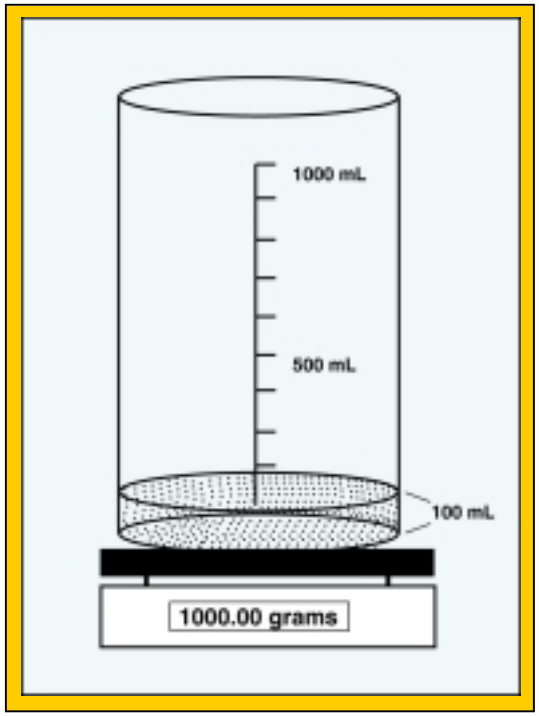
Cosmic Chemistry: Cosmogony

Dark Matter—More Than Meets the Eye

Student Text Supplement



Beaker containing 100 mL of water on a balance.

If a beaker contains 100 mL of water, we expect the water to have a mass of 100 grams, since the density of water is 1 g/1 mL. Let's say the balance showed the contents of the beaker to have a mass of 1000.00 grams. Ah, there must be more to this situation than "meets the eye."

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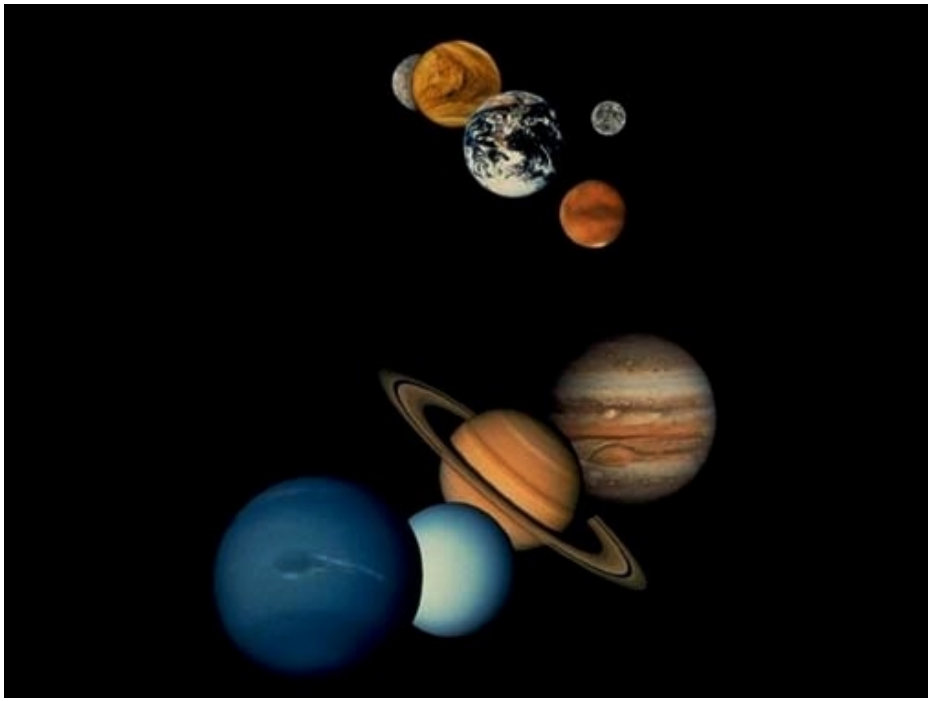

In our solar system, the inner planets revolve more rapidly in orbit than do those farther out. Why do you think this is so?

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Most astronomers thought that rotating galaxies should show the same characteristics as our solar system.

