Christian Webb

"**The most beautiful** thing about mathematics is a certain kind of unity. Although it often seems like mathematics consists of isolated parts that people study separately, barely talking to each other, particularly mathematical physics involves different branches of mathematics coming together. Methods that have been developed for a totally different purpose can prove extremely effective when used in combination with others", says Associate Professor Christian Webb.

Webb received the Väisälä Prize 2021 from the Finnish Academy of Science and Letters. Väisälä Prizes are awarded annually to distinguished scientists in mathematics and science who are in the active part of their careers. The prizes were now awarded for the 22nd time, and they are worth 15,000 euros.

Webb's research is related to mathematical physics and probability theory, or the mathematical theory of chance. This may sound complicated. Webb compares it to flipping a coin: you cannot know beforehand whether you will get heads or tails. Mathematically it can be said that the probability of getting tails is half and the probability of getting heads is half.

"There are so many complex phenomena and we cannot know precisely what is actually going on in them. However, mathematical models allow us to make reasoned guesses. Mathematical physics, for example, studies physical systems that contain numerous particles. If you want to describe a material, it has a huge number of atoms and we cannot precisely model how each one moves. We then apply a mathematical probability model and use it to try to understand the desired properties, such as whether the material conducts electricity", says Webb.

Probability and chaos theories are closely related, and both involve complex mathematical questions that are not yet fully understood.

"Chaos is disorder and uncertainty. A system may appear simple, but it can contain highly delicate interdependencies.

”Mathematics is an endless source of successes”

This is linked to the butterfly effect: when a butterfly flaps its wings, it changes the entire system in tiny ways, the effects of which can be extremely difficult to predict. When I look at the world less as a mathematical physicist and more as a human being and a father and husband, the direction we are headed sometimes looks quite scary. Even if the options are fairly limited, it’s still important for scientists to try to do their best for the world. We are living in difficult times”, says Webb.

For Webb, science and mathematics at their best mean successful problem solving.

“I have pretty much always lived for moments of success that produce excitement and energy. I enjoyed sport when I was younger. Mathematics is an endless source of things that you can succeed in. Of course, you can also fail and get extremely frustrated, but there are so many unsolved problems and whenever you understand something new, you experience that feeling of success. That is an integral part of my personality. Sometimes it may be more of a hobby than work, because I enjoy doing it so much”, he says.

There are numerous questions that we do not know the answers to. But science, in Webb’s opinion, provides the best basis for making decisions.

“When the coronavirus pandemic began, scientists and others would sometimes give advice that has proved wrong in

retrospect. But how else could decisions have been made in those circumstances? I have yet to see any good alternatives to science."

As a researcher in mathematical physics, Webb says he is more a mathematician than a physicist.

"When I was a child, mathematics was my favourite subject in school. After graduating from an upper secondary school specialising in mathematics, I went on to study mathematics and physics. I thought about working as a consultant after my studies, but solving problems appealed to me more. My academic future seemed highly uncertain back then, as I had already started a family and there was quite a limited number of positions available. I decided to continue doing this for as long as someone pays me for it. So far, this has luckily been the case, and hopefully I can spend the rest of my career in mathematical physics as well", says Webb.

Webb has yet to discover why bread always falls on the floor with the buttered side down.

"I think this is a question for the next generation. I'll have to remember to add it to my next funding application", says Webb with a laugh.