Dark – The Movie

DARK is a fulldome movie that explains and explores the nature of Dark Matter, the missing 80% of the mass of the Universe.

The search for Dark Matter is the most pressing astrophysical problem of our time – the solution to which will help us understand why the Universe is as it is, where it came from, and how it has evolved over billions of years – the unimaginable depths of deep time, of which a human life is but a flickering instant.

But in that instant, we can grasp its immensity and, through science, we can attempt to understand it.

The movie is presented by Dr Alan Duffy, a brilliant young astronomer from the International Centre for Radio Astronomy Research (ICRAR) at the University of Western Australia – who creates simulations of Dark Matter evolution inside supercomputers.

Alan introduces us to the idea of Dark Matter, why astronomers think it exists, and explains why Radio Astronomy is so well-suited to its discovery.

We explore why the new Australian Square Kilometre Array Pathfinder (ASKAP) Telescope, currently under construction in remote Western Australia, will be so important in this scientific quest.

But this is only the beginning.

We journey through completely immersive visualisations of Dark Matter evolution calculated upon some of the world's fastest supercomputers – cosmological visions on a truly vast scale, in which galaxies themselves are but points of light, distributed across far larger intergalactic structures of Dark Matter. These visualisations, developed by Paul Bourke, demonstrate the cutting-edge of contemporary supercomputer visualisation of massive scientific datasets and astrophysical simulation.

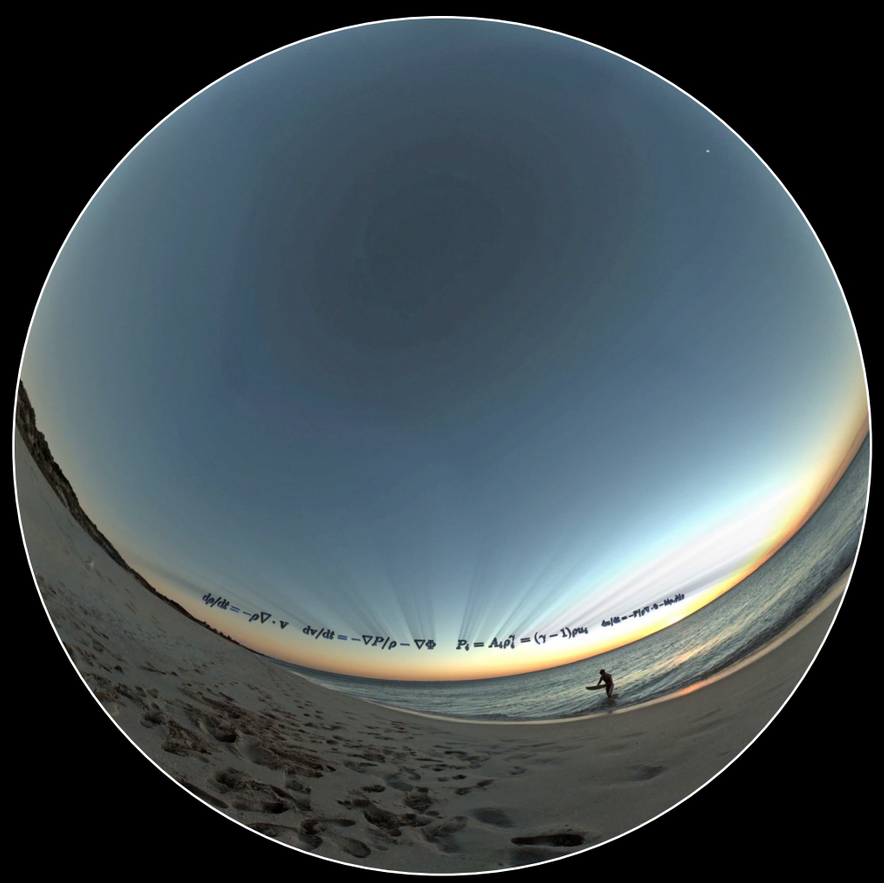
It sounds like Science Fiction, but it's not. It's the real stuff. Real Data, seen in this way for the very first time.

