



CROWN JEWEL

'I want to see holography in the sky'

'Gravity is like a bad boyfriend. You love it, but it never meets your expectations,' says Alejandra Castro, theoretical physicist at the University of Amsterdam. She researches gravity at a fundamental level. For example, she looks at ideas about quantum gravity, combining quantum mechanics, which describes the behaviour of small particles and light, with Einstein's laws of gravity, which deal with the movements of large objects such as falling apples and stars circling each other.

'Einstein's general theory of relativity is a beautiful and elegant way to describe gravity, but the theory also raises questions,' Castro says. 'One of the things we struggle with is how to apply our understanding of gravity to the quantum world. One successful way of uniting these two important branches of physics is based on the holographic principle.' According to this principle, you can find all the information about a volume in its edges; in the shell around it. Like a hologram, it is a two-dimensional representation of a three-dimensional image. 'The idea is that the shell can be understood with quantum mechanics and the volume with Einstein's theory of relativity. The power of the holographic principle is that it connects the two.'

Anyone researching quantum gravity soon encounters black holes. These objects exert a great deal of gravity in a small space. They force you to combine gravity and quantum mechanics. 'One of my goals is to establish a link between theoretical holographic ideas and observations of black holes by astronomers. I want to see holography in the sky.'

Text: Dorine Schenk