Tomas van Dijk (Aerospace Engineering) wants to launch a space telescope to search for life on these planets. There are scores of earth-like planets outside our solar system. Dr Daphne Stam (faculty of Aerospace Engineering) wrote a proposal entitled ‘Exploring habitable worlds beyond our solar system’, after ESA asked scientists to submit proposals for major missions after 2020.

‘I don’t think we are alone’

Does your proposal have a lot of support?

‘More and more planetary scientists and astronomers are calling for the launch of such a space telescope. Our proposal was signed by almost seven hundred “fans”. The world of exoplanets has opened up to us. In the 1990s we detected the first exoplanets with ground-based telescopes. Later came ESA’s small space telescope Corot (convection rotation and planetary transits), which discovered the first rocky exoplanet. The launch of the more specialized Kepler telescope gave a huge boost to the search for these relatively small planets. We now know they exist in great numbers. In 2011, when we completed its main task anyway, thanks to the Kepler, we now know that almost ten per cent of all the stars in the Milky Way have at least one planet that is the right distance from a star for it to be able to accommodate water in liquid form.

And where there is liquid water, there could be life. Stam believes it is time to launch a telescope that can actually see such exoplanets, rather than ‘merely’ observe them indirectly, and also search for signs of life on them. Together with other European researchers she wrote a proposal entitled ‘Exploring habitable worlds beyond our solar system’, after ESA asked scientists to submit proposals for major missions after 2020.

‘Now we want to search closer to home.’

Do you wish to study the exoplanets discovered by Kepler and Corot?

‘No, they are much too far away for that. Kepler and Corot were only meant to find exoplanets. Kepler kept a constant watch on nearly one hundred and fifty thousand stars, looking for dips in the light produced by these stars. To measure such a dip, the planet’s orbit must be perfectly oriented in relation to the telescope. Of course this is rarely the case. Corot and Kepler monitored such huge numbers of stars simultaneously to increase the chance of encountering such perfect positions.’

‘Now we want to search closer to home. We would like to study the starlight that falls on a planet and is reflected, in just the same way that we can see the moon from the earth. We are interested in this reflected starlight, because it provides information about the presence and composition of an atmosphere around a planet. If the atmosphere contains a lot of oxygen, then it must have a source, because oxygen generally breaks down quickly. This could be an indication of life. We also want to measure the polarization state of the light waves. This polarization state is very sensitive to the properties of a planetary atmosphere. If there are water clouds, we should, under certain viewing angles, be able to see a rainbow using a polarimeter.’

What will the space telescope look like?

‘One option is to split the mission into two parts; the actual telescope, with a cross-section of four metres, and a screen that flies fifty thousand kilometres ahead of the telescope. The screen will be fifty metres in diameter and will prevent the telescope from being blinded by the light of the star around which it is orbiting. This starlight is ten billion times more intense than that of the star. The screen will also contain a pair of lenses that will focus the light onto the telescope. ‘

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before we try to do useful research on planets that are millions of times further away.

Despite this uncertainty, you are working together with colleagues from the University of Leiden on a small polarimeter that you hope one day to put on the moon as a kind of preliminary test.

“You can look at the earth from the moon as if it were an exoplanet. This would provide us with information about the colour and the polarization state of the earth’s light, which we could use as reference material for future observations of exoplanets. We will need this information because we will only pick up very little light from the real exoplanet. Moreover, all the spatial variation on such a planet, caused by such phenomena as the rotation of the planet and the dynamics of the clouds, will be compacted into a single pixel.”

“Because we know the composition of the earth’s atmosphere, the distribution of the oceans and continents, and the behaviour of the clouds, we can carry out measurements of the earth to learn how reliable polarization measurements of exoplanets would be and what information can be derived from these measurements.”

Some time ago, ESA and NASA had a plan to launch a cluster of telescopes to search for earth-like exoplanets. This project, called Darwin, and involving TU Delft researchers, was cancelled in 2007 because of the technical risk. If the plans for the new telescope meet the same fate, will your life’s work have been for nothing?”

“Don’t worry, I won’t have a breakdown! I’m also studying planets in our own solar system. A small polarimeter, such as that developed by the astronomers in Leiden, can also be used to make valuable discoveries with ground-based telescopes or on missions to the planets in our own galaxy. It could, for example, determine the composition of clouds in gas giants and the properties of the dust particles on Mars.”