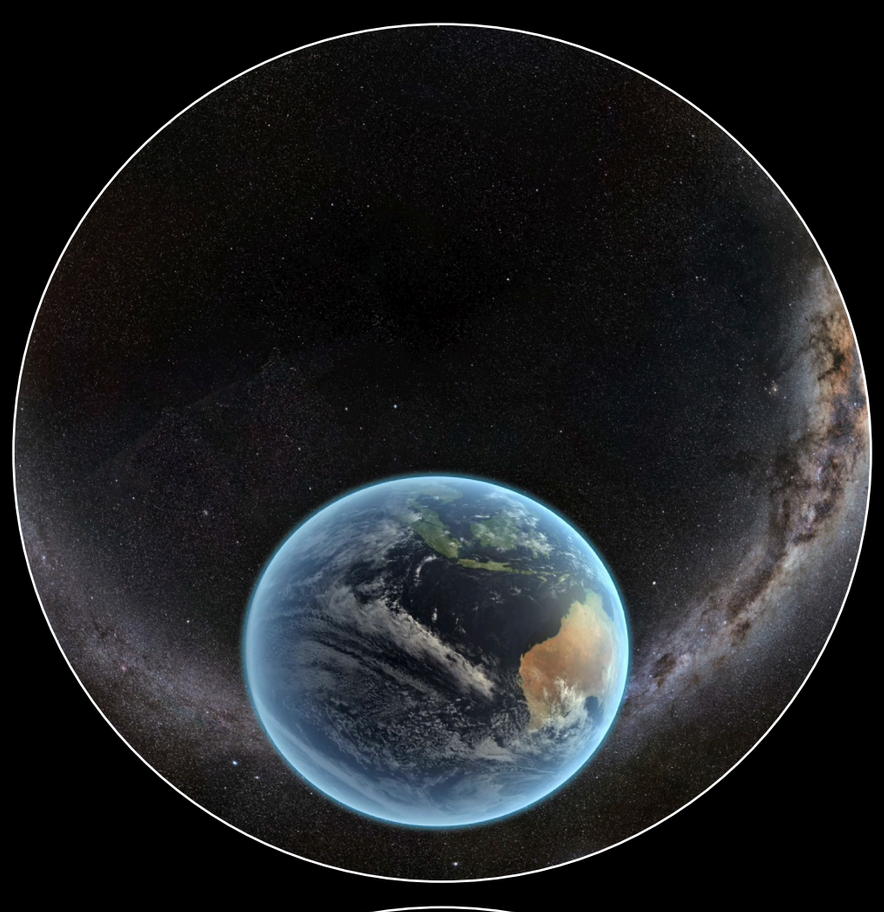
In Western Australia, a new telescope called the Australian Square Kilometer Array Pathfinder - is under construction. With 36 dishes spread over 6 kilometres, this instrument will see details 100 times finer than the Parkes telescope. Yet what really sets ASKAP apart are the Australian-built phased array feeds sitting at the focus of the dish. These are the eyes of the telescope, able to view 30 times more of the sky in a single snapshot than a standard receiver. Similar to your digital camera - they can take in light (in this case radio waves) and create digital images. This happens across all the dishes and we can later add them together using a supercomputer, to form a giant virtual telescope. Because of this ground-breaking technology, ASKAP will be able to survey the sky 10 times faster than Parkes - making it amongst the most powerful radio telescopes ever built, capable of viewing more of the Universe,

