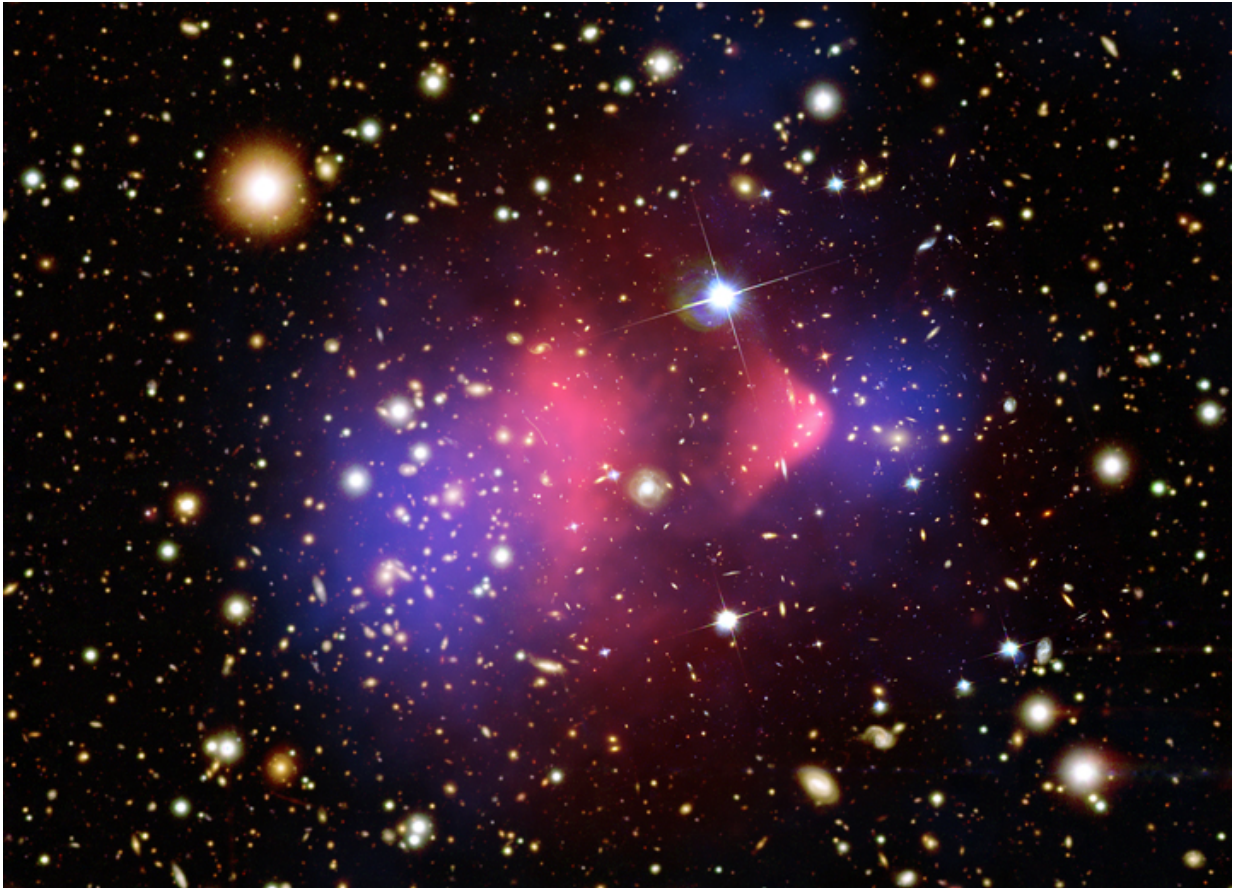


# 3 knowns and 3 unknowns about dark matter

June 8 2016, by Glenn Roberts Jr

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A composite image of the “bullet cluster,” a galaxy cluster formed by a collision of two clusters. The pink clumps show hot gas containing most of the normal matter, while the two blue clumps reveal where most of the mass in the clusters is actually contained. This provides evidence for dark matter since most of the mass was expected to be concentrated around the pink areas. Credit: NASA/CXC/M.Markevitch et al.; optical image by NASA/STScI, Magellan/U.Arizona/D.Clowe et al.; lensing map image by NASA/STScI, ESO WFI, Magellan/U.Arizona/D.Clowe et al.