M100: A Grand Design *NASA*

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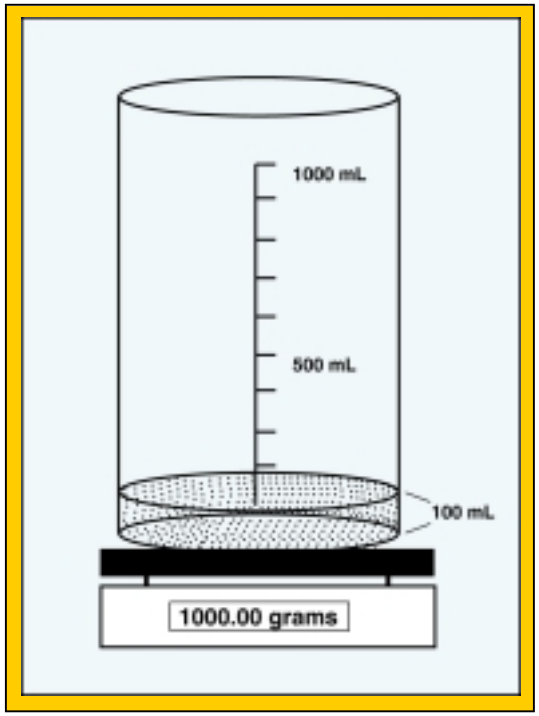
Milky Way Galaxy in Infrared *NASA*

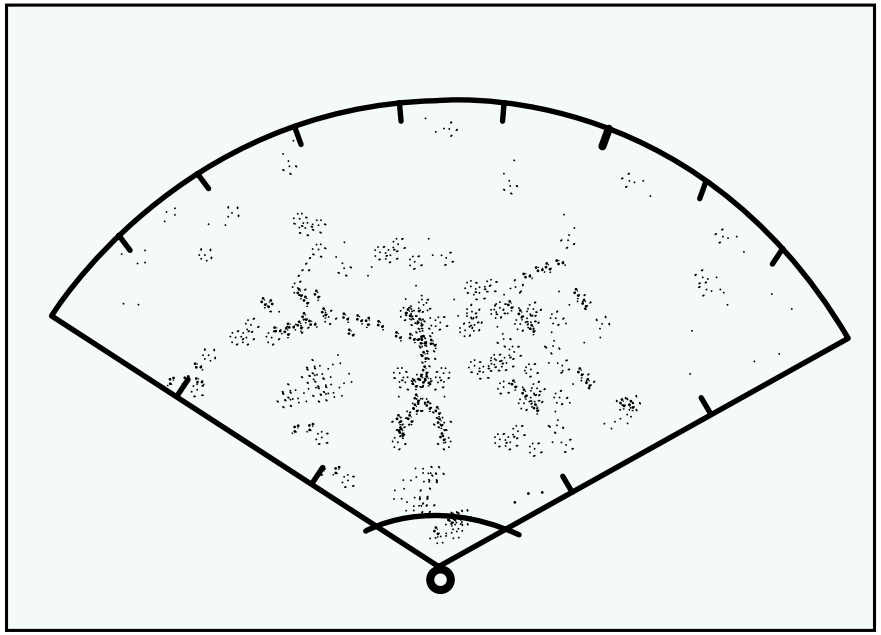
Scientists were surprised to find that there are stars in our galaxy at a *greater* distance from the center of the galaxy than our sun that revolve *faster* than our sun!



Beaker containing 100 mL of water on a balance.

Could one answer to our beaker "discrepant event" be that 90% of its contents are dark matter?

Dark matter may be clumped around galaxies, in much the same way that we found matter clumped around voids in "The Spongy Universe."



A map of a slice through the universe, where the Earth is at the point of the wedge and the distance from the Earth increases as one moves away from the point.

