

<p>ESOCast Episode 31: Pandora's Cluster</p>	
<p>00:00 [Visuals start]</p> <p>[Narrator] A team of scientists has studied the unusual galaxy cluster Abell 2744, nicknamed Pandora's Cluster.</p> <p>Using telescopes in space and on the ground, including the NASA/ESA Hubble Space Telescope and ESO's Very Large Telescope, they have discovered that it was formed by the simultaneous pile-up of at least four separate galaxy clusters.</p>	<p>Images:</p>  <p>Galaxy Cluster Abell 2744</p>
<p>00:31 ESOCast intro</p> <p>2. This is the ESOcast! Cutting-edge science and life behind the scenes of ESO, the European Southern Observatory. Exploring the ultimate frontier with our host Dr J, a.k.a. Dr Joe Liske.</p>	<p>ESOCast introduction</p>
<p>00:48 [Narrator]</p> <p>When huge clusters of galaxies crash together, the resulting mess is a treasure trove of information.</p> <p>Observing these cosmic pile-ups lets astronomers reconstruct events that have happened over hundreds of millions of years.</p> <p>It also lets them study how different types of matter behave during these collisions.</p>	 <p>Simulation of galaxy cluster collision</p>

01:10

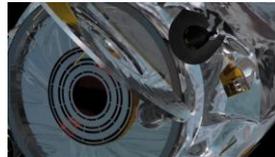
[Narrator]

The cluster galaxies in Pandora's Cluster are clearly visible in images from Hubble and ESO's Very Large Telescope. However they only make up about 5% of the cluster's mass.

About 20% is hot gas, which is shown here in pink. This gas is visible thanks to its X-ray emission which can be detected with NASA's Chandra satellite.



Abell 2744 in visible light



Chandra X-ray Observatory

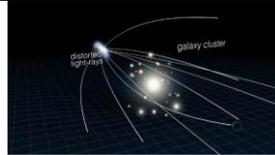
01:34

[Narrator]

The lion's share of the mass in the cluster, about 75%, is dark matter.

Dark matter cannot be seen directly, and is somewhat of a mystery in modern day astronomy. But there is a trick astronomers can use to find out its location: by looking at the way gravity distorts light from distant galaxies, they can work out where dark matter is hiding.

This lets the astronomers make a detailed map of where the dark matter is, shown here in blue.



Simulation of galaxy cluster collision with annotations.

02:14

[Narrator]

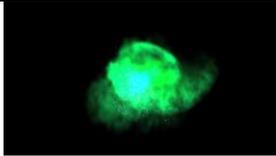
Comparing the location of the galaxies, the hot gas and the dark matter, shows that this is not a simple crash between two clusters.

By reconstructing the history of Pandora's Cluster, astronomers think it must have formed from four different clusters involved in a series of collisions over a period of some 350 million years.

It seems that the complex collision has separated out some of the hot gas and dark matter so that they now lie apart from the visible galaxies.



Abell 2744 mass map

<p>02:48 [Narrator]</p> <p>Near the core of Abell 2744, the gas of one cluster has collided with that of another to create a shock wave. The dark matter passed through the collision unaffected.</p> <p>In another part of the cluster there seem to be galaxies and dark matter, but no hot gas. The gas may have been stripped away during the collision, leaving behind no more than a faint trail.</p>	 <p>Abell 2744 in X-ray (Chandra image)</p>
<p>03:13 [Narrator]</p> <p>Even stranger features lie in the outer parts of the cluster. One region contains lots of dark matter, but no luminous galaxies or hot gas. A separate ghostly clump of gas has been ejected, which precedes rather than follows the associated dark matter.</p> <p>This puzzling arrangement may be telling astronomers something about how dark matter behaves and how the various ingredients of the Universe interact with each other.</p>	 <p>Artist's impression of a galaxy cluster collision</p>
<p>03:41 [Narrator]</p> <p>Galaxy clusters are the largest objects in the Universe to be held together by their own gravity and understanding how they form and evolve is a vital aspect of unravelling the history of the cosmos.</p> <p>Learning more about dark matter not only furthers our understanding of clusters, but it also takes us a little closer to fathoming the nature of this mysterious and elusive substance.</p>	 <p>Abell 2744 in visible light</p>
<p>04:09 [Outro]</p>	<p>ESOcast is produced by ESO, the European Southern Observatory.</p> <p><i>ESO, the European Southern Observatory, is the pre-eminent intergovernmental science and technology organisation in astronomy designing, constructing and operating the world's most advanced ground-based telescopes.</i></p>

05:09
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