Explained in 60 Seconds

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Gravitational Lenses

Gravitational lenses are a useful tool in the belt of the modern cosmologist. Massive bodies deflect light, focusing it towards the observer and causing distant objects to appear magnified and distorted, or even as multiple images. Einstein's General Theory of Relativity tells us exactly how light rays are affected by the warped space around a galaxy or cluster acting as a lens. Interestingly, the lensing effect is stronger than expected for the amount of mass we can see. This adds weight to the idea that the main constituent of galaxies and clusters is an unseen "dark matter".

The density of a galaxy increases towards its centre, much like the thickness of the base of a wineglass. In fact, a wineglass makes a good model gravitational lens: look into the glass from the top and through its stem toward a light to discern the effect. By seeing how it distorts the light, it is possible to work out the shape and thickness of the glass. In the same way, observing distant galaxies through gravitational lenses allows the density distribution of the clumpy, transparent dark matter to be mapped out. Gravitational lensing may not yet be able to tell us what the dark matter is, but it is telling us where to look.

Key Words

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To mark the 18th anniversary of the *NASA/ESA Hubble Space Telescope* on 24 April 2008, 59 new images of colliding galaxies were released simultaneously. This is the largest collection of *Hubble* images ever released to the public at one time and was assembled over a period of more than a year from the several terabytes of archived raw images. Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration and A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University) — http://www.spacetelescope.org