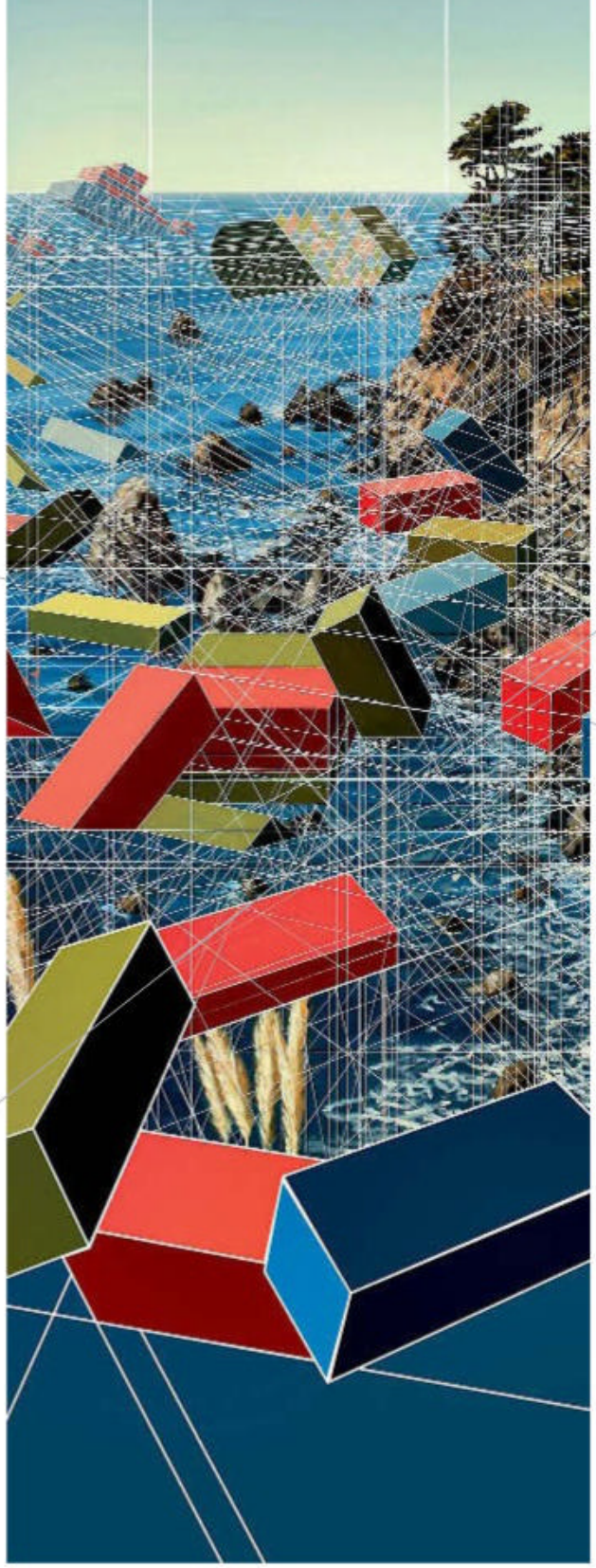

The duo were inspired by research carried out in 2016 by Markus Müller and Philipp Höhn, both then at the Perimeter Institute in Waterloo, Canada, who imagined a scenario in which two people, Alice and Bob, send each other quantum particles in a particular state of "spin". Spin is a quantum property that can be likened to an arrow that can point up or down along each of the three spatial axes. Alice sends Bob a particle and Bob has to figure out its spin; then Bob prepares a new particle with the same spin and sends it back to Alice, who confirms that he got it right. The twist is that Alice and Bob don't know the relative orientation of their reference frames: one's x-axis could be the other's y-axis.

If Alice sends Bob just one particle, he will never be able to decode the spin. Sometimes in physics, two variables are connected in such a way that if you measure one precisely, the other no longer exists in a definite state. This tricky problem, known as the Heisenberg uncertainty principle, applies to particles' spin along different axes. So if Bob wants to measure spin along what he thinks is Alice's x-axis, he has to take a wild guess as to which axis that really is – if he is wrong, he erases all the information. The pair can get around this, however, if they exchange lots of particles. Alice can tell Bob, "I'm sending you 100 particles that are all spin 'up' along the x-axis." As Bob measures more and more of them, he can begin to work out the relative orientation of their reference frames.

Here is where it gets interesting. Müller and Höhn realised that, in doing all this, Alice and Bob automatically derive the equations that enable you to translate the view from one perspective to another in Einstein's special relativity. We tend to think of space-time as the pre-existing structure through which observers communicate. But Müller and Höhn flipped the story. Start ›