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Indirect Detection of Dark Matter in a New Experimental Era[1]

ELLIOTT BLOOM, KIPAC-SLAC, Stanford University

The discovery of the nature of dark matter has been a major goal of Particle Astrophysics over the past two decades. In order to establish the existence of particle dark matter one needs (in no particular order) to detect dark matter as particles in the galaxy and the universe, and detect the identical particles in controlled environments at particle accelerators. Indirect detection of dark matter is the method used to detect dark matter particles via the decay products of their annihilation or decay in situ in the galaxy and the universe. The decay products most commonly used as dark matter messengers in current searches are photons, electrons, positrons, protons, antiprotons, and neutrinos. Indirect detection methods use both information about the particle physics model needed to calculate annihilation or decay rates, and the source structure of the dark matter under consideration, e.g., the density distribution of dark matter halo of the galaxy. In addition, depending on which particle messenger is used, astrophysical backgrounds can be more or less a source of confusion to a potential signal and need to be well understood via subsidiary measurement before reliable limits can be reported or a discovery claimed. A new experimental era promising much better limits or (hopefully) a discovery will soon begin. New indirect detections experiments involving space based satellites (the Large Area Space Telescope, GLAST is one of my favorites), ground based gamma ray telescopes, and neutrino telescopes have recently started operation or are coming on line this year. In addition, improved underground based direct detection experiments and of course the LHC are also beginning operation latter this year. In my talk I will review the current status of indirect detection experiments, and speculate on what the dramatic improvement of experimental capability expected this year might bring.

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