deftly scrolling through the data and confirming wavelengths she said "Remember today, because nothing like it may ever happen again in your career".

"Something is reflecting light at discrete wavelengths from the planet's upper atmosphere. The best bet is water vapour in clouds or water ice crystals. Our first actions are ..." she paused in thought "... we call the Project Director and get permission to notify the IAU Central Bureau for Astronomical Discoveries. Then we release this data to ESO, Chile and Australia for independent review. Then we set a Press Conference at NASA HQ for next week."

"Does this mean that Kepler-163 f might support life of some kind?"

"It surely increases the chances. It's probably going to make the network news. How's your television profile?"

"Non-existent. Yours?"

"OK, one more thing. We need to propose a name for this planet. It was discovered by Kepler, but we can replace the 'f' with something more meaningful, provided the boss, IAU, NASA and JPL agree. Don't get too excited; we can't use the names of living persons, so Mitch Harvey and Maddy Lopez are not going to feature."

"What about Arcus Sagan 1?"

"Great idea! Arcus because it's a Project Arcus discovery and Sagan is perfect."

Ten days later, Mitch, Maddy and the Director were sat in front of several TV cameras in the NASA Presentation Theater. After the briefing and a barrage of flashes from the press cameras, the correspondents asked their questions.

“Mitch”, called one “Jim Roberts, BBC Science correspondent, what’s at the end of the rainbow on Arcus Sagan 1?”

“Well, who knows? Perhaps, if Carl Sagan were here, he would say with that familiar grin ‘I hope it’s life, Jim, but not as we know it!’”

The room collapsed with laughter and Mitch raised his hand and said “I apologise, I couldn’t resist that.”

The headline worldwide on the evening news and in the next day’s papers was “There’s Life at the end of the Rainbow – but not as we know it!”

Ref 1: <http://optics.org/news/6/10/9>