What's known:

## **1. We can observe its effects.**

While we can't see [dark matter](#), we can observe and measure its [gravitational effects](#). Galaxies have been observed to spin much faster than expected based on their [visible matter](#), and galaxies move faster in clusters than expected, too, so scientists can calculate the "missing [mass](#)" responsible for this motion.

## **2. It is abundant.**

It makes up about 85 percent of the total mass of the universe, and about 27 percent of the universe's total mass and energy.

## **3. We know more about what dark matter is not.**

Increasingly sensitive detectors are lowering the possible rate at which dark matter particles can interact with normal matter.

## **What's unknown**

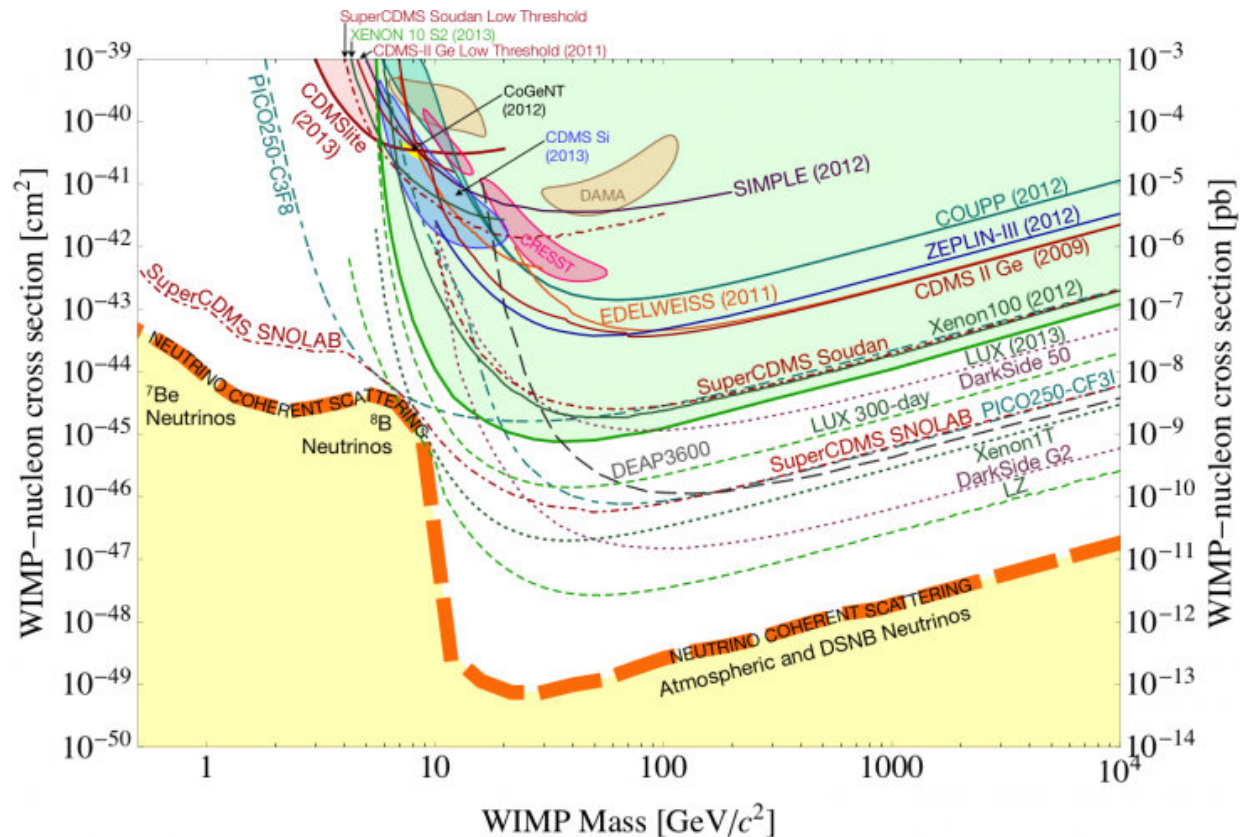
### **1. Is it made up of one particle or many particles?**

Could dark matter be composed of an entire family of particles, such as a theorized "hidden valley" or "dark sector?"

### **2. Are there "dark forces" acting on dark matter?**

Are there forces beyond gravity and other known forces that act on dark

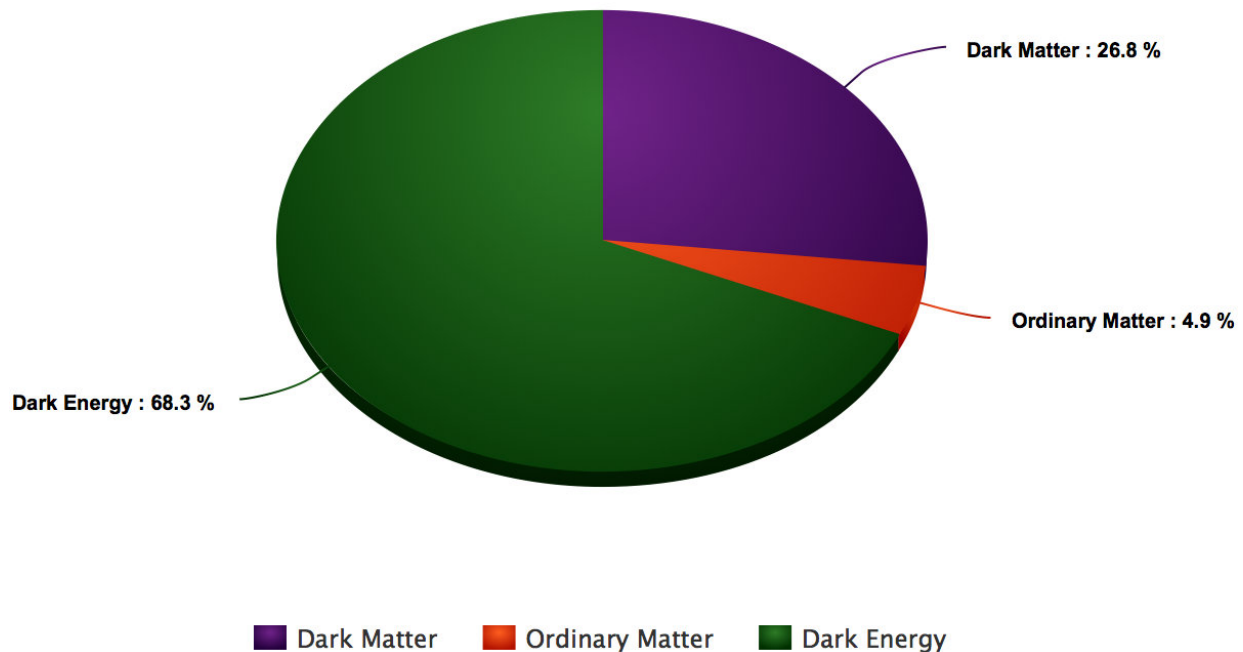
matter but not on [ordinary matter](#), and can dark matter interact with itself?



This chart shows the sensitivity limits (solid-line curves) of various experiments searching for signs of theoretical dark matter particles known as WIMPs (weakly interacting massive particles). The shaded closed contours show hints of WIMP signals. The thin dashed and dotted curves show projections for future U.S.-led dark matter direct-detection experiments expected in the next decade, and the thick dashed curve (orange) shows a so-called “neutrino floor” where neutrino-related signals can obscure the direct detection of dark matter particles. Credit: Snowmass report, 2013

### 3. Is there dark antimatter?

Could dark matter have an antimatter counterpart, as does normal matter, and is there a similar imbalance that favored dark matter over "dark antimatter" as with normal matter-antimatter?



Credit: University of California - Berkeley

Provided by University of California - Berkeley

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