

## Finding Exoplanets on the Dublin Mountains Way - An Emotional End.

In July this year (2018), Dr Fergal Mullally<sup>1</sup> gave a lecture, which included a full visual presentation, under the night sky on NASA's<sup>2</sup> space probe for planets outside our solar system which might be capable of supporting human life. The talk/presentation was given as part of a Dublin Mountains Partnership (DMP) night-time guided walk which was held in place of its normal Summer Solstice night walk. It took place outside the DMP Ranger hut on the Dublin Mountains Way close to the masts in Ticknock.

Planets outside the solar system are called exoplanets (extrasolar planets). Prior to 1988, there was no scientific evidence of exoplanets: the first confirmed one was a Jupiter-sized object in 1995.

NASA first proposed in 1984 to set up a mission to determine how exoplanets, if they existed, could be detected, bearing in mind that they could never be seen even with the most powerful telescopes. This ultimately led to NASA launching a spacecraft in March 2009 called Kepler (named after Johannes Kepler, the 17th century mathematician, astronomer, and astrologer best known for his laws on planetary motion). The Kepler Mission was specifically designed to survey our region of the Milky Way Galaxy to discover Earth-size and smaller rocky planets in or near the habitable zone of their suns (referred to as the 'goldilocks zone' – that is, not too near their sun – too hot; not too far from their sun – too cold) and determine the fraction of the hundreds of billions of stars in our galaxy that might have such planets. Kepler and NASA scientists would use the transit method of detecting exoplanets, that is, measuring the (minuscule) reduction in light reaching our Earth when a planet transits in front of their parent star as seen from Earth. The search was confined to a very small part of the sky/Milky Way, as the same stars had to be monitored over a long period of time. Kepler could measure the size of the planet and whether or not the planet was near the habitable zone of its star, but it couldn't detect whether water, oxygen etc, which are required to support life, existed on them.

In October 2018, the Kepler Spacecraft finally ran out of fuel and was left to drift in space for eternity but not before the mission had been completed successfully. Most of the data collected has now been analysed but scientists will continue to further analyse it for many years. In all, over 4,700 'candidate' exoplanets were discovered in a very small part of the Milky Way Galaxy where Kepler was looking and 2,000 of these have been confirmed as most probably planets. Projected to the entire Milky Way, scientists have estimated that at least 10 million, but it could be up to 100 million, Earth-like planets about the size of the Earth are in existence in the goldilocks zones of their own stars. As the Milky Way is but one galaxy among at least 100 billion others in the known Universe, the total number of Earth-like planets could be in the tens of billions.

NASA is currently working on new missions to add to our understanding and knowledge of the environments on these planets. Missions, in place or planned, will hopefully detect life supporting water, oxygen etc. Meanwhile, SETI<sup>3</sup> is an ongoing project which is trying to detect intelligent signals from outer space. Hopefully, these may eventually answer the question "Is there someone else out there?"

Fergal Mullally joined the Kepler Team in 2010 and worked with them until 2016. He is still analysing data from the mission. He mused about the end of Kepler when "its "lights were turned off" on 31<sup>st</sup> October 2018. This is reproduced below. We in the DMP are very appreciative of the talk/presentation he gave in Ticknock last July and privileged to have learned about the possibility life on other planets. Perhaps, when next he is in Ireland, he will join us again on the Dublin Mountains and treat us to another talk/presentation on matters astronomical.

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<sup>1</sup> Fergal Mullally is from Knocklyon, Dublin and graduated from UCD with an Honours Science Degree in Experimental and Mathematical Physics in 2001 before he was conferred with a Doctorate from the University of Texas in Austin in Astrophysics in 2007.

<sup>2</sup> National Aeronautics and Space Administration of the USA

<sup>3</sup> SETI is an acronym for the Search for Extra-terrestrial Intelligence. It is an effort to detect evidence of technological civilizations that may exist elsewhere in the universe, particularly in our Galaxy.

*In college I was taught to never anthropomorphise. "Never think of a machine as having feelings", I was told. It doesn't hate you, it doesn't love you, it's just following the laws of physics, or whatever instructions were programmed into it. It doesn't have emotions.*

*But on some level, that's bad advice. We're human, and a considerable fraction of our brain power is devoted to figuring out how other people are feeling. It's often easier to treat a machine as a person, and put that brain power to use. If you work with something long enough, you start to feel "Oh, she's not going to like that", much faster than you can figure out why that is going to place extra stress on a weak part of the design. Anthropomorphism has its advantages.*

*I worked on the Kepler spacecraft for 6 years, and I knew her pretty well. Staring at her data, I would watch her stretch as the sunshine spread across her shoulders. Studying her telemetry, I could see her get jostled as the occasional stray piece of dust collided with her, moving so fast it would knock her off balance for a few minutes until she recovered. Mostly, I watched as she sat, calmly, serenely, in the depths of space, millions of miles from home, changing our understanding of the Universe.*

*When Kepler was first proposed back in 1984, humanity knew of no planets outside our solar system. For all we knew we were alone in the void. Worse, learned astronomers doubted we would ever be able to find other planets given the difficulties involved, and treated the whole idea as slightly crazy, and not worthy of serious attention. Today, thanks to Kepler, we can go out to any dark place on a clear night, look up, and know that we can probably see a star that hosts a planet like our own. We might not know which one, but Kepler has told us that planets like the Earth commonplace throughout the Galaxy.*

*That's a big idea. In a time where thinking big seems limited to designing the next time-wasting app on your phone, that's a very big idea. In a world where half the population seems to be in a panic over what people are doing on a slightly different part of that world... well I wonder if more of us understood our place in the Universe, this planet wouldn't seem quite so scary to them, and we could all live a bit more serenely.*

*Today, it was announced that the Kepler spacecraft has run out of fuel, and reached the end of her life. There's nothing that can be done, and nothing left to do but send the last commands to turn off the radio, shut down the computer, and go to sleep for the last time.*

*I knew Kepler's moods, I knew her tempers. She wasn't perfect, but then again, who is? She could chatter too much sometimes, and sometimes she could over-react when things went wrong. But the men and women who built her got as close to perfect as they could have ever hoped. The measurements she made were so precise it was like measuring a child growing taller by less than the width of a single strand of hair, all while they danced around your kitchen. That was what she was designed to do, and that's what she did, over and over again. There has never been a machine that could do what she did.*

*And now it's over. I know that she's just a machine, and she doesn't get emotional about the end in the same way I do. I know she does not fear death, cannot understand it. But having worked on her for so long, I just can't think of her as a machine anymore. She may not be a person, but she was a personality.*

*I guess I have a lot of emotions tonight.*

*Fergal Mullally*