How did you become so passionate about planetary science?

“I actually got into planetary research by accident. I was studying physics at VU University Amsterdam. The only professor of planetary science in the Netherlands at the time, professor Joop Hovenier, was working there too. He introduced me to this field. The student counsellor at my secondary school had also once told me that I should become an astronomer. He said that astronomers were true artists, which was fitting, because as well as being good at maths, I was good at drawing too. And it’s true that many astronomers are artistically inclined. Hovenier had a talent for drawing too. You need fantasy and imagination to be able to form a picture of objects that are so far away. Maybe that’s got something to do with it.”

But you became a planetary scientist, not an astronomer.

“That’s correct. As it happens, these two disciplines are drawn closer together, thanks to the new research on exoplanets. Astronomers always appeared to find planetary science boring. ‘We already know all there is to know about the planets,’ I’ve been told a number of times. Maybe they have the same feeling about planetary science as I had with earth observation after my PhD research. After a time it all comes to seem too detailed and specialized. But we still know virtually nothing about exoplanets, and that seems to have piqued the interest of the astronomers.”

Who is Daphne Stam?

Daphne Stam (1969) studied physics at VU University Amsterdam. During her PhD research with KNMI and the university’s department of planetary atmospheres she focussed on the diffusion of sunlight in the earth’s atmosphere. As a postdoc at Cornell University in the United States, she studied clouds in the atmospheres of Saturn, Uranus and Neptune. Back in the Netherlands, she applied her knowledge of light diffusion and polarization to exoplanets, with the help of a Veni and then a Vidi scholarship. She started this research at the University of Amsterdam, then moved on to SRON Netherlands Institute for Space Research, and finally joined TU Delft in early 2013. The enormous influx of new mechanical and maritime engineering first-year students, in combination with the new curriculum of the faculty of Mechanical, Maritime and Materials Engineering (3me), necessitates increasing the number of rooms for tutorials. It has been decided to replace the steel and synthetic frames with aluminium at the same time this ‘sober but efficient’ project is carried out.

Interview

If you could do with a laugh, I recommend watching the YouTube film ‘Mocked billion’ in 1999. (Mobile phones in 1999) in which documentary maker Franz Bremet asks passers-by if they own a mobile phone. A man who is working on his car doesn’t see the need for one. “If I do get stranded somewhere there’s usually a roadside telephone or a farmhouse nearby.” A mother with child bursts out laughing: “just imagine cycling along and then the telephone starts ringing!”

A student gives a shrug: “I already have an answering machine at home. That works just fine for me.”

And there are more. Young, old, male, female; you all declare that they have no need for a mobile phone. It is the ultimate proof of the law that says ‘You don’t know you need it until you have it’. Some other revolutionary product is bound to turn up again soon. A gadget that you can barely picture now, but which, in a few years, you’ll be as addicted to as a jumbo is to their needles.

Gadget websites tell us that the iWatch will be launched next year. If Franz Bremet had called at my door yesterday to ask if I would buy such an iWatch, I probably would have tapped my wrist and said: “No need, I already have a watch. That works just fine for me.”

However, after these street interviews, held barely fourteen years ago, I’m starting to doubt my self-knowledge as a consumer. Do I really understand my own needs?

Techradar.com heard from a reliable source that the iWatch will have a whole bunch of health-related sensors. Sleep phase monitoring, keeping track of calorie consumption, emergency services alerts in case of a heart attack, that kind of stuff. What a load of rubbish, is my reaction today. But what if my neighbour overtakes me during my usual run with just such a watch on his wrist: what would be my reaction then? Column

Another film on YouTube: ‘Martin Cooper – inventor of the cell phone!’ This film features the American inventor explaining how he made the first mobile phone for Motorola in 1973. The device was the size of a carton of yoghurt, cost a million dollars and had a battery life of twenty minutes, but still Cooper predicted that one day everyone on the planet would have a mobile telephone.

His next prediction? That in the near future we will have mobile phones implanted under our skin, just behind the ear. Do I want that? Now my answer is a resounding ‘no’. But what will my answer be tomorrow?

Press: Sam Rentmeester

Must-haves

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