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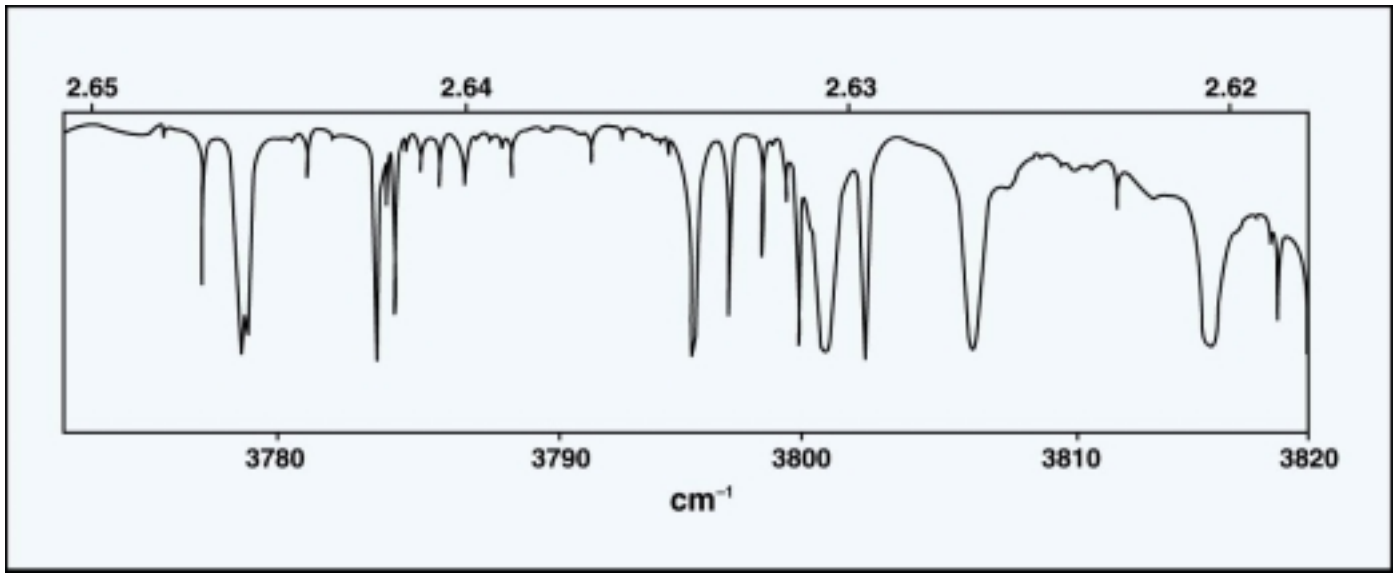

A *spectroscope* can be used to detect composite radiation spectra of individual stars and gas in a particular location of a spiral galaxy.

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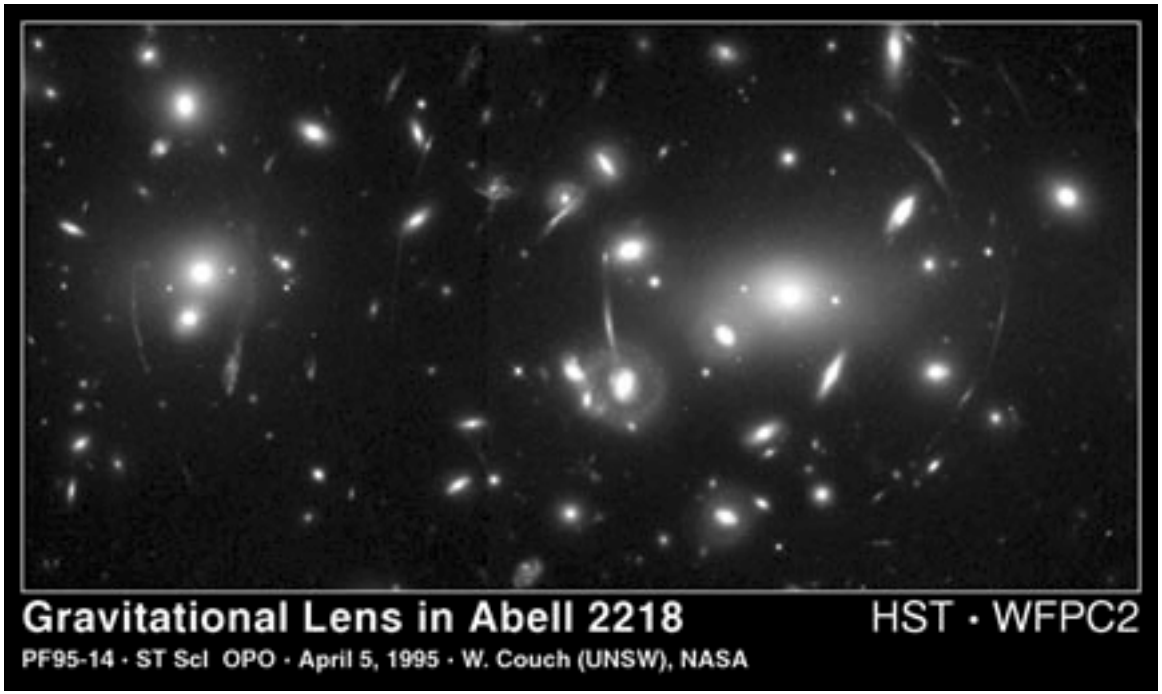

Gravitational lensing **is a technique for measuring distance that takes advantage of the fact that matter distorts the space surrounding it.**