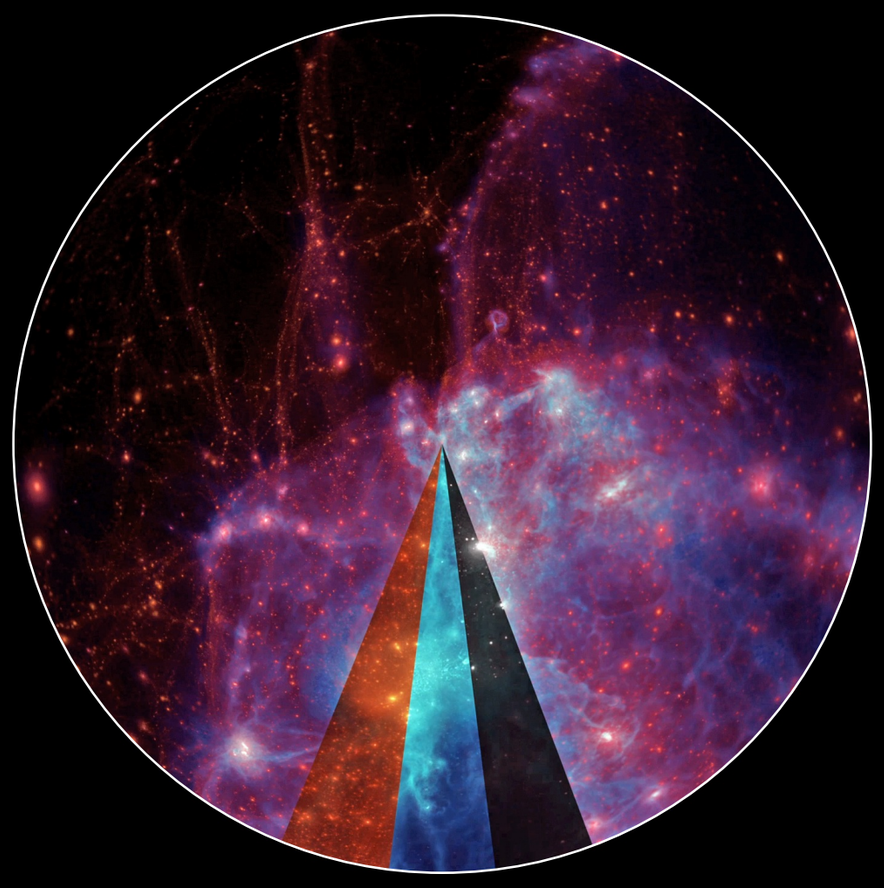
- faster, than ever before
- creating an unprecedented wealth of data.

To help make sense of all this information, as well as guide the design of such a groundbreaking telescope, astronomers create simulations of the Universe inside supercomputers.

But, we can only indirectly detect Dark Matter through its gravitational effects on the gas and stars. In computer simulations, however, we know exactly where the Dark Matter, gas and stars are, because we put them there! This can aid astronomers in understanding how Dark Matter causes galaxies to form and stay together.







Imagine trying to search for something that you can't see. You don't know what it looks like, what it's made of, or where it is. But you do know that nearly 80% of the mass of the universe is made of it. Now that's a real problem. At least we've been able to name it - it's called 'Dark Matter' One way scientists investigate the natural world is to look for patterns. Now we can discern patterns across a range of scales. From the foam on this beach, to the stars above us. From something very small, local and intimate - to something across the very distant cosmos.

Have you ever been lost in the fog? The fog blocks visible light, which makes it very difficult for you to see through it. Astronomers have the same challenge when they try and look at galaxies. They try and look through the gas the galaxies are made of, to try and determine the inner structure of the galaxy, as well as all the other hidden processes, such as the formation of our Sun and the formation of the stars. When you're in the car in the fog - you can still hear the car-radio play, even when you can't see through the windscreen. This means that radio waves can be detected even when visible light cannot. So astronomers use radio telescopes to peer through this thick gas and make unique observations that visible telescopes can't.

We've used some of the largest supercomputers in Australia to follow the formation of a galaxy from the Big Bang until now. But this is only a model. To see what's actually happening we need the futuristic ASKAP Telescope. The first 24 of the dishes are already onsite in the Murchison Radio-Astronomy Observatory, in Western Australia. It's already taking data. And we're already analysing it - at the International Centre for Radio Astronomy Research in Perth. ASKAP will help us to answer some fundamental questions:

- What are the hidden processes by which stars form?
- Are there organic molecules in the atmospheres of exoplanets
- Why are galaxies distributed across the Cosmic Web?
- And the greatest puzzle of all what is the nature of Dark Matter? this mysterious substance that makes up 80% of all the mass in the universe.

Production Credits:
Produced by Peter Morse & Paul Bourke
Directed by Peter Morse
Written by Alan Duffy, Peter Morse
and Carley Tillett
Music by Cathie Travers
Audio Production by Trevor Hilton