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Shedding Light on Dark Matter

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Abstract: Of all the matter in the universe, only 20% is made of stuff that we know. We call the remaining 80% “Dark Matter” of which we know little but the name. In the standard model of cosmology, a non-zero Dark Matter density is just one additional parameter, yet it correctly predicts and explains independent observations on all scales, from the formation of structure in the Universe and hence our own very existence, to gravitational lensing effects. The question is: What is all that Dark Matter made from?

In short, we don't know yet, but the feeling is that we will learn very soon. A promising candidate is a particle left over from the Big Bang, a Weakly Interacting and rather Massive (a few to a few thousand proton masses) Particle, WIMP for short. We use satellite and balloon borne experiments to search for known particles from space which may be produced when Dark Matter particles annihilate, for example at the center of our galaxy. A more direct path to unravel the Dark Matter mystery is the detection of Dark Matter particles with a laboratory experiment. Obviously such Dark Matter interactions are feeble, or we would have detected them long time ago. Hence, large detectors are needed that can separate Dark Matter induced signals from the background induced by abundant natural radioactivity. Currently we are searching for less than one single WIMP caught in the mass equivalent of a human body per week. Yet, in every one of us over 4000 atoms of a radioactive potassium isotope decay every second. How to distinguish that one Dark Matter interaction from the vast particle background is the real challenge. I will review the evidence for Dark Matter and the state-of-the-art in direct detection, with particular emphasis on noble liquid filled detectors such as the XENON experiment, currently at the forefront of the race for shedding light on Dark Matter.

Más información: http://www.ft.uam.es/docencia/seminarios.html