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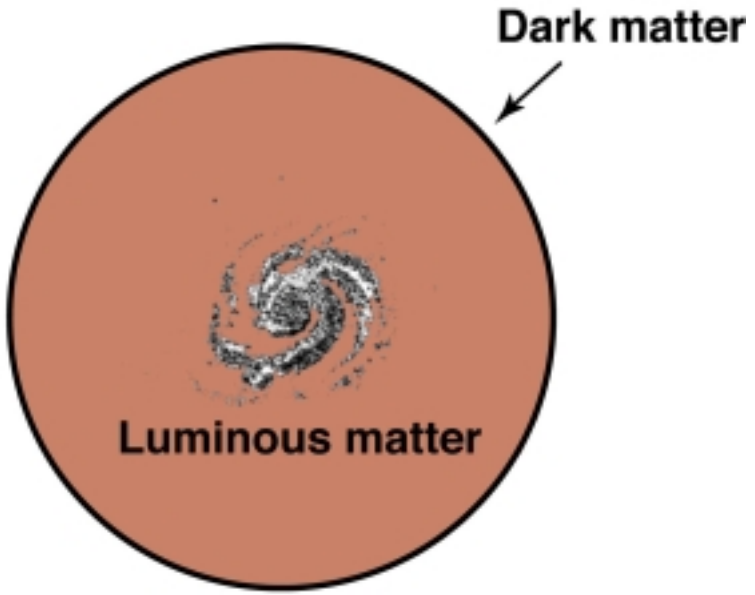
Across the visible part of a galaxy, the luminous disk is matched by an equal *nonluminous halo* mass of dark matter.



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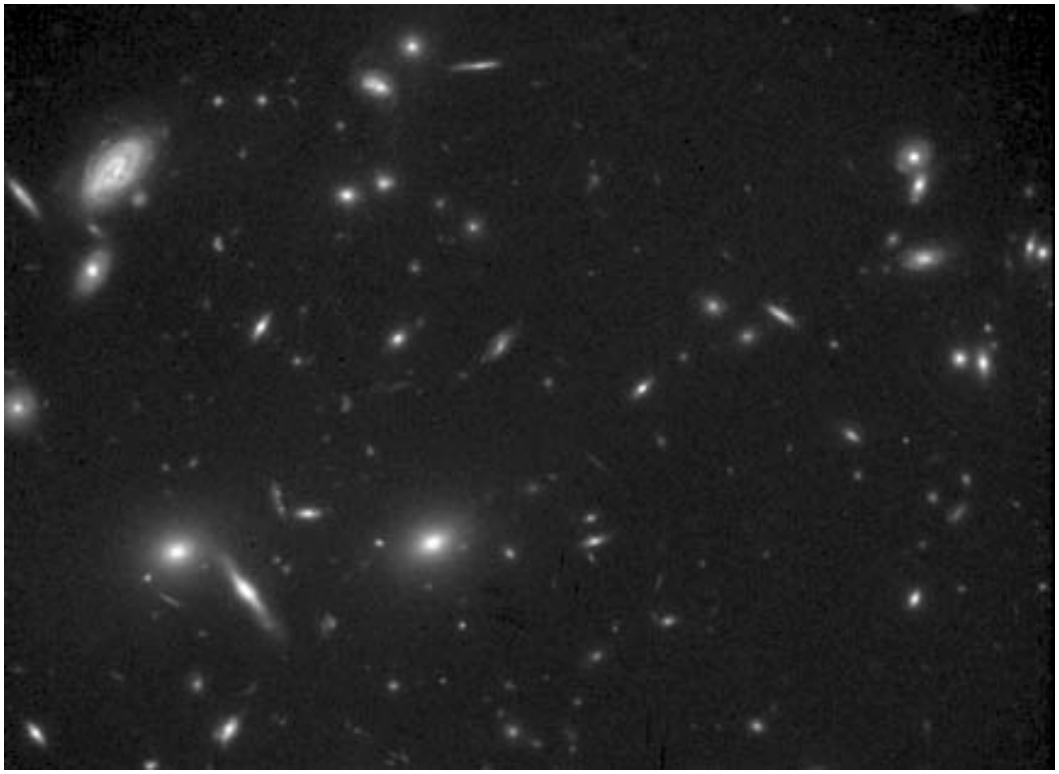

A Distant Cluster of Galaxies *NASA*

Clusters of galaxies are at least nine-tenths dark matter.

ELEMENTARY PARTICLES THAT MIGHT MAKE UP DARK MATTER	
Baryons (MACHOs)	**Leptons (WIMPs)**
protons	electrons
neutrons	neutrinos

***MACHOs* stands for Massive Compact Halo Objects. MACHOs are made of *baryons*.**

***WIMPs* are *leptons*, an abbreviation for Weakly Interacting Massive Particles.**

Where does that